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Elementary Learners' Emotions, Emotion Regulation, and Enjoyment During Asynchronous Online Learning

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Abstract

This study aimed to investigate elementary learners' emotions, emotion regulation, and enjoyment as they experienced asynchronous online learning in the post-pandemic context. Gross's (2006) Process Model of Emotion Regulation was used to investigate the interrelationships between these three components, resulting in theoretical and practical advancement in the field of study. A total of 14 Malaysian elementary learners participated in this study. Data were collected through interviews and observations. Thematic analysis revealed two primary domains of emotion regulation that affect learners' enjoyment of asynchronous online learning: situational control and cognition/internal control. The analysis also identified both positive and negative activating emotions as significant components that optimise elementary learners' enjoyment. It is also critical to confront negative deactivating emotions promptly to prevent learners' enjoyment from being impeded. Regarding the interrelationships between emotions, emotion regulation and enjoyment, learners' enjoyment is increased or retained when emotions are effectively regulated; emotions take the lead when emotion regulation is lacking or ineffective, which in turn impacts the rise or fall in enjoyment. The implications provide instructors with encouragement to thoughtfully plan asynchronous online learning that takes elementary learners' optimal emotional and enjoyment fulfilment into account, utilising emotion regulation as a mediator.

Keywords:

Asynchronous Online Learning, Elementary Education, Emotions, Emotion Regulation, Enjoyment

Introduction

Technological-enhanced learning has gained prominence in recent years because of the COVID-19 pandemic. The education situation has undergone a significant transformation, which presents a remarkable opportunity to investigate how learners feel while experiencing online learning. In fact, learning online is not solely a cognitive or metacognitive process but also emotional. O'Regan (2019) stated that online learning elicits a variety of emotions in learners throughout the learning

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and teaching process. Ismail et al. (2023) found a significant relationship between online learning and emotions, as well as a positive correlation between learners' online learning emotions and enjoyment. If learners fail to effectively regulate their emotions during online learning, the likelihood of online classes becoming less engaging and the loss of enjoyment in the online learning process rises.

Concerning the emotional impact of online learning, there is a scarcity of follow-up research on the learners' online learning emotions after the pandemic. Several studies have taken the initiatives to reflect on the online learning that was conducted during the pandemic to shape an effective post-pandemic online education experience (e.g., Hill et al., 2024; Saleh et al., 2023), yet not focusing on learners' emotions. In this context, it was recommended that learners' emotions be considered as one of the aspects to enhance post-pandemic online education (Aladsani et al., 2022; Hamzeh, 2021). Aladsani et al. (2022) and Hamzeh's (2021) studies highlighted that stress, loneliness, fear, anxiety, sadness, moodiness, guilt, and frustration were the prevalent emotions experienced by learners during online learning, which have the potential to possess a lasting impact on the development of online education in the future. However, these studies did not delve deeply into the emotional circumstances and regulation that the learners encountered, which could have yielded valuable insights to aid in the development of effective post-pandemic online education. Ismail et al.'s (2023) study has proven the close relationships between emotions and enjoyment indeed, but only focused on five emotional experiences (enjoyment, hope, pride, anxiety, and boredom) which limits its generalisability.

Consequently, it is becoming increasingly critical to comprehend the ways in which emotions affect the attitudes of learners and the ways in which learners manage their emotions in relation to a variety of learning environments, as today's educational system prioritises learners' engagement and enjoyment in their online learning activities (Borup & Archambault, 2023). One of the prevalent online learning activities was asynchronous online learning, in which learners can access learning materials, complete tasks, and participate in discussions at their own pace rather than in real-time. Previous investigations have demonstrated that elementary learners are apprehensive about learning online asynchronously because they are unconfident to learn independently due to the absence of hands-on coaching and continuous supervision (Kanyakumari, 2020; Wan, 2020). Tabiin et al. (2022) indicated that in the absence of a direct interaction with teachers and peers, younger learners experience feelings of sadness and isolation during asynchronous online learning. On that note, the investigation of elementary learners' emotions regarding asynchronous online learning was given high attention during the pandemic, and the level of asynchronous online learning maturity among those learners was determined to be lower than that of adults (Hauk & Groschner, 2022). Conversely, it is interesting to note that some elementary learners demonstrated a genuine level of enjoyment for asynchronous online learning which had shown an effective emotion regulation within the context (Chzhen et al., 2022). Learners demonstrated a variety of emotions, levels of enjoyment, and ways of emotion regulation throughout the asynchronous online learning practices during the pandemic. Hence, the situation and the manner in which learners emotionally manage their asynchronous online learning practices necessitate a comprehensive investigation, as this could potentially assist the progression or shaping of online education in the post-pandemic era.

To bridge the research gap of the previous studies, this study investigates elementary learners' emotions and enjoyment when experiencing asynchronous online learning, by highlighting emotion regulation as a mediator. This study emphasises asynchronous online learning, as the majority of previous work has focused on online learning in general. In addition, the majority of emotional issues encountered by elementary learners are associated with asynchronous online learning. These demonstrate the significance of examining the emotions, emotion regulation, and enjoyment of elementary learners in the context of asynchronous online learning. As compared to the similar study conducted by Ismail et al. (2023), this study investigates learners' emotional experiences broadly to ensure the generalisability of the study findings.

Literature Review

Emotions in Learning

Based on decades of emotional development research and practice, emotions grow in supporting relationships with social and cognitive processes (Jones et al., 2019). Besides, during learning, emotions may be seen as subjective evaluations in response to achievement demands or outcomes (Wu & Yu, 2022) and the use of learning strategies and learning motivations (Tyng et al., 2017), which are often being influenced by instructional context and one's personal development. Recognising the nature of emotions in the educational setting is crucial, as emotions play a significant role in almost all facets of the teaching and learning processes. On that note, emotions may have an impact on learners' well-being (mental and physical states), role in socialisation, learning quality, and so on; in turn, teaching and learning processes may also elicit emotions in positive or negative ways.

Smith (2017) contends that addressing children's emotions is essential to advancing our understanding of how children engage in learning and how they perceive or make meaning to their experiences. In this study, the emotional states of the children were determined by the significance attached to their responses and interpretations at any specific point of learning, as well as by their contemplation on the aspirations that they created i.e. personally or socially constructed goals, and correlational links between affective and cognitive processing. In precise, focus was placed on the learners' incidental and integral emotions. An incidental affective state, often known as "mood", is the one that brought on by prior experiences or by personal affective traits; however, integral emotion is brought about by the decision made by a particular learner based on the materials or tasks that he/she is working through (Blanchette & Richards, 2010).

Theoretically, emotions in the learning context, according to Pekrun and Linnenbrink-Garcia (2012), can be identified through four facets: epistemic emotions, achievement emotions, topic emotions, and social emotions. It has been discovered that epistemic emotions and achievement emotions are particularly significant in computer-based learning due to technological constraints and a limited capacity to monitor learners' emotional states (Engelmann & Bannert, 2019). Learners experience epistemic emotions when interpreting new information and relating it with existing knowledge. For instance, when the new information is difficult to understand or contradicts learners' existing knowledge, it triggers epistemic emotions e.g. curiosity, surprise, confusion, anxiety, boredom, frustration and so on. Emotions such as fear, happiness, pride, hope, disappointment, and relief are examples of achievement emotions. These emotions are related to outcomes or achievements that are often evaluated using competency-based standards. In spite of that, all four facets were thoroughly investigated in this study.

According to Oatley et al. (2011), emotions can have an intrapersonal and interpersonal impact on a person's learning process. Emotional influences on cognitive processes are commonly considered as intrapersonal effects, in terms of attentional biases, emotion-memory congruence, and decision-making being influenced by emotions. With the influence of social context and emotional experiences, the interpersonal impacts of emotions influence one's social judgment and social perception. According to research, positive-valence emotions appear to have a beneficial effect on learning, and vice versa; however, some negative-valence emotions might positively relate to learning as well (Asikainen et al., 2018). For instance, Loderer et al. (2020) categorised emotions into three categories: positive activating emotions, negative activating emotions, and negative deactivating emotions. Mayer (2020) concluded that present studies that tend to investigate emotions in technology-enhanced academic learning should place particular emphasis on positive activating emotions such as happiness and negative activating emotions such as anxiety.

Emotion Regulation in Online Learning

Academic emotions can be pleasant and unpleasant, activating and deactivating, and beneficial and destructive, depending on an individual's emotions and situations. Of these, learners need to deal with emotional challenges when undertaking various kinds of academic tasks. The majority of self-regulation theorists asserted that self-regulation is a broader notion that encompasses the essential components of regulating emotions (Boekaerts, 1996). It is commonly assumed that emotions play a role in supporting or undermining the application of deep or superficial learning processes in self-regulated learning. Hence, emotion regulation plays a crucial role in the self-regulated learning process because it monitors, changes, and preserves the duration, valence, and intensity of learners' emotions (Boekaerts, 2011). This kind of regulation usually contributes to the development of positive emotions and the decrease of negative emotions during the learning process, which benefits learners' well-being and academic performance.

Gross (2014) classified emotion regulation into intrinsic and extrinsic emotion regulation. The intrinsic emotion regulation refers to an individual controlling and regulating his/her personal emotional experiences, emotion-related states, and emotional behavioural manifestations, whereas extrinsic emotion regulation refers to an individual regulating someone else's emotions (Gagne et al., 2021). At a broader level, Gross (2006) made a distinction between antecedent-focused and response-focused emotion regulation. Antecedent-focused emotion regulation e.g. attentional deployment, situation selection, situation modification, and cognitive reappraisal are those learners employ prior to the activation of emotion response tendencies, which involves the regulation of subsequent emotional responses. Response-focused emotion regulation e.g. expressive suppression describes the regulation of emotions that occurs during or after the emergence of response tendencies.

Recently, there have been calls to consider regulation practices in the context of online learning (Lai & Hwang, 2023) as well as the context of children online education (Alserhan et al., 2023; Lan et al., 2023). Regarding children's emotional development, Vergara et al. (2022) highlighted the significance of emotion knowledge in today's children to process their emotional information effectively and predict children's adjustment. Regarding the field of emotion regulation research, Harrington et al. (2020) indicated that the process of regulating one's emotional arousal and expression, so-called emotion regulation, is crucial to a child's capacity to adjust to the changing demands of school surroundings. López-Pérez and Pacella (2021) also highlighted the significance of children's interpersonal emotion regulation to better manage their emotions of fear, anger, and sadness. According to Sanchis-Sanchis et al. (2020), however, children have less developed emotional regulation strategies compared to adolescents and adults. Nonetheless, there is not much research that examines children's emotion regulation as well as investigating children's emotion regulation in the context of asynchronous online learning.

Enjoyment in Online Learning

This study conceptualised enjoyment as a process of positive feelings, perceived in a broader sense than a discrete emotion. Literally, enjoyment is an act of having fun or joy while carrying out a certain activity. Kawabata and Mallett (2022) precisely defined enjoyment as a proactive and psychological process that an individual engages in an activity that elicits hedonic or eudaimonic qualities of positive feelings, as opposed to passively waiting for something enjoyable or joyful to happen or simply reacting to a particular stimulus. It appears that proactive process of enjoyment is associated with approach motivation. Ebrahimzadeh and Alavi (2016) demonstrated the close relationships between motivation and enjoyment, showing that learners' motivation to learn in an online learning environment is predicted by how much they enjoy the process of learning. However, the manifestation of enjoyment by every learner is different. Some of them enjoy learning because of basic psychological need satisfaction, such as comfort, safety, ease, and effortlessness of the activity (pursuing hedonic quality of positive feelings); some of them approach learning because it is prized, meaningful, or challenging which often requires more efforts and emotion regulation (pursuing eudaimonic quality of positive feelings). We argue here that emotions and emotion regulation have distinct impact on enjoyment.

An increasing number of studies confirmed the positive effect of enjoyment on children's online learning, in terms of experience satisfaction (Espinosa-Curiel et al., 2020), sustainable or long-term learning (Ebrahimzadeh & Alavi, 2016), attitude and motivation (Smith & Li, 2020), and so on. However, these studies focused narrowly on enjoyment without consideration of learners' emotion and emotion regulation. There are few studies that link enjoyment to children's academic emotions and regulation (Obergriesser & Stoeger, 2020; Zaccoletti et al., 2020), yet the ones that do exist are limited to conventional classroom settings.

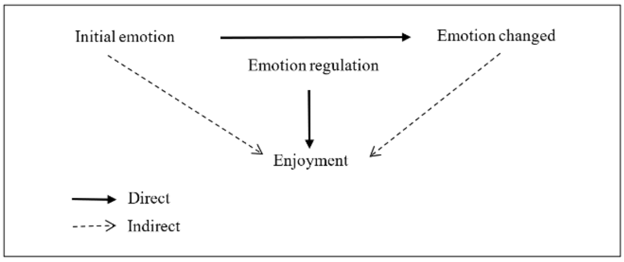
Although the studies reviewed here identified the significance of emotions, emotion regulations, and enjoyment in children's learning, none of them investigated the interrelation between these three components specifically in the asynchronous online learning context. Thus, it is necessary to conduct an investigation to further explore children's emotions, emotion regulations, and enjoyment during asynchronous online learning.

Interrelationships Between Emotions, Emotion Regulation, and Enjoyment in Asynchronous Online Learning Context

There are a lot of "emotional blanks" caused by the asynchronous online learning context's deficiencies in time and place, interaction channel, and interaction content (Zhang & Yu, 2023). To further explain the "emotional blanks" as the particular difficulty that asynchronous online learning poses in relation to learners' emotional experiences, the lack of real-time interaction with teachers and peers limits learners' emotional responses to specific events that causes them to feel disconnected from people, leading to indifference, loneliness and isolation. This situation may trigger stress responses and a state of collapse that makes the practice of emotion regulation strategies more difficult as compared to other learning environments. Hence, this study highlights the significance of investigating the interplay between emotions, emotion regulation, and enjoyment in asynchronous online learning context.

Figure 1

Hypothesised interrelationships between emotions, emotion regulation, and enjoyment



According to Figure 1, emotions are implied factors that indirectly impact learners' enjoyment in asynchronous online learning. Emotions are also essential factors that structure the manifestation of learners' enjoyment in asynchronous online learning. Nonetheless, emotions can be controlled, regulated, and changed by learners through emotion regulation to produce different emotional outcomes such as positive activating emotions, negative activating emotions, and negative deactivating emotions. This study recruited Gross's (2006) Process Model of Emotion Regulation to investigate the emotion regulation processes of asynchronous online learning learners, in terms of antecedent-focused emotion regulation (attentional deployment, situation selection, situation modification, and cognitive reappraisal) and response-focused emotion regulation (expressive suppression). In precise, the emotion regulation serves as a mediator between emotions and enjoyment to modulate responses triggered by emotions and help to filter the pieces of information and motivate learners to attend to it in a way that would stimulate excitement and enjoyment in asynchronous online learning. For example, poor emotion regulation causes learners' actions and behavioural patterns always be at the mercy of their emotions. Whereas well emotion regulation allows learners to carefully judge and have better balance of their affective outcomes to embrace enjoyment when experiencing asynchronous online learning; consequently, the emotion regulation alters the initial identified emotions which ultimately demonstrated the noticeable change of enjoyment that triggers learners to pursue hedonic or eudaimonic qualities of positive feelings. Throughout the process, the preferred type of emotion regulation among learners were identified as well as how the implied emotions and emotion regulation process could impact learners' enjoyment in asynchronous online learning.

After reviewing fundament theories, concepts, and practices implied in the previous research, this study sought to investigate elementary learners' emotions, emotion regulation, and enjoyment when experiencing asynchronous online learning. The present study identified the types of emotion regulation that address different emotions, emotions that affect learners' manifestation of enjoyment, and how the emotions and emotion regulation impact learners' enjoyment in asynchronous online learning. Meanwhile, this study highlighted the interrelationships between emotions, emotion regulation, and enjoyment which could theoretically and practically advance the field of study, especially to enhance elementary learners' enjoyment in asynchronous online learning. This study addresses the following research questions:

1. What are the primary types of emotion regulation of elementary learners during asynchronous online learning?
2. What are the implied emotions that affect elementary learners' enjoyment in asynchronous online learning?
3. How do the learners enact different types of emotions and emotion regulation that impact their enjoyment in asynchronous online learning?

Method

Research Context and Design

Malaysia's education system has undergone a substantial transformation in the aftermath of the COVID-19 pandemic, which has prompted a transition to continuous learning and increased flexibility in the learning process (Amini et al., 2024). In Malaysia's post-pandemic education context, as is the case with other educational levels, the elementary educational system is incorporating blended learning in tandem with conventional classroom settings. Blended learning is an approach that combines online educational materials and online interaction with conventional place-based classroom method. The online learning platforms are usually equipped with a variety of learning resources and materials, which learners have unrestricted access according to their individual learning needs. This is what we called as asynchronous online learning. The resources and materials are distributed based on learning topics and are sequentially arranged from basic to complex, complementing children's sequential reasoning to acquire knowledge or solve problems (Bruner, 1960). Furthermore, the resources and materials come in different forms, including quizzes, games, videos, and so on, with the goal of drawing children's attention and interest throughout the learning process.

In that context, this study attempted to gain a deeper understanding of the elementary learners' emotions, emotion regulation, and enjoyment in asynchronous online learning, as well as to demonstrate the interrelationships between these three components. Therefore, an approach that would enable discovery is needed for this investigation. To gain a comprehensive and in-depth description of learners' learning experiences, Merriam's (2009) qualitative case study methodology was employed.

Participants

A Malaysian elementary school that is currently engaged in the School Transformation Programme 2025 (TS25) was purposefully selected. TS25 is a program proposed by the Ministry of Education (MOE) to improve learners' success rate and schools' quality in 21st century education (Harun & Hamzah, 2018). The selected school is currently engaged in the implementation of activities that are bounded to the TS25 modules, including the redesign of learners' learning experiences, the utilisation of digital tools and resources, and the establishment of a conducive learning environment (Lazarov, 2018; Ismail & Aziz, 2019). With the influences of TS25, multimodal methods of teaching and learning are highly encouraged in the school due to the post-pandemic educational change that focuses on 21st century skills at the basic educational level. The school ideally suited to the typicality of the case needed by this study due to its educational digitalisation led by TS25, which establishes asynchronous learning practices particularly in the form of blended or flipped learning. It was anticipated that the selected school would contribute significantly to the background information that could help achieve the objective of this study.

The participants were recruited using criterion sampling. Considering the limited manpower and space available, the selected school proposed only third grade learners to be the target group for a long-term substantial active learning program training organised by the RITE Education Consultancy, despite the fact that all learners in the selected school are obligated to adopt the "new normal" teaching and learning under the instructions of their teachers. The RITE Education Consultancy provides a diverse array of physical and digital resources, as well as supporting materials to facilitate the learning program training. For this reason, third grade learners were chosen for this study, who were anticipated to adopt asynchronous online learning techniques and could provide rich data for this study.

14 Year-3 learners (age 9) from a Malaysian public elementary school participated in this study. There were 7 girls and 7 boys among them. According to Table 1, the distribution of gender was balanced to promote generalisability. A scoring system known as the standard-based performance assessment level is implemented in Malaysian schools to assess the prescribed level of performance of learners, which encompasses their knowledge, comprehension, and ability to perform. The participants' English performance level ranged from lower intermediate (LI), intermediate (I), to higher intermediate (HI) based on their English performance report in the current year. Only learners falling within the performance level range were selected because they reflected the average learner group, for the purpose of generalising results. Nonetheless, the required number of participants was contingent upon the point at which saturation was achieved, as if the data collection process had ceased to generate any new or pertinent information (Dworkin, 2012).

Table 1
Demographic information of participants

Participants	Performance Level	Gender
A	LI	Female
B	LI	Female
C	LI	Male
D	LI	Female
E	LI	Male
F	I	Male
G	I	Male
H	I	Male
I	I	Female
J	I	Male
K	HI	Male
L	HI	Female
M	HI	Female
N	HI	Female

Source: Learners' standard-based performance assessment level report provided by the selected school teachers

Data Collection and Analysis

First, by conducting systematic observations of individuals in their natural environments, it is possible to obtain information that enables the researcher to observe their actions rather than their verbal declarations. Merriam (2009) indicated that every observation should include the setting, the participants, activities and interactions, conversations, even subtle factors that are less obvious in a phenomenon. Hence, in this study, by using "free writing", field notes were recorded based on the three main focuses of this study: (1) emotions – facial expressions, language and tones, reactions to stimuli; (2) emotion regulation – behavioural adjustments, self-reported strategies, help-seeking; and (3) enjoyment – engagement level, expressions of satisfaction. The "free writing" method of taking field notes did not adhere to any format or protocol in order to record any noteworthy events that may have addressed the three primary focal areas listed above.

The observation process was conducted every week by capturing any significant occurrence that could potentially address the research questions throughout the three-month investigation; whereby the teachers and learners of the selected school engaged in weekly asynchronous online learning activities in accordance to their academic schedule. The researcher collected as much data as possible without adhering to a set time frame until information saturation was reached (Merriam, 2009); wherein after three months of investigations, no new information was found in the data collected. For observation purposes, participants were asked to enable online conferencing while engaging in asynchronous online learning. To prevent participant sensitivities from being observed or susceptible to the "Hawthorne Effect", the researcher told the participants that observations will be made during the study but did not tell them when or how long it would take. Since the observation was conducted by a single researcher, the way to reduce the observer bias was through regular reflection on potential biases, strived to only observe progress adhering to the precise guidelines (the three main focuses of the study - emotions, emotion regulation, enjoyment) for the behaviours and emotions that need to be noted, and being humble and non-judgmental throughout the study. To further reduce observer bias, the researcher also made repeated observations to establish a consistent trend for obtaining data.

Besides, participants were requested to attend 45-minute audio-visual interviews, using their native language; if more information was needed, follow-up questions would be addressed. The interviews were conducted after observations to cross-check the information obtained from subjective perspectives. This is because observations are susceptible to observer bias. Furthermore, observations are limited to noticing participants' interactions but not the reasons they behave the way they do. This study requires an approach that enables deep understanding of participants. To put it briefly, the interview was adhered to Merriam's (1998) case study interview procedure, which calls for probing, insightful questioning and interaction, recording, and data analysis. The interview protocol in this study was semi-structured, developed by borrowing some elements from the National Children's Advocacy Center Child Forensic Interview Structure (NCAC CFIS) (National Children's Advocacy Center, 2019). This is because NCAC provides a model for the forensic interview of a child which has a semi-structured format that can be adapted to children of different ages and cultural backgrounds; whereas the NCAC CFIS emphasises a flexible, thoughtful, decision-making approach throughout the interview and does not recommend a scripted format. The researcher also took references from Patton's (2002, pp.343-349) general interview guide approach, as well as from reviewing the literature on interviewing children. With the participants' consent, interviews were recorded for later transcription and analysis.

Thematic analysis was implemented to establish codes, generate categories, and develop themes. To ensure that the data could address the research questions, the first step was to conduct coding in conjunction with ongoing reflection. Data collected from interviews was analysed using In Vivo coding, while descriptive coding was employed for data collected from observations. Then, second-cycle coding was conducted and generated codes for descriptions through focused coding. In order to demonstrate the relationship between each code by generalising code patterns and categories, this study implemented Saldana's (2015) code mapping approach. In the "first iteration" of code mapping, a large number of codes were identified. Followed by "second iteration", the initial codes were categorised resulting from comparing and sorting all the codes to determine which one seems to come together. During the "third iteration", the previous categories were further classified into more specific groups; some categories found in previous categories were downgraded into "subcategories". The analysis process then continued with the second cycle coding via focused coding. Focused coding is a more rigorous analysis that filters the codes and generates interpretation and description for emerging patterns, categories, and themes through constant comparative analysis. Eventually, the researchers applied the "code weaving" (Saldana, 2015) technique by integrating themes into narrative form to see how the puzzle pieces fit together and address the research questions.

To ensure rigor in the thematic analysis process, the researcher employed member checking and constant reflexivity. Member checking involved sharing findings or themes with participants to validate that interpretations accurately represent their experiences and integrating their feedback to refine and validate themes. Reflexivity required the researcher to keep reflective journals to note biases, assumptions, and influences on the analysis, helping to ensure that the analysis was conducted more objectively and transparently. These strategies contribute to producing more reliable and valid findings in thematic analysis.

Ethical Considerations

Informed consent was obtained from the school principal, participants, and participants' parent(s)/guardian(s) prior to the study. The researcher kept participants' identities anonymous to safeguard the privacy of the participants. All the data collected were stored in a pin-secured hard disk. Hence, the information given by the participants would be kept confidential and were not shared with other people outside of this study.

Results

Primary Types of Emotion Regulation During Asynchronous Online Learning

The results indicated that elementary learners exhibit a high inclination towards intrinsic emotion regulation. In that context, antecedent-focused emotion regulation received more attention than response-focused emotion regulation.

According to Table 2, there is no significant difference between which type of antecedent-focused emotion regulation being commonly applied by elementary learners in online learning. Each type of emotion regulation plays a significant role in specific aspect. For instance, situation selection and modification help learners to select and modify situations which generate pleasant emotions that encourage them to keep learning. Followed by attentional deployment and cognitive appraisal which assist learners' emotion regulation in terms of cognition and internal control. Entirely, learners' emotion regulation result in beneficial outcomes, as though an increase in positive activating emotions and effective switch from negative deactivating to negative/positive activating emotions.

Besides, response-focused emotion regulation in terms of expressive suppression significantly aids learners to deliberately control their reflexive behavioural expression of emotions. Consequently, it results in positive emotion regulation. For example:

Participant J is taking a video of his project presentation. He sets his camera. He then gets to his feet and holds his work in his hands. He glances over

Table 2

Antecedent-focused emotion regulation among elementary learners

Types of Antecedent-focused Emotion Regulation	Change of Emotions		Examples of Excerpts
	Types of emotions	Facet of emotions	
Situation selection Justification Choosing a situation that generate more pleasant emotions.	Increase of positive activating emotion [Intrapersonal – decision making]	Topic emotion: Interest → Courage [Integral]	I will be more interested to attempt because no one has ever succeeded before...mostly because I have never tried. So, I give it a try. (Participant H/Interview/396-400)
	Increase of positive activating emotion [Intrapersonal – decision making]	Epistemic emotion: Passion → Satisfaction [Integral]	I will go through all the learning materials... I can gain more knowledge. (Participant I/Interview/182-186) I feel like I can learn more things. We must learn everything, not to learn halfway. (Participant F/Interview/245)
	Increase of positive activating emotion [Intrapersonal – decision making]	Achievement emotion: Confident → Grit [Integral]	I want lesser control from the teacher...I hope teacher does not interrupt what am I doing...I want teacher to let me do it by myself. (Participant L/Interview/243-273) I prefer to do the work by myself, even though sometimes I need help... Teacher helps me when I face problems. (Participant E/Interview 02/269-280)
	Negative activating → Positive activating [Intrapersonal – emotion-memory congruence]	Epistemic emotion: Confused → Secure [Integral]	I feel like it is better to start from one to five...I feel like it is safer. (Participant K/Interview 01/112-114). I always start from number one...I feel confused if I skip here and there. (Participant F/Interview/219)
	Negative activating → Positive activating [Interpersonal – social judgement/ social perception]	Social emotion: Annoyed → Determined [Integral]	I don't want other people to influence me...They may say something, but I am not going to do that...I must insist... because I want to do the thing I prefer to do. (Participant F/Interview/382-411)
	Negative deactivating → Positive activating [Intrapersonal – emotion-memory congruence]	Achievement emotion: Unattained → Pride [Integral]	My work isn't really good. Therefore, I don't show it to my friends...I dare to show it when I have improved, or I have done it better than them. (Participant J/Interview 02/167-177) I think she is not confident in doing the work. She will join the discussion on other subjects because she is confident. (Participant C/Interview/148-149) I will show them the very hard one...since it makes me feel a little bit more accomplished. (Participant K/Interview 01/381-389) I want them to be jealous. (Participant N/Interview 01/455)
	Negative deactivating → Positive activating [Intrapersonal – attentional biases]	Topic emotion: Overwhelmed → Interest [Integral]	I have a hard time to choose the learning materials... When I need to choose, I will choose my favourite one. (Participant M/Interview/178-206)
Situation modification Justification Modify a situation so as to change its emotional impact.	Increase of positive activating emotion [Intrapersonal – decision making]	Epistemic emotion: Passion → Satisfaction [Integral]	Participant N expressed that "harder is better". (House/Observation/MChat/00:59:23)
	Negative activating → Positive activating [Intrapersonal – decision making]	Achievement emotion: Dependence → Confident [Integral]	Some of the questions, I ask other people ...I don't ask them every question. Sometimes, I do it by myself. (Participant F /Interview/449-461)
	Negative activating → Positive activating [Intrapersonal – emotion-memory congruence]	Epistemic emotion: Confused → Attainable [Integral]	I learn with my friends because the work is confusing, or it is too hard for me. If I learn alone, that means I know how to do it by myself, I know how to do it properly. (Participant K/Interview 02/48-50)
	Negative activating → Positive activating [Interpersonal – social judgement/ social perception]	Social emotion: Guilt → Self-compassionate [Integral]	I am not that part of myself sometimes... Sometimes, I want to make my mother proud... Sometimes, I think learning can help me to gain more knowledge, more friends. (Participant M/Interview/480-523) Sometimes, I learn for others. Sometimes, I learn for myself... I learn for parents...I want them to be proud. (Participant N/Interview 01/426-436)

Table 2
Continue

	Negative deactivating → Positive activating [Interpersonal – social judgement/ social perception]	Social emotion: Mortified → Acceptance [Integral]	I will make an effort to do better than him and prove to him that I am better. So that he will stop making fun of me. (Participant J/Interview 02/181)
	Negative deactivating → Positive activating [Intrapersonal – decision making]	Social emotion: Isolated → Enlightened [Integral]	Participant N, C, and J are discussing about their works at the chat box. Teacher gives guidance. Participant C learns alone most of the time, but today, he joins the conversation. Whereas Participant N is active in asking and responding as usual. (House/ Observation/MChat/00:11:31-00:20:44)
Attentional deployment Justification Shifting attentional focus within an emotional scene	Increase of positive activating emotion [Intrapersonal – emotion-memory congruence]	Topic emotion: Interest → Excitement [Integral]	>I am always happy< with my learning... because I don't think about when the "best time" of my learning is. (Participant M/Interview/48-60)
	Negative activating → Positive activating [Intrapersonal – emotion-memory congruence]	Epistemic emotion: Uncertain → Passion [Integral]	I start by copying the answers from my friends since I have no idea how to do it. After that, I think I should consider what I want to learn and do throughout the learning process. I then attempt to do it on my own. (Participant E/Interview 01/457-460)
	Negative deactivating → Positive activating [Intrapersonal – decision making]	Achievement emotion: Despair ? Grit [Integral]	I want to keep studying even if there are moments when I feel like giving up. I refuse to give up...I will put a lot of effort if I still not sure. (Participant G/Interview/497-505)
	Negative deactivating → Positive activating [Intrapersonal – decision making]	Achievement emotion: Afraid → Grit [Integral]	I am not willing to take part in the online learning at the beginning because I am afraid that I won't be able to accomplish the works on my own. Then, I tried to fit in, and I found it interesting. (Participant L/Interview/33-37; Participant F/Interview/58)
	Negative deactivating → Positive activating [Intrapersonal – decision making]	Achievement emotion: Afraid → Grit [Integral]	I feel like I am not going to success... I think my grade is too low, so I am going to give up...however, I feel like I have to self-adjust after that (Participant J/Interview 02/134-149)
Cognitive reappraisal Justification Restructure attributions to prevent from entering into a negative believe cycle.	Increase of positive activating emotion [Intrapersonal – decision making]	Achievement emotion: Pride → Grit [Integral]	We will look at each other's work after we have finished our work...I think my friends may find my work to be quite excellent...but I won't stop working on my work despite compliments from friends or teachers. (Participant D/Interview/380-398)
	Negative activating → Positive activating [Interpersonal – social judgement/ social perception]	Social emotion: Unsecure → Self-compassionate [Integral]	Maybe my work is good, just that teacher doesn't say it out... I think they are proud of me... or maybe I make a lot of mistakes... I don't feel accomplished...I feel sad, a little bit angry and not feeling proud...Just don't think about it. That will make me feel better. (Participant M/Interview/431-445)
	Negative activating → Positive activating [Interpersonal – social judgement/ social perception]	Social emotion: Guilt → Self-compassionate [Integral]	If teacher is satisfied with my learning performance, I have no reason to judge myself as "I am not good". (Participant J/Interview 01/433)
	Negative activating ? Positive activating [Interpersonal – social judgement/ social perception]	Social emotion: Unsecure → Appreciate [Integral]	I posted my work. They could say anything like, "Wah ↑ You are good" or "You make a mistake". That does not bother me, and I am happy they point out my mistakes...It don't mind if people don't compliment me, as long as they tell me *oh! you make mistakes here*... and I correct it...I am happy there is someone who can tell me where am I done wrong and where am I done right. (Participant A/Interview/70-90) I feel okay if my friends say my work is nice. I feel like I can do better if they say my work is not nice. (Participant L/Interview/328-330)
	Negative deactivating → Negative activating [Interpersonal – social judgement/ social perception]	Social emotion: Mortified → Acceptance [Integral]	I am not happy...because I have already worked so hard, but teacher doesn't praise me... I think maybe I am not doing good enough. I need to work harder until teacher praises me one day. (Participant G/Interview/523-535)

Source: Author's findings.

his work a few times before he is ready to speak. He seems nervous. Then, he inhales deeply and starts to present his project. (House/Observation/0:37:41VT-0:38:32VT)

The above scenario demonstrates the participant's attempt at expressive suppression to regulate his tense emotion in order to calm himself down throughout the project presentation.

Despite elementary learners demonstrating a tendency for intrinsic emotion regulation, some of them performed prosocial behaviour in an effort to reduce their peers' negative emotion to achieve a desired outcome. Consider the following situation:

My friends are feeling frustrated to resolve problems by themselves. I teach them how to resolve it. I guide them to work harder, learn more, and think deeper...I will ruin their day if I never encourage them. (Participant A/Interview/454-476)

Participant A's action in the scenario led to effective regulation of her peers' emotions through situation modification (extrinsic emotion regulation), which offered specific support that helped to reduce peers' frustration when trying to resolve problems.

Emotions That Affect Elementary Learners' Enjoyment Manifestation in Asynchronous Online Learning

Emotion regulation leads to either positive or disruptive emotions as the natural consequence. On that note, positive activating emotions inevitably increases elementary learners' enjoyment of asynchronous online learning. Elaborating from Table 2, the most prevalent emotion among elementary learners that contributes to the increase in asynchronous online learning enjoyment is grit. The grit emotion was elevated by their intrapersonal drive when they have to decide how much persistent effort is required to achieve particular learning goals. Followed by interest, an intrapersonal type of emotion that falls under the facet of topic emotion. It is the second prevalent emotion that positively influences students' asynchronous online learning enjoyment when students engage with the learning topics. This study discovered the emergence of enjoyment in a range of emotional practices, including decision making, attentional biases, and emotion-memory congruence. In short, enjoyment encompasses a broad range of situations.

Thirdly, learners' enjoyment of asynchronous online learning is positively impacted by passion, a type of epistemic emotion elevated by learners' intrapersonal beliefs about the nature of knowledge and knowing, in terms of their enthusiasm for ongoing learning within the asynchronous online learning context. The fourth emotion that has a substantial impact on learners' asynchronous online learning enjoyment is self-compassion. In contrast to the above emotions, it is an interpersonal type of emotion which falls under the facet of social emotion. In precise, learners' self-compassionate emotion is driven by social judgement and perception; the social environment has a big influence on learners' self-compassionate emotion, which in turn influences their enjoyment of learning. Although other positive activating emotions such as excitement, courage, satisfaction, confident, secure, determined, pride, attainable, acceptance, enlightened, appreciate, and calm have a positive impact on learners' enjoyment of asynchronous online learning, however, this study identified them as the less influential emotions on learners' asynchronous online learning enjoyment.

On the other hand, this study discovered negative activating emotions as an inferior feature that proportionally raises elementary learners' enjoyment of asynchronous online learning, with emotion regulation acting as a catalyst. From the facet of epistemic emotion, learners' emotions of confusion and uncertainty occurred when they experienced emotion-memory congruence. However, they never stop learning in dedication to resolve their confusion and uncertainty. From the facet of achievement emotion, learners who had engaged in asynchronous online learning were found to be nervous and dependent when it came to making their own decisions. Nonetheless, nervousness encouraged learners to be more cautious and focused on their learning, whereas the feeling of dependence assisted learners in obtaining support for scaffolding which guarantees continuous learning. Furthermore, social emotions such as annoyance, guilt, and unsecure often arise during interpersonal interactions. Despite being in the midst of difficult situations or dragged by negative emotions, learners were still able to participate actively in the asynchronous online learning process.

The positive and negative activating emotions discovered in this study fall under the category of integral emotions, resulting from learners' consideration about decision parameters or its implications. In any events, negative deactivating emotions must be carefully attended because they evidently retard learners' learning engagement and decrease their asynchronous online learning enjoyment, such as the feeling of unattained, overwhelmed, mortified, isolated, despair, afraid, unconfident, demotivated, disinterest, neglect, and lost, as being identified by this study. Negative deactivating emotions are a mixture of integral and incidental emotions.

The Impact of Emotions and Emotion Regulation on Learners' Enjoyment of Asynchronous Online Learning

Drawing from the previous discussion of learners' enactment on how they effectively regulate their emotions, this study identified four types of interrelation patterns between emotions and emotion regulations, which have positive impacts on learners' asynchronous online learning enjoyment:

Positive activating emotion → Positive activating emotion = Increase of enjoyment
(Positive emotion regulation)

Negative activating emotion → Positive activating emotion = Increase of enjoyment
(Positive emotion regulation)

Negative deactivating emotion → Positive activating emotion = Increase of enjoyment
(Positive emotion regulation)

Negative deactivating emotion → Negative activating emotion = Increase of enjoyment
(Positive emotion regulation)

Unfortunately, there are instances where the failure of emotion regulations leads to disruptive emotional outcomes and a decrease in enjoyment. For instance:

Negative deactivating emotion → Negative deactivating emotion = Decrease of enjoyment
(Disrupted emotion regulation)

> *I won't take any action if I am not curious. (Participant D/Interview/274)*

> *I will not write anything when I lose my confidence. (Participant A/Interview/559)*

The above scenarios demonstrated emotion dysregulation, showing learners were unable to break out from the destructive emotional cycle (disinterest/unconfident?demotivated) which retarded their learning progress and their effort to pursue hedonistic enjoyment.

Not all activating emotions will be positively elevated after learners make effort to regulate their emotions. Consider the following situation:

Negative activating emotion → Negative deactivating emotion = Decrease of enjoyment
(Disrupted emotion regulation)

> *I am not sure how to proceed...I don't understand...but I tried to complete the easy one...then, I tell teacher that I don't know how to solve the other one...I wait for the answers. (Participant E/Interview 01/402-428)*

Although participant E was confused at the beginning of his learning, he still tried to solve his learning problem. However, he failed to effectively manage his confused emotion while he was learning, he felt despair and lost enjoyment in continuing trying and learning.

Furthermore, elementary learners frequently struggled to predict their learning capacity accurately, which then stimulate various emotions within their learning context. Consider the following situation:

Positive activating emotion → Negative deactivating emotion = Decrease of enjoyment
(Disrupted emotion regulation)

> *I think I am ready for something more difficult. But when I am working on a difficult task, I feel like I should be doing something easier... I have no idea what I want. (Participant M/Interview/577-583)*

The participant presented a disrupted emotion regulation of her passion in learning, which eventually led herself lost while predicting her learning ability. This situation results to a decline in eudaimonic enjoyment of discovering the meaning of learning.

Discussion

To address the research question 1, this study identified situational control and cognition/internal control as two major domains of emotion regulation in elementary learners' asynchronous online learning. Nonetheless, this study underscored that the functions of these two types of emotion regulation are not significantly different from one another; rather, they complement one another both internally and externally, which helps learners' emotions remain stable during asynchronous online learning. For instance, Participants L attempted to consciously shift her attention away from feeling afraid of learning independently in asynchronous online learning (internal control); concurrently, she engaged with her self-learning capability and deliberately avoiding the teacher's intervention (situational control), the learning circumstance provided her more opportunities to project herself which subsequently stimulated her learning interest in the context. This study's finding is supported by Gross's (2014) study, stating that emotional reactions can alternatively be either internal or can be described in terms of the aspects of external environment. This is because emotional responses often lead to changes in the environment that affect the probability of subsequent instances of other emotions.

According to Zhang et al.'s (2023) study, learners who tend to practice antecedent-focused emotion regulation were more likely to repair unpleasant emotions in a more optimistic manner, while those who prefer to practice response-focused emotion regulation experiencing less positive affect. Despite expressive suppression, a form of internal regulation, was not identified as a major type of emotion regulation among elementary learners in this study, the finding potentially challenged Zhang et al.'s (2023) perspective, arguing that response-focused emotion regulation e.g. expressive suppression may provide notable positive affect, as if learner like Participant J found it easier to concentrate on task after suppressing his emotional response and avoid distractions during his presentation. This type of response-focused emotion regulation motivated Participant J to confront learning challenges, which imperceptibly stimulated his self-confidence to perform or strive for his best if he was able to overcome the challenge, as he stated that "I dare to show it when I have improved" and "I will make an effort to do better than him". Nonetheless, there are many factors that influence learners' expressive suppression, such as individual differences and development in socialisation experiences, culture, and traits, which worth to be further investigated (Gross & Cassidy, 2019). Undeniably, expressive suppression comes with cost over time, such as increased stress and decreased satisfaction, and it usually results in greater unpleasant emotions in response to negative affective stimuli. This study suggests asynchronous online learning instructors to create a more open and supportive virtual learning environment where learners feel safe to express their emotions. Instructors can also incorporate various emotion regulation strategies, such as teaching cognitive reappraisal to help elementary learners reframe their thoughts and mindfulness techniques to enhance emotional awareness.

On the other hand, extrinsic emotion regulation, a person's initiative to regulate the emotions of others, was lacked among elementary learners. Learners are inclined to regulate their own emotions than to influence other people's emotions. Despite the fact that learners were generally observed to exhibit empathy for their peers, this did not necessitate engaging in other-oriented behaviour, as highlighted in Singer and Klimecki (2014). This finding demonstrated that learners at this stage are in the process of learning to understand and manage their own cognitive and emotion; they still struggle with emotional expression which would enable them to navigate social interactions more effectively. Hence, this study goes in line with Pollak et al.'s (2024) initiative, suggesting the needs of social-emotional learning programs for elementary learners to foster a sense of community and mutual respect that would positively support peer relationships as well as classroom climate in the asynchronous online learning context. However, an issue that should be taken into consideration is that asynchronous online learning environments often limit direct peer interaction and hinder learners' skills development to regulate not only their own emotions but also understanding and responding to the emotions of others. Instructors are encouraged to design more structured peer activities and to schedule synchronous check-ins via video calls or chats to provide opportunities for real-time interaction and emotional support.

Research question 2 aims to identify the emotions that implied in elementary learners' emotion regulation, as the key factors that should be considered when determining learners' enjoyment in asynchronous online learning. This study emphasised both positive and negative activating emotions as important components that optimise elementary learners' enjoyment of asynchronous online learning. This was a move forward over Mayer's (2020) study, which practically demonstrated that these two types of emotions were worthwhile to be explored when investigating emotions in technology-enhanced academic learning. Despite the inevitable effectiveness of positive activating emotions, this study stands in line with Wu and Yu (2022), proved that negative activating emotions is advantageous for asynchronous online learning indeed. To provide further context for this statement, for instance, confusion/uncertainty could be addressed by suspending the ongoing task to consider other options, by trying things out, or elevating critical thinking. Trying out various solutions not only addresses learners' confusion/uncertainty but also deepens their understanding of knowledge. Moreover, learners must evaluate different options, consider various perspectives, and make informed decisions to navigate confusion/uncertainty through critical thinking and analytical skills. Consequently, successfully overcoming confusion/uncertainty can provide a sense of accomplishment. This positive reinforcement enhances learners' confidence and motivate them to tackle future challenges, adding to their overall enjoyment of the asynchronous online learning experience.

Negative deactivating emotions do arise in the context of asynchronous online learning, as indicated by previous research (Aladsani et al., 2022; Hamzeh, 2021). According to the study's findings, negative deactivating emotions, such as boredom, frustration, and anxiety significantly reduced learners' motivation and confidence to engage in the learning activities, and increased learners' cognitive load, making it harder for learners to process information, concentrate, and retain knowledge. These situations caused avoidance behaviour such as avoiding challenging tasks and discourage learners to interact with teacher and peers, leading to feelings of isolation. This study suggested attention to specific negative deactivating emotions that anticipate further actions from instructors to improve the state of asynchronous online learning enjoyment among elementary learners. Rather of considering the influence of learners' intrapersonal emotions on their asynchronous online learning enjoyment, instructors must be aware of the influences of social environment in that context which is closely associated with the interpersonal impact on learners' emotions manifestation, as highlighted by Kamei and Harriott (2021).

Research question 3 concerned the relationship between emotions, emotion regulation, and enjoyment, regarding how the elementary learners carry out the regulation process during asynchronous online learning. The finding of this present study refutes the findings of Sanchis-Sanchis et al. (2020), arguing that children normally have weak emotion regulation skills. Based on the elementary learners' demonstration of the interrelation pattern between emotions, emotion regulation, and enjoyment, this study discovered the possibility for children to further expand their emotion regulation practices through asynchronous online learning due to a high incidence of successful emotion regulation in the context. For instance, elementary learners possessed a pleasant ability to regulate their emotions during asynchronous online learning, which led to an increase or persistence of positive emotions. Consequently, those positive emotions such as interest and excitement prompted learners' hedonic enjoyment of feeling effortless to pursue happiness through pleasurable asynchronous online learning activities. To extend further, the development of positive emotions brought about by efficient emotion regulation also increased learners' eudaimonic enjoyment in achieving long-term contentment by accepting more challenging asynchronous online learning tasks. Hence, emotion regulation was identified to be an action that significantly determines learners' emotion manifestation in the learning context, simultaneously established a close connection between learners' emotions and hedonic or eudaimonic qualities of enjoyment. Nonetheless, learners occasionally lacked or struggled with emotion regulation. Here comes the outcome that indicates an emergence of negative emotions like feeling despair or tendency to give up. Consequently, it caused a fall in hedonic enjoyment (e.g. I won't take any action if I am not curious/lose confidence) and a fall in eudaimonic enjoyment (e.g. I feel like I should be doing something easier). Regarding this matter, Keane and Griffin (2018) indicated that young learners are often hard to predict individual strengths and weaknesses that hinders their attempts to pursue hedonic or eudaimonic qualities of enjoyment or positive feelings. Initiatives that help in developing children's emotion regulation skills should be incorporated, in both preventive and treatment interventions in asynchronous online learning to improve the current situation.

Conclusion

This study initially looks into the background and theoretical underpinnings of emotions, emotion regulation, and learning enjoyment in the post-pandemic asynchronous online learning context of Malaysian elementary education. Subsequently, readers were provided with detailed methodological information to determine whether the practice is pertinent to their own context. Research questions were addressed. As per research question 1, this study identified situational control and cognition/internal control as two complementing domains (internally and externally) of emotion regulation that influence learners' emotions stability and enjoyment during asynchronous online learning. Meanwhile, response-focused emotion regulation such as expressive suppression can also have positive effects, like improved learners' concentration and motivation, if synchronous online learning instructors carefully guide elementary learners to manage their emotions effectively. In addition, fostering a sense of community and mutual respect through extrinsic emotion regulation is significant because it would positively support peer relationships as well as classroom climate in the asynchronous online learning context.

While addressing research question 2, this study identified positive and negative activating emotions as important components that optimise elementary learners' enjoyment of asynchronous online learning. At the same time, specific attention should be put to negative deactivating emotions that anticipate further actions from instructors to avoid hindering learners' enjoyment during asynchronous online learning. To address research question 3, this study has explored how elementary learners regulate their emotions to maintain or increase their enjoyment during asynchronous online learning. Furthermore, this study also identified the interrelationships between emotions, emotion regulation, and enjoyment which resulting in desired and undesired outcomes that suggest advancement to the field of study.

Nonetheless, this study only investigated 14 elementary learners from single Malaysian school. Future studies should involve more participants from a wider range of academic levels and institutions to strengthen the findings on learners' emotion, emotion regulation, and enjoyment of asynchronous online learning. Besides, this study did not relate learners' gender and academic achievement with their emotions, emotion regulation, and enjoyment in asynchronous online learning. Future studies may delve deeper into these domains to uncover worthful insights and enhance the field. Since different online learning approaches and platforms may provide different affordances to learners, it would be useful for future studies to investigate learners' emotions, emotion regulation, and enjoyment in other online learning context, such as synchronous online learning.

Despite the limitations, there are theoretical and practical implications that may be drawn from the study's findings. From a theoretical perspective, the present study extends previous studies on elementary learners' emotions, emotion regulation, and enjoyment to an asynchronous online learning context. Within this context, the findings offer a novel understanding of the interrelation between emotions and emotion regulation in relation to asynchronous online learning enjoyment. From a practical perspective, this study proposed that instructors should provide opportunities to raise elementary learners' understanding of their emotions and awareness of regulating the emotions in order to improve or maintain their enjoyment of learning. Instructors should consider both situational/ environmental control and cognition/internal control as two major domains of emotion regulation to be cultivated in elementary learners when designing asynchronous online learning. Furthermore, this study suggests instructors' attention to enhance learners' positive and negative activating emotions, while restricting learners' negative demotivating emotions that significantly impede their enjoyment of learning.

Ethics Board Approval

This study has been officially approved by the Educational Planning and Research Division (EPDR), Ministry of Education (MOE), and District Education Department.

Conflicts of Interest

The author has no conflicts of interest to declare.

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References

Aladsani, H., Al-Abdullatif, A., Almuhanna, M., & Gameil, A. (2022). Ethnographic reflections of K-12 distance education in Saudi Arabia: Shaping the future of post-pandemic digital education. *Sustainability, 14*, 1-17. https://doi.org/10.3390/su14169931

Alserhan, S., Alqahtani, T. M., Yahaya, N., Al-Rahmi, W. M., & Abuhassna, H. (2023). Personal learning environments: Modeling students' self-regulation enhancement through a learning management system platform. *IEEE, 11*, 5464-5482. https://doi.org/10.1109/ACCESS.2023.3236504

Amini, M., Ravindran, L., & Lee, F. L. (2024). Adapting education shifts in Malaysia after COVID-19: A comprehensive review of flexible assessments, lifelong learning initiatives, and diversified learning trajectories. *Asian Journal of Assessment in Teaching and Learning, 14*(1), 1-14. http://dx.doi.org/10.37134/ajatel.vol14.1.1.2024

Asikainen, H., Hailikari, T., & Mattsson, M. (2018). The interplay between academic emotions, psychological flexibility, and self-regulation as predictors of academic achievement. *Journal of Further and Higher Education*, *42*(4), 439–453. https://dx.doi.org/10.1080/0309877X.2017.1281889

Blanchette, I., & Richards, A. (2010). The influence of affect on higher level cognition: A review of research on interpretation, judgement, decision making and reasoning. *Cognition and Emotion*, *24*(4), 561–595. https://doi.org/10.1080/02699930903132496

Boekaerts, M. (1996). Self-regulated learning at the junction of cognition and motivation. *European Psychologist*, *1*(2), 100–112. http://dx.doi.org/10.1027/1016-9040.1.2.100

Boekaerts, M. (2011). Emotions, emotion regulation, and self-regulation of learning. In *Handbook of self-regulation of learning and performance* (pp. 408-425). Routledge.

Borup, J., & Archambault, L. (2023). Designing online learning for children and youth. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of open, distance, and digital education* (pp. 1287-1307). Springer.

Bruner, J. (1960). *The process of education*. Harvard University Press.

Chzhen, Y., Symonds, J., Devine, D., Mikolai, J., Harkness, S., Sloan, S., & Sainz, G. M. (2022). Learning in a pandemic: Primary shool children's emotional engagement with remote schooling during the spring 2020 Covid-19 lockdown in Ireland. *Child Indicators Research, 15*(3), 1517-1538. http://dx.doi.org/10.1007/s12187-022-09922-8

De Vaus, D. A. (1993). *Surveys in social research* (3rd ed.). UCL Press.

Dworkin, S. L. (2012). Sample size policy for qualitative studies using in-depth interviews. *Archives of Sexual Behavior, 41*(6), 1319-1320. http://dx.doi.org/10.1007/s10508-012-0016-6

Ebrahimzadeh, M., & Alavi, S. (2016). Motivating EFL students: E-learning enjoyment as a predictor of vocabulary learning through digital video games. *Cogent Education, 3*(1), 1-14. https://doi.org/10.1080/2331186X.2016.1255400

Engelmann, P., & Bannert, M. (2019). Fostering students' emotion regulation during learning: Design and effects of a computer-based video training. *International Journal of Emotional Education, 11*(2), 3-16. https://www.um.edu.mt/library/oar/handle/123456789/49172

Espinosa-Curiel, I. E., Pozas-Bogarin, E. E., Martínez-Miranda, J., & Pérez-Espinosa, H. (2020). Relationship between children's enjoyment, user experience satisfaction, and learning in a serious video game for nutrition education: Empirical pilot study. *JMIR Serious Games, 8*(3), e21813. https://doi.org/10.2196%2F21813

Gagne, J. R., Liew, J., & Nwadinobi, O. K. (2021). How does the broader construct of self-regulation relate to emotion regulation in young children? *Developmental Review, 60,* 100965. https://psycnet.apa.org/doi/10.1016/j.dr.2021.100965

Gross, J. J., Richards, J. M., & John, O. P. (2006). Emotion regulation in everyday life. In D. K. Snyder, J. Simpson, & J. N. Hughes (Eds.), *Emotion regulation in couples and families: Pathways to dysfunction and health* (pp. 13–35). American Psychological Association. https://doi.org/10.1037/11468-001

Gross, J. J. (2014). Emotion regulation: Conceptual and empirical foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–20). The Guilford Press.

Gross, J. T., & Cassidy, J. (2019). Expressive suppression of negative emotions in children and adolescents: Theory, data, and a guide for future research. *Developmental Psychology, 55*(9), 1938-1950. http://dx.doi.org/10.1037/dev0000722

Hamzeh, N. (2021). *Learnings from the impact of online learning on elementary students' mental and social-emotional well-being amid the COVID-19 pandemic* [Master's thesis, Dominican University of California]. Dominican Scholar. https://doi.org/10.33015/dominican.edu/2021.EDU.05

Harrington, E. M., Trevino, S. D., Lopez, S., & Giuliani, N. R. (2020). Emotion regulation in early childhood: Implications for socioemotional and academic components of school readiness. *Emotion, 20*(1), 48–53. https://doi.org/10.1037/emo0000667

Harun, Z., & Hamzah, K. A. (2018). *Program Menuju Puncak dikalangan murid sekolah rendah luar bandar* (pp.11-15). Prosiding Konvensyen Kebangsaan 2018 Program Transformasi Sekolah 2025. University Kebangsaan Malaysia.

Hauk, D., & Groschner, A. (2022). How effective is learner-controlled instruction under classroom conditions? A systematic review. *Learning and Motivation, 80,* 1-12.

Hill, W., Hill, J., Abzhaparova, A., Cox, W., & Alexander, A. (2024). Pandemic pedagogies: Reflecting on online learning using the community of inquiry framework. *Journal of Geography in Higher Education, 48*(2), 157-176. https://doi.org/10.1080/03098265.2023.2190962

Ismail, M. I. H., & Aziz, A. A. (2019). TS25 school teachers' perceptions of differentiated learning in diverse ESL classrooms. *Journal of Education and Social Sciences, 13*(1), 95-107.

Ismail, N. H., Fathil, N. F., & Jaafar, S. B. (2023). Students' achievement emotions in online learning. *Politeknik & Kolej Komuniti Journal of Sciences and Humanities, 8*, 1-12.

Jones, S. M., McGarrah, M. W., & Kahn, J. (2019). Social and emotional learning: A principled science of human development in context. *Educational Psychologist, 54*(3), 129-143. https://doi.org/10.1080/00461520.2019.1625776

Kamei, A., & Harriott, W. (2021). Social emotional learning in virtual settings: Intervention strategies. *International Electronic Journal of Elementary Education, 13*(3), 365-371. https://www.iejee.com/index.php/IEJEE/article/view/1487/517

Kanyakumari, D. (2020, May 20). Home-based learning: Odds stacked against teachers in Malaysia's public primary schools, while private counterparts are more prepared. *Channel News Asia*. Retrieved April 20, 2024 from https://www.channelnewsasia.com/news/asia/malaysia-covid-19-homebased-learning-primary-school-teachers-12735306

Kawabata, M., & Mallett, C. J. (2022). Progressing the construct of enjoyment: Conceptualizing enjoyment as a proactive process. *Discover Psychology, 2*(1), 1-9. https://doi.org/10.1007%2Fs44202-021-00015-1

Keane, L., & Griffin, C. P. (2018). Assessing self-assessment: Can age and prior literacy attainment predict the accuracy of children's self-assessments in literacy? *Irish Educational Studies, 37*(1), 127-147. https://doi.org/10.1080/03323315.2018.1449001

Lai, C.-L., & Hwang, G.-J. (2023). Strategies for enhancing self-regulation in e-learning: A review of selected journal publications from 2010 to 2020. *Interactive Learning Environments, 31*(6), 3757-3779. https://doi.org/10.1080/10494820.2021.1943455

Lan, P.-S., Liu, M.-C., & Baranwal, D. (2023). Applying contracts and online communities to promote student self-regulation in English learning at the primary-school level. *Interactive Learning Environments, 31*(1), 468-479. https://doi.org/10.1080/10494820.2020.1789674

Lazarov, L. (2018). Education in the 21st century - pedagogical approaches in digital environment. 'E-teacher' information system. *Eastern Academic Journal, 2*(2), 13-25.

Loderer, K., Pekrun, R., & Lester, J. C. (2020). Beyond cold technology: A systematic review and meta-analysis on emotions in technology-based learning environments. *Learning and Instruction, 70,* 1-15. https://doi.org/10.1016/j.learninstruc.2018.08.002

López-Pérez, B., & Pacella, D. (2021). Interpersonal emotion regulation in children: Age, gender, and cross-cultural differences using a serious game. *Emotion, 21*(1), 17–27. https://doi.org/10.1037/emo0000690

Mayer, R. E. (2020). Searching for the role of emotions in e-learning. *Learning and Instruction, 70*, 1-3. https://doi.org/10.1016/j.learninstruc.2019.05.010

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. Jossey-Bass Publishers.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implement.* Jossey-Bass Publishers.

National Children's Advocacy Center (2019). *National Children's Advocacy Center's Child Forensic Interview Structure*. Author.

Oatley, K., Parrott, W. G., Smith, C., & Watts, F. (2011). Cognition and emotion over twenty-five years. *Cognition & Emotion*, *25*(8), 1341–1348. https://doi.org/10.1080/02699931.2011.622949

Obergriesser, S., & Stoeger, H. (2020). Students' emotions of enjoyment and boredom and their use of cognitive learning strategies – How do they affect one another? *Learning and Instruction*, *66*, 101285. https://doi.org/10.1016/j.learninstruc.2019.101285

O'Regan, K. (2019). Emotion and e-learning. *Online Learning, 7*(3), 78-92. https://doi.org/10.24059/olj.v7i3.1847

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Sage Publications.

Pekrun, R., & Linnenbrink-Garcia, L. (2012). Academic emotions and student engagement. In S. Christenson, A. Reschly, and C. Wylie (Eds.), *Handbook of research on student engagement* (pp.259-282). Springer.

Pollak, I., Stiehl, K. A. M., Birchwood, J., Schrank, B., Zechner, K. A., Wiesner, C., & Woodcock, K. A. (2024). Promoting peer connectedness through social-emotional learning: Evaluating the intervention effect mechanisms and implementation factors of a social-emotional learning programme for 9 to 12-year-olds. *Journal of Youth and Adolescence, 53*, 89-116. https://doi.org/10.1007/s10964-023-01871-x

Saldana, J. (2015). *The coding manual for qualitative researchers* (3rd ed.). Sage Publications.

Saleh, M. A., Khan, M. I., Banerjee, S., & Safi, F. (2023). A tale of online learning during COVID-19: A reflection from the South Asian Association for Regional Cooperation (SAARC) countries. *Heliyon, 9*(6), 1-16. https://doi.org/10.1016/j.heliyon.2023.e16347

Sanchis-Sanchis, A., Grau, M. D., Moliner, A.-R., & Morales-Murillo, C. P. (2020). Effects of age and gender in emotion regulation of children and adolescents. *Frontiers in Psychology, 11*, 1-13. https://doi.org/10.3389/fpsyg.2020.00946

Singer, T., & Klimecki, O. M. (2014). Empathy and compassion. *Current Biology, 24*, 875-878. https://doi.org/10.1016/j.cub.2014.06.054

Smith, M (2017). *The emotional learner.* Routledge.

Smith, S. A., & Li, Z. (2020). Closing the enjoyment gap: Heritage language maintenance motivation and reading attitudes among Chinese-American Children. *International Journal of Bilingual Education and Bilingualism, 25*(3), 1070-1087. https://doi.org/10.1080/13670050.2020.1742653

Tabiin, Q. A., Khomisah, S., Sutiyono, A., & Abdullah, S. (2022). Implications of students' online learning experience on social and emotional behavior. *Social Sciences and Education Research Review, 9*(1), 97-106. https://doi.org/10.5281/zenodo.6794681

Tyng, C. M., Hafeez U. Amin, Mohamad N. M. Saad, & Aamir S. Malik (2017). The influences of emotion on learning and memory. *Frontiers in Psychology, 8*, 1-22. https://doi.org/10.3389/fpsyg.2017.01454

Vergara, A. I., Alonso-Alberca, N., Gutièrrez, J., & Schultz, D. (2022). Measuring emotional knowledge: Assessment of children's emotional skills (ACES) with Spanish school-age children. *International Journal of Emotional Education, 14*(2), 68-87. https://www.um.edu.mt/library/oar/handle/123456789/104116

Wan, C. D. (2020). *Malaysia: An unexpected disruption to teaching and learning*. The Head Foundation. Retrieved April 27, 2024 from https://headfoundation.org/2020/06/16/malaysia-anunexpected-disruption-to-teaching-and-learning/

Wu, R., & Yu, Z. (2022). Exploring the effects of achievement emotions on online learning outcomes: A systematic review. *Frontiers in Psychology, 13,* 1-15. https://doi.org/10.3389/fpsyg.2022.977931

Zaccoletti, S., Altoè, G., & Mason, L. (2020). Enjoyment, anxiety and boredom, and their control-value antecedents as predictors of reading comprehension. *Learning and Individual Differences, 79*, 101869. https://doi.org/10.1016/j.lindif.2020.101869

Zhang, N., Liu, W., Che, H., & Fan, X. (2023). Effortful control and depression in school-age children: The chain mediating role of emotion regulation ability and cognitive reappraisal strategy. *Journal of Affective Disorders, 327,* 111-119. https://doi.org/10.1016/j.jad.2023.01.129

Zhang, T., & Yu, S. (2023). Effects of asynchronous interaction on positive emotional experiences of learners during online learning. *International Journal of Emerging Technologies in Learning (iJET), 18*(8), 48–60. https://doi.org/10.3991/ijet.v18i08.38703

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Russian Mathematics in Norwegian Classrooms Challenges in Implementing Zankov's Didactic-Methodological System in Primary Mathematics Education in Norway

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Abstract

Developmental Education in Mathematics (DEM) according to Zankov's model, or "Russian mathematics", has been in use in Norway since 2009 in an increasing number of schools (about 100 elementary schools in 2024). There has been relatively little research into the implementation of this teaching method in a Norwegian context. In this article we review the fundamental elements and characteristics of Vygotsky's Zone of Proximate Development (ZPD) and the didactic principles and methodology in Zankov's system. We also discuss some challenges concerning the implementation of Zankov's didactic system in Norwegian primary schools and some possible explanations.

Keywords:

Vygotsky, Zankov, Devlopmental Education, ZPD, Mathematics, Didactic Principles, Methodology, Primary School

Introduction

What is optimal teaching for students? How is a knowledge system formed in the minds of schoolchildren by systematic learning? What do connections between didactic principles, the content in education, and teaching methods look like? What exactly is the influence of education on the mental, emotional, and physical development of students? Questions like these raise several important and interesting issues. Many teachers, searching for the "golden key" that opens the doors to optimal teaching, want a practical answer to these questions and not just theoretical considerations. The relationship between education and development is not easy to uncover because "... any pedagogical influence can only lead to a result other than through the student's mind, i.e., by triggering this or that mental activity in the student" (Zankov, 1973a, 128, author's translation). Cultural-historical psychology has undoubtedly become the most influential theory of mental development with Vygotsky as the most cited psychologist, with his concept of "the zone of proximate[1] development" (ZPD), the golden zone of teaching. Since 2009 Norwegian teachers have been experimenting with

Zankov's teaching method, which has its own didactic system and philosophy built on Vygotsky's theories: "... we proceed from the theoretical principles of L. S. Vygotsky" (Zankov, 1963b, 12, author's translation). Developmental education in mathematics (DEM) has attracted great interest among several teachers. But how is DEM and Vygotsky's and Zankov's concept of the ZPD implemented in Norwegian classrooms? Some preliminary research into the implementation of the Zankov system in Norway has been done (Gjære & Blank, 2019). Research by Gjære (2022, 2023) may indicate certain challenges even for teachers with strong loyalty to Zankov's didactic principles. These findings should be properly addressed, and possible explanations searched for.

Vygotsky and Zankov: Zone of Proximate Development (ZPD)

Lev Semyonovich Vygotsky (1895-1934), "the Mozart of psychology" (Toulmin, 1978, 51-52), revolutionized psychological science (Newman & Holzman, 1993) in that he created new approaches in cognitive psychology. Among other things, Vygotsky, popularly called the "founder of the sociocultural learning theory" (social constructivism), studied the relationship between teaching-learning (обучение, obuchenie) and children's development (развития, razvitiya) - both a psychological and pedagogical problem - and concluded that "The only good form of teaching is the one that leads development ..." (Vygotsky, 2001, 167, author's translation). Zankov agrees: "Learning-teaching (обучение) comes ahead of development (развития)" (Zankov, 1968, 12, author's translation). Teaching and education are the motor of the child's cognitive development. Vygotsky's famous but under-communicated "theorem" reveals his thinking: "One step in learning may result in a hundred steps in development" (Vygotsky, 1982 apud Zaretsky, 2016, 149; cf. Zankov 1963b, 22).

The well-known concise and "classical" definition of the ZPD from 1935 (Zaretsky, 2021) of

> *the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers*

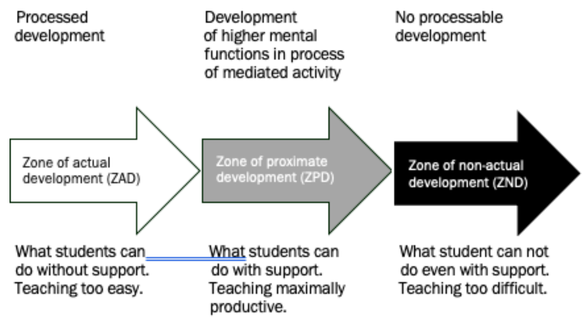
appeared in Vygotsky's first English translation (Vygotsky, 1978, 86, 131). If the goal of education is to promote the student's development, the teaching in the classroom should address not what is manifestly achieved (the actual level of development), but the abilities, mental functions, and skills that a child has neither expressed nor achieved as yet (the proximate or potential level of development). These are developed with the help of the teacher or other more capable fellow students who function as "collaborators" for the student.

> *What the child can do today with the help of adults, it will be able to carry out tomorrow on its own. In this way the zone of proximate development will help us to define tomorrow's achieve-ments and the dynamics of the child's development, taking into account not only what it has already mastered, but also its process of growth (Vygotsky, 2017, 366)*

> *The zone of proximal development defines those [higher mental] functions that have not yet matured but are in the process of maturation, functions that will mature to-morrow but are currently in an embryonic state. These functions could be called "buds" or "flowers" of development rather than the fruits of development. (Vygotsky, 1978, 86)*

If the goal of education is to promote the development of the student, "The role of teaching as the source of development [is] creating the zone of proximate development ..." (Vygotsky, 2017, 368). While the zone of actual development (ZAD) talks about development that has already taken place, the zone of proximate development (ZPD) speaks of future development. Vygotsky's texts indicate that he placed greater emphasis on the ZPD than the 1935 definition would suggest. The ZPD, that exists because of the presence of maturing mental functions, is often presented in a simple way like this:

Figure 1
ZAD, ZPD and ZND



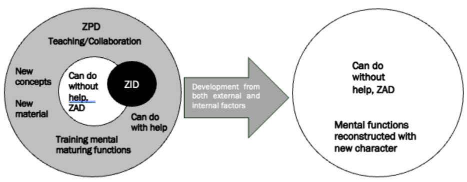
To uncover processes that can tell us about the students' development, we need a "system" (Vygotsky, 1982, apud Zankov, 1968, 20) due to the principle of systematic learning where the "system is a whole that represents a unity" (Zankov, 1968, 86, author's translation). Zankov's didactic system operationalizes the ZPD concept in classroom teaching (Guseva & Solomonovich, 2017; Zankov 1963b; 1975/1977a). The essence of proximate development and Zankov's system is that the teaching must address the student's mental abilities as they are emerging, but which have not yet matured. By following Vygotsky's theoretical standpoint, Zankov considered collective learning activity, either with adults or peers, as the core of the ZPD:

> *This level [the ZPD] is identified by noting the kinds of problems that the child is unable to cope with by himself, but can solve with the aid of grownups, in collective activity, or through imitation. But what a child can do in cooperation with someone else today, he will be able to do alone tomorrow (Zankov, 1977a, 18)*

With good collaboration between teacher and student, the ZAD can be expanded. "Training creates a zone of nearest development, which then turns into actual development" (Zankov, 1963b, 11-12, author's translation). At the same time, Zankov believes that the ZPD is not the only place where development can take place! Collaboration and imitation are not the only conditions for development as Vygotsky believed. Zankov writes: «... the zone of proximate development ... does not represent the only way of learning to influence children's development» (Zankov, 1963b, 12, author's translation, cf. Longarezi & Ferola, 2023, 16-17). The point is that the teacher can also organize the material so that the students process it in their own independent way, without help: "... in the process of independently solving the questions posed, the child advances in one or another area of mental activity" (Zankov, 1963b, 13, author's translation). The "collaboration" is done in advance. Perhaps we can call this the ZID, the zone of independent development, and place it as a separate zone within the ZPD and ZAD, wherein "imitation is completely excluded" (Zankov, 1963b, 13, author's translation) and the children perform problem solving on their own. The ZPD interacts with other ways that training influences the development of mental activity of schoolchildren. There is a difference between independent and assisted task performance.

Figure 2

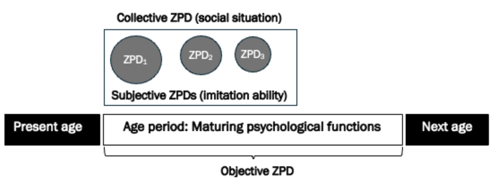
ZPD in Vygotsky (1978) and Zankov (1963b; 1968): ZPD (mental functions that require external stimulus e.g. "good teaching" that promotes the student's development) turns into ZAD (restructured mental functions that are used independently to solve certain tasks)



The individual ZPD of the child can be smaller or larger depending on the extent of which the child is able to utilize the collaboration in the classroom. The "objective" ZPD reflects mental functions needed to be formed during a given age period to form the next period (Chaiklin, 2003).

Figure 3

Age, age period and different kinds of ZPDs in Vygorsky (apud Chaiklin, 2003)



Zankov writes that there are several ways in which teaching can affect the student's development. These pathways are not isolated but exist in a complex interaction. The creation of ZPD through teaching interacts with teaching's other ways of influencing the students' development of mental activity. Zankov also writes about "zones of proximate development" ("зоны ближайшего развития") (Zankov, 1963b, 16, author's translation) in which the paths of learning, which have a complex interrelation, can influence the student's mental development. If there are different "depths of the child's own mind" (Vygotsky, 1978, 45), there should also be different depths of the child's ZPDs. A deeper understanding of these processes, for which ZPD is a diagnostic principle, will lead to knowledge of the mutual relationship between learning and development (Zankov, 1963b). Gjære & Freiman (2022) write about a "zone of collective proximal development", meaning a symmetrical co-construction of a ZPD and in a "creative polyphony" among the students. Zankov writes:

> *The differentiated teaching methodology has a number of characteristics, the most important of which is that the same questions in the curriculum are worked through to different depths by different students. This allows the entire class, including the weakest students, to proceed ... (Zankov, 1968, 35-36, author's translation)*

All students, with their individual mental "depths" and their individual ZPDs can contribute to the class's "average" or "larger" collective ZPD through collaboration with the teacher, differentiated teaching and creative "polyphonic" discussions and search activities together with other students and the teacher.

While the ZPD is often considered to include an asymmetric relationship between "a more knowledgeable other" and the student, a recent reworking of the concept has led to a more symmetrical model (Roth, 2020). The teacher's role can be dynamic where students guide the teacher towards their educational goals. The ZPD is not only dependent on the teacher, who selects appropriate learning activities, but also on the student's acceptance of participation in the activities. Breive (2020) has shown that the ZPD not only depends on the teacher, but also on the student's active contribution and commitment to achieving the learning goals together. In other words, the ZPD is viewed as a co-construction between the participants, where the teacher and the students almost form an "educational team" and where everyone is oriented towards the same goal for the activity (Radford, 2010). This is in line with Zankov's system's break with the "teacher-as-authority" culture that dominated the Tsarist system and, in the USSR (and elsewhere) during Zankov's time. A symmetrical perspective on the ZPD is described by Roth & Radford (2010). They begin with a critique of the ZPD:

> *Unfortunately, following a simplified reading of its original definition and primary sense in the quote that opens this text, the concept tends to be thought of in terms of the opposition of individuals. One of these individuals, a teacher or peer, is more capable than another individual, the learner (Roth & Radford, 2010, 299)*

Based on this criticism, Roth and Radford developed a symmetrical perspective on the ZPD, i.e. "...in a reciprocal manner, the participants in a symmetric space of inter-action." (Roth & Radford, 2010, 304). They further write:

> *The advantage of the symmetric approach to the zone of proximal development that we propose here is that it allows the question of the more capable subjectivity to emerge from the interaction, appropriate especially when the question who is in the know cannot be established on the basis of the institutional positions that the individuals otherwise take.*

The ZPD is not only a "zone of agreements", but also a zone of "tensions, disagreements, misunderstandings, conflict, and subversion" (Roth & Radford, 2010, 306). But it is not connections between the didactic principles of Zankov that cause the tensions, but rather the level of difficulty, discussions, and the way of solving the problem. The ZPD reflects a certain "collision" between the teacher's and the student's perspectives. Zankov (1975/1977a) believes that such collisions can naturally emerge in the learning activities and thus create greater intensity. By overcoming these tensions, both the students and the teacher can learn and develop. This therefore takes place through a co-construction of the ZPD. A practice based on a sociocultural perspective can build on tensions between teacher and student to achieve increased student engagement (Brown, 2020). Zankov (1968, 1990) believed that one should allow students room to think, express doubts and questions and make mistakes, and considered mistakes as a stepping stone to a solution to the problem in a classroom with this kind of classroom atmosphere.

Zankov had the same definition and understanding of the ZPD as Vygotsky (Zankov, 1990, 1963b). Zankov talks about "child" and "adult" (Zankov, 1990, 94). The ZDP has an asymmetric perspective in the sense that the adult or the teacher or other children in primary education often is "the knowledgeable other" or "a more capable peer" in relation to the child. However, with Zankov, the teacher and the child are not in "opposition" (Roth & Radford, 2010) to each other. In this way, the ZPD has a symmetrical aspect in that the teacher listens attentively to the child, to impressions the child wants to share, impressions, doubts and questions that need to be answered (Zankov, 1968, 35). Here the teacher also gets the opportunity to learn and develop new approaches when it comes to didactics, pedagogy, and methodology. Zankov considered the nature of the relationship between the teacher and the student to be very important in his didactic system. An atmosphere of trust, cooperation and creativity is absolutely essential:

> *The creation of a creative atmosphere and atmosphere of cooperation in the classroom is facilitated by the content of teaching and methods of work, which provide a variety of activities for students and allow each of them to fully participate in the educational process (Zankov, 1990, 19, author's translation)*

"Vygotsky viewed the relationship he outlined between teaching and development as a working hypothesis and not as the solution to the problem" (Zankov, 1968, 45, author's translation). The ZPD can also be included in this working hypothesis. With Zankov's didactic system, the "solution" or the description of the relationship between teaching and development was closer than ever before. Focusing on how children develop long-term cultural concepts with "higher mental functions" rather than the short-term problem of helping children in their individual learning and problem-solving, was Vygotsky's primary concern. It is also wrong to connect the metaphor "scaffolding" to Vygotsky (Wood et al, 1976), as this has obscured Vygotsky's view of development together with the conflation of the ZPD concept (Smagorinsky, 2017; cf. Chaiklin, 2003).

According to Chaiklin (2003) Vygotsky used the ZPD term in his writings at least eight published texts. In general, the ZPD is mentioned in relation to development and learning in school age and to formal learning in school. The way to understand Vygotsky's ZPD concept is to understand the conceptual problem Vygotsky wished to address. Chaiklin (2003) sums up the Vygotsky's core understanding of this concept:

- Vygotsky distinguished between teaching that has the child's whole development and teaching technical skills. ZPD is therefore a concept related to development, not skills (generality aspect)

- More important for Vygotsky than the help that the child gets to do more and solve more difficult tasks so that he can become independent, is why this happens and why ZPD occurs (assistance aspect)

- Even if learning in ZPD not always is enjoyable, the child's potential is an indication of the existence of certain mental maturing functions, which in turn provide a potential for meaningful, interventional action (potential aspect). The ZPD was introduced by Vygotsky as a part of an analysis of child development. Its role is to indicate an important moment in child development

- The purpose of the ZPD is to identify the maturing mental functions that the child needs to transit from one age period to the next, and to identify the child's current state of developing these functions

- For Vygotsky the ZPD is a diagnostic principle that can help us understand the inner connections of the child's development process and the child's ability to imitate (within its intellectual potential) is the basis for the subjective ZPD, while the social situation in the child's development is the reason for the objective ZPD

- The ZPD of the child exists because of the maturing mental functions. The most important of the collaborative interventions in teaching is to indicate these maturing psychological functions. The interaction is used to assess the child's subjective ZPD because this gives an opportunity of imitation and thereby identifying the mental functions. Lower mental functions are genetically inherited, unmediated and involuntary, while the higher mental functions are socially acquired, mediated and voluntary controlled.

- The "larger" or "smaller" individual ZPDs of the children is determined by the child's ability to take advantage of collaboration beyond independent performance and age norms

- Vygotsky says that children with the same IQ can have different ZPD. A child can have a high IQ and a large ZPD or a small ZPD. Likewise, a child with a low IQ may have either a large ZPD or a small ZPD. Therefore, Vygotsky rejects IQ tests because they test family conditions rather than abilities. Optimal learning requires homogeneous groups and ZPD is suggested as an effective grouping principle (Barrs, 2022).

- The idea of ZPD is intended to direct teaching (obuchenie) attention to the maturing mental functions, instead of already existing functions. These functions are not created in interaction, but the interaction gives conditions for identifying their existence and how much they have developed.

- The ZPDs content and meaning will change from age period to another

- The focus on learning in school concepts in ZPD is due to the relevance of school age

- The function of the ZPD is to identify the development of the whole child

- The ZPD describes the relations between subjective maturing mental functions and objective functions needed for the next age period. This objective ZPD is the same for all children, but the individual ZPD of the child is positioned differently in the objective ZPD. The ZPD is not located in the child alone, but even the subjective ZPD. The subjective ZPD is an evaluation or assessment of the child's capabilities in connection to the theoretical age period

Chaiklin writes: "Vygotsky does not seem to have any systematic principles, methods or techniques that should guide how collaboration should be constructed by a person who is assessing a zone of proximal development" (Chaiklin 2003, 54). For such a system we had to wait for his student and colleague Zankov.

Zankov: "Psychodidactics" and didactic principles

Leonid Vladimirovich Zankov (1901-1977) believed that there was a need for a new approach to didactics in primary school, with new principles and new didactics for a new and modern school. If the development of the children in primary school went very slowly and sluggishly, then it was necessary to construct a new educational system with new didactics (Zankov, 1963a; 1996). It was also necessary to arrange teaching and guidance in school "in such a way that it ignites in the child a spark which then flares up more and more - a thirst for knowledge ..." (Zankov, 1996, 4, author's translation). He conducted large-scale educational experiments to test Vygotsky's learning theory (Zankov, 1977a) in primary schools in the 1950s and 1960s, recognizing its fundamental importance. The experiments of Zankov represent a direct and continuous line from Vygotsky concerning educational practice. The Zankov's system sought to implement Vygotsky's views on pedagogy in large-scale and broad education. His experiments terminated in the 1970s, but his system saw a revival in 1996 when "Zankova" gained nationwide status and "was officially accepted as one of the three officially recognized variants of Russian elementary school education" (Boguslavsky, 2015, online). Asmolov uses the rather precise term "psychodidactics" for this direction, which creates a new didactic system that has the student's general mental development as its goal (Asmolov, 1998, 21), and where Zankov is the "undisputed leader of psychodidactics" (Asmolov, 2007, 15). Boguslavsky cites Asmolov: "Zankov's pedagogy is a pedagogy of interesting challenges and, while interesting challenges are life challenges, following Zankov means following vital didactics" (Boguslavsky, 2015, online). The relationship between teaching and development can be examined both as a problem of psychology and as one of pedagogy (Zankov, 1963b, 1968). The tradition of Vygotsky and Zankov regards this relationship as complex. Zankov says that in educational research psychological methodology and psychological analysis are needed (Zankov, 1968), because "psychology serves to reveal pedagogical patterns" and is a "support for pedagogy" (Zankov, 1990, 66, 104, author's translation).

Zankov's idea was to create a system of instruction and guidance in the primary (1-4) grades with a focus on the general (mental) development of children (Zankov, 1964). Zankov writes about the purpose of didactics and his didactic system:

> *Since the development of students takes place in the teaching process, didactic principles and requirements aimed at acquiring knowledge and skills also produce certain results in terms of development. However, the task is not to achieve any*

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> *[particular] result, but rather to achieve the maximum effectiveness of the lesson for the development of the students. However, the fulfillment of this task requires … that the teaching process should be analyzed and structured from a special perspective (Zankov, 1968, 7, author's translation)*

Zankov's idea is that didactics can no longer be reserved or limited to the area of knowledge and skills, no matter how important this is. It is necessary to develop scientific pedagogical foundations for a structure of the teaching process that ensures an optimal result in the development of students. It requires the development of new didactic principles, rules, requirements, and methodology – including curriculum, textbooks, and guidelines for teaching – to indicate the relationship between teaching and the students' mental development. While acquisition of knowledge, abilities and skills are the goal in the traditional system, they are just means for general development in the Zankov system.

The central idea of the didactic system is to achieve the highest possible efficiency in teaching for the overall development of the students (Zankov, 1968, 1977a). "By general development we mean development of the child's personality, all its sides" (Zankov, 1963b, 31, author's translation). That means the cognitive processes ("mind"), volitional qualities that govern all human activity ("will") and moral and ethical qualities manifested in all types of activity ("feelings"). Zankov transformed Vygotsky's theoretical ideas into a coherent and holistic system of curriculum and practice and tested it in public schools. Zankov formulated the main ideas of his new education system in five major principles (e.g. Zankov, 1968; 1973a, 1973b; 1977a, 1977b; Guseva & Sosnowsky, 1997). These five principles must always be understood as a unit; one of them cannot be removed from or underestimated in the system and they are interconnected on different levels. The problem of the correlation between learning and the development of the child's psyche was in the focus of Zankov's attention throughout all stages of his research activities. Zankov's major contribution was to link development's dependence on teaching through the study of development through a changed educational structure. The idea that a child has an inner world that is formed before school age, and that this inner world is a strong force that determines the direction of the child's mental development, runs like a red thread through the research and works of Zankov. In addition to the creation of the ZPD, another concept of Vygotsky is important for Zankov: the need to create conditions that ensure the unity of the functioning of affective and intellectual processes, which acts as an internal factor that determines development. The deep essence of Zankov's system is concretized in its didactic characteristics. The originality and pioneering spirit of Vygotsky and Zankov makes them deserve the title "harbingers of change" (Guseva & Sosnowski, 1997, 14). In Zankov, we not only have a learning theory, but also, for the first time, a complete didactic-methodological system with concepts of activity-oriented and personality-oriented approaches to teaching students in primary education and an interdisciplinary study, that combines pedagogy, didactics, psychology, paedology and teaching methodology. For the first time psychological methods were included as an integral part of pedagogical research. For the first time, the theoretical idea and the development of children became a practical implementation in the form of an integral system of education through an experiment. For the first time such a system organically combined pedagogical and psychological methods. A new educational goal had been formulated: to achieve the optimal overall development of each child. A new task had been put forward: a broad holistic world view by means of science, literature, art, and direct cognition. A new type of training had been created incorporating both a structure of training (principles, content, methods etc.) and attention on the inner world of the child.

The didactic principles have their own role, function, and nature in relationship to other principles (Zankov, 1977a). The mastery of knowledge is a means to an end. The implementation of the principles leads to "the birth, growth and deepening of an internal motivation for learning" (Zankov, 1977a, 62).

> *The didactic system is based not on some kind of isolated, heterogeneous principles, but rather on principles that are fundamentally interrelated, … it is inconceivable for these principles to be realized separately … (Zankov, 1977a, 61-62)*

The leading role of theoretical knowledge

The didactic system emphasizes theoretical knowledge. Zankov writes:

> *The decisive role in elementary education should be played by the cognitive aspect, the theoretical knowledge, and not the cultivation of skills in language and mathematics. It is necessary to develop these skills on the basis of valuable general development, on the basis of deeper understanding of language regularity and mathematical connections and dependencies. (Zankov apud Guseva & Solomonovich, 2017, 779)*

This principle, which includes the acquisition of scientific concepts, is about children being made aware of the characteristics of various phenomena and the connections between them. In the learning process in Zankov's system, students make different observations related to the material being studied. The teacher directs the students' attention and leads them forward towards finding the existing connections and dependencies in the studied material themselves. Students are guided towards explaining specific dependencies and drawing conclusions. The principle does not imply absolutization, nor does it prescribe to reduce the content of primary education programmes to scientific concepts. It requires that students, starting from independent observations, constantly rise to the disclosure of interconnections and inter-dependencies between phenomena. The path from empirical cognition to abstraction and generalization should be made by the student (of course, at an accessible level) from the first steps of learning. This principle is important for the formation of the foundations of a scientific worldview in students. "Being able to use a scientific term presupposes the important condition of correct generalization and consequently the formation of concepts" (Zankov, 1973a, 41, author's translation). So, in the ZPD, the students' spontaneous concepts meet the teacher's theoretical concepts.

Teaching at a high level of difficulty

One must teach at a so-called high (optimal) level of difficulty, "without making it too difficult" (Zankov, 1965, 19). Students try to overcome difficulties (challenging tasks and problems) in the zone of nearest/potential/ proximate development. Zankov writes:

> *Among the didactic principles of our experimental system a decisive role belongs to the principle of learning at the high level of difficulty. The concept of "difficulty" [трудность, trudnost] is used in didactics in different contexts and in different meanings. One aspect of this concept – is "overcoming obstacles" (Zankov, 1990, 114, author's translation).*

In elaborating this term, Zankov followed the works of the great Russian pedagogue Konstantin Ushinsky. His 19th-century monograph emphasizes the importance of overcoming the difficulties or obstacles to human development, which underlies this principle. Simply put: no obstacles, no development. The main idea of this principle is to create a special atmosphere in which the intellectual activity of school children is observed. Vygotsky is also clear on the necessity of difficulty in education:

> *Thinking always arises out of difficulty ... it is necessary to take care to create as many difficulties as possible in the child's education, as starting points for his thoughts (Vygotsky, 1997, 173, 174)*

In Zankov's system, "difficulty" is understood as the tension in the student's intellectual and spiritual forces, the intensity of mental work when solving problems, and overcoming obstacles that arise in the process of cognition. Sometimes this principle is misunderstood by claiming that the principle is inconsistent with nature. Such a characterization of the principle is then combined with an acknowledgment that education, if it is to be developmental, must be based on the child's ZPD. But one cannot have a ZPD without the principle of a high level of difficulty. The link between Vygotsky and Zankov is obvious when it comes to ZDP and difficulty:

> *... with collaboration, direction, or some kind of help [in ZDP] the child is always able to do more difficult tasks that [sic] he can independently (Vygotsky, 1987, 209)*

"ZPD" is a psychological term with developmental-, educational-, and assessment-related aspects. In order to use it in the construction of education, it is necessary to translate it into a pedagogical plan; to fill it with pedagogical meaning. This is precisely what the aforementioned principle serves. It obliges one to look for the zone of proximate development of each student in the learning process; to search for the top step of the students' capabilities of a given class, which is not at all guided by the old principle of accessibility – the idea that the education and upbringing of children should be age appropriate. The principle of teaching at a high level of difficulty is a prerequisite for creating the ZPD in the Zankov system. This principle of a high level of difficulty reflects, in a nutshell, the peculiarity of the psychological processes of the students when acquiring the subject matter. The effectiveness of this principle is due to the implementation of the educational material that is offered by the teacher and that can be comprehended by schoolchildren.

Fast-paced progress

Zankov's method claims that a fast pace of study suits children's needs. They are interested in learning something new instead of repeating material that has been previously studied many times. Rather, they should repeat the material while learning something new. Vygotsky believed that children had to be taught something new and that the ZPD is an important "moment" for both education and teaching (Vygotsky, 1982). With Zankov's perspective:

> *Making rapid progress in no way means undue haste in a lesson or hurried communication of the greatest possible amount of information to the pupils. Haste and the desire to set records are completely alien to our experimental system (Zankov, 1977a, 58)*

Students' minds are better stimulated by variety than repetition and drill:

> *Repeating over and over to the pupils what they already know, resorting to reiterated monotonous repetitions, leads to mental indolence and to spiritual apathy, and consequently, hampers development (Zankov, 1965, 19)*

This principle does not mean that in Zankov's system there is no return to the material already studied. The process of cognition is built in such a way that progress goes simultaneously with the return to what has been passed. Such repetition is aimed not at consolidating knowledge in the initially perceived form, but at a deeper comprehension of it. As a result, in the minds of schoolchildren, there are ever wider connections between the studied issue and others, which leads to the firm retention of knowledge in the students' memory, and also contributes to the development of their thinking activity. When the development of the children is individual, so also must the high level of difficulty and rapid pace (organization and progression) vary from student to student, or at least among different student groups. Rapid pace or progress is linked to working in the ZPD since the children there will always learn something new; always pushing their limit and potential of mental activity, which differs for individual children (Vygotsky, 1982, 209). But it is a major mistake to think that this principle means great pace and haste in the classroom. The point is to secure progress, not to stress the children and risk their falling out of the ZPD. Essentially, this principle is based on Vygotsky: "The main function of education is to teach the child something new" (Vygotsky, 1982, 250) and is about enrichment of material and making the teaching continuously interesting and preventing it from producing boredom.

Students' awareness of the learning process

With this principle, the method seeks to develop students' awareness of the learning process, a principle that is directed inward. The awareness and realization of one's own learning process – the dynamics of learning – are related to different mental activities. Zankov states:

> *Thus, the process of mastering knowledge and skills itself becomes the object of awareness to a certain extent. How is the knowledge to be learned linked together? What are the various aspects of mastering spelling or computational operations? What is the mechanism underlying errors and the prevention of errors? These and many other questions relating to the mastery of knowledge and skills are the subject of unflagging attention on the part of school pupils (Zankov, 1977a, 60-61).*

The principle of pupils' awareness of the learning process is very important in a system aimed at general mental development. This is a principle of educating schoolchildren in the ability to self-learn, to form their attitude to the world around them. The identification of the sprouts of reflection in schoolchildren, while studying their development, as the ability not only to realize the mechanism of the emergence of concepts, but also in a broader, personal sense, testifies to the effectiveness of this principle and its application by teachers. Formative assessment is central in connection with this principle, giving the opportunity to observe the process of their own learning. It relieves the feeling of being unnoticed by the teacher and confirms that the teacher cares about how the learning takes place. It shows when it is necessary to change the methods of work and adjust or vary the learning style. Finally, it helps students to become more effective, capable of self-organization and self-assessment. While the principle of consciousness is directed at the object of cognition, the principle of awareness of the learning process is turned inward to the student's own awareness of the process of learning.

Planning of systematic development of each student in the classroom

A goal-oriented, systematic development of each student is sought by using the aforementioned four principles. This is also linked to the child's ZPD and applies to all children, including the "weakest" (Zankov, 1973b, 153). Zankov believes that this group of students has an even greater need than other students for systematic work to promote their development. Overloading these students with tasks causes them to lag behind in their development (Zankov, 1977a). He considers any isolation and division of students according to their progression, or creation of classes on the basis that students think alike, is contrary to the principle of development and to the very nature of teaching. All children should be able to move forward in their development. The development process takes place either slowly or unevenly, depending on the individual's potential, characteristics of the nervous system, personal experiences and so on.

Although Zankov's principles of theoretical knowledge, high level of difficulty and rapid progression can be perceived as the more "professional" principles, all five principles, including the principles of awareness and planning for all students' development, will form the whole of the teacher's work in the ZDP. The special development in individual subjects ("the direct path", Zankov, 1977a, 163) will contribute to a greater or lesser extent to the students' general mental development (the decisive role of "the indirect path", Zankov, 1977a, 163). Both paths are present in school teaching. Zankov believes that, in the right learning environment, each child can find their own path of development. The awakening of children's life in the classroom, the fully fledged process of their general development, is determined by the entire integrity of the system, including all its didactic components. But on the operational level, there can arise challenges regarding teaching in the ZPD, even with good learning resources. The principles of the experimental system are implemented in changing the content of primary education (curriculum), in methods of training and education, and in methodological construction work on academic subjects. "The difference between didactic systems is expressed in the nature of the relationship between direct and indirect ways" (Zankov, 1968, 127, author's translation). The system's methodology can illustrate this.

Zankov: Methodological system with pedagogical properties

Zankov's didactic principles were created on the basis of findings from the practical teaching in his experiment, and these constituted a regulatory and directive role that was distinct from the daily teaching activity. Didactic principles are implemented through content, training and working methods. The teaching methods of the experiment determine the teacher's work.

> *These teaching methods make it possible to realize the guiding idea of the experimental system and its didactic principles in the everyday activity of the teacher and in the pupil's learning (Zankov, 1977a, 274)*

The common characteristic of these teaching methods is that they are based on the didactic principles. The didactic principles are on an abstract level and only the teaching methods communicate a didactic content to the teacher and the students (Zankov, 1977a). In this way, a methodologically uniform system is created with a specific structure and with typical pedagogical characteristics. These are revealed in the teacher's teaching methods and teaching techniques and in the students' study activities (observation activity, mental activity, and practical activity, Zankov, 1977a, 71-159), but primarily in the students' total mental activity.

Broad focus (versatility, multilateralism)

Broad focus means that teaching techniques have different functions on a methodological level. It is about learning resources (e.g. textbooks) that not only aim for the students to assimilate knowledge and skills, but also to promote the students' development. The teaching must also draw the pupils' actual broad mental activity into the learning sphere. It is a learning process that includes a diversity of students' personal experiences – emotional, intellectual, volitional, and aesthetic. This characteristic is distinguished by the richness of both the content and the form of the children's activity. Although one must develop knowledge, emphasis is also placed on developing emotions and a desire to learn. Pupils should have experiences that appeal to their emotional and aesthetic senses. Here we are talking about the joy of learning, sympathy, intellectual joy, but also dissatisfaction, disappointments, and doubts.

The progressive nature of the teaching (process nature)

The procedural nature of the teaching methods operates at different levels in the educational process, in the communication of theoretical knowledge that reveals the essence of the didactic units studied, and the sequence of problems that the students encounter. The textbooks are not presented in the traditional sense, topic by topic. It is a continuous learning process where the students analyse and study individual elements, which can be assembled into a larger whole. Previous knowledge must be processed and viewed from new angles which, taken as a whole, will provide a more meaningful structure.

> *In keeping with the process nature of our system of methods, each segment of a school course becomes a dependent element in a single, basic chain of components. (Zankov, 1977a, 276)*

Confrontations (cognitive conflict)

In Zankov's didactic system, cognitive confrontations have a significant place. The nature of the confrontations reveals contradictions of full and incomplete knowledge, worldly and scientific ideas, and concepts. The confrontations support research activities and help develop skills such as reflection, and dialectical and critical thinking. Students often have misconceptions or facts that in some ways contradict what they will learn in class. By including these facts, one will, through conflicting information, set old learning against the new knowledge, which in turn will contribute to increased learning intensity among the students and to a deeper attainment of knowledge. This methodology can be linked to the principles of high difficulty, rapid progression, and theoretical knowledge.

> *... such [cognitive] confrontations should be used in every way to increase the intensiveness of the pupil's learning, to assure his ascent to every succeeding stage of learning activity and development (Zankov, 1977a, 277)*

Variation (flexibility)

The nature of the variation depends on different and specific conditions, especially the individual character of the pupils. Taking students' individual abilities into account can result in variations in the degree of difficulty of the material being studied. This includes variations in the degree of difficulty, rapid progression, task types, and didactic methods (individual work, group work, class discussion, etc.). Variation can also involve physical activity and "outdoor mathematics". Variation has an important place in the methodological system when it comes to the implementation of problems in practice.

> *This property [variation] plays a functional role in the search for ways and means of altering the system of methods to accommodate permissible differences in the way the content of the educational process is structured as well as differences between teachers with regard to the style of work ... (Zankov, 1977a, 277)*

The teaching methods provide direction for the individual characteristics of the various school subjects, for the degree of mastery in the various subjects, for how the students develop in the subjects, etc. The methods fulfil the didactic principles, but only after the didactic principles have contributed to crystallizing the methods in the various subjects. The methods take place, like the use of the didactic principles, in the ZPD, and again, as a comprehensive didactic and methodological system, contribute to the students' general (mental) development. It is the didactic principles that play a decisive role:

> *Boundaries on variation in the system of methods are set by the didactic principles. Variation - even significant variation - in the typical pedagogical properties of the system does not affect the operation of the experimental system as a whole, if the changes are in keeping with those didactic principles that characteristically play a directing and regulatory role (Zankov, 1977a, 277)*

Zankov: Different activities as indicators of general development

The general development of the student is the goal of Zankov's didactic system and the ZPD is a vital part of this system. But there are also certain activity traits that the system possess; that are indicators for achieving this general development: observational activities, mental activities and practical activities (Zankov, 1963b, 1977a). Zankov emphasizes that these activity traits must be understood as a whole:

> *An analysis of general development that allows one to differentiate various lines within the process of development as a whole (observation, reasoning, practical activity) represent not a fractionation into elementary components but rather a separation into units (Zankov, 1977a, 67)*

Zankov believed that students' development occurred according to three elements, as Vygotsky also presented it. We can talk about the students' development units: observation activities, mental activities and practical activities. When comparing experimental classes with traditional classes, Zancov asks:

> *What typical features should a didactic system have, that will bring optimal results in the overall development of schoolchildren? (Zankov, 1990, 186, author's translation)*

In Zankov's system, the overall idea is important. The didactic principles form a whole, in which no elements can be taken out or undermined, and the typical activity characteristics in the didactic system are also a whole.

Observation activity

It is essential to study the development of observation since the process of perception is the basis for this. This activity is about perception, motivation, interest, and emotions. Perception of objects can differ in structure and complexity. This makes observation a complex activity. Perception is part of observation and is organically linked to reasoning. The observation activity incorporates a unique type of reasoning, and this reasoning process is directly based on sensory cognition of reality. Zankov states:

> *There is no cause, however, to obliterate the significant differences between observation and reasoning. The object of observation is the object that is directly perceived. Cognition of this object consists in singling out, correlating, and combining the data on its various parts, aspects, and properties by means of the senses (Zankov, 1977a, 71)*

Observation brings a unique way of thinking. The thought processes are directly based on sensory cognition of reality and represent only the initial analysis and synthesis of sensory experience data (Zankov, 1963b), naming colours, shapes, and other properties; pointing out differences and similarities.

Mental activity

Zankov's starting point is that mental activity is fundamental to the students' general development. Regarding the development of theoretical thought, Zankov refers to S. L. Rubinstein who explains when it develops:

> *When theoretical reasoning develops, neither sensorimotor (visually active) nor visually figurative reasoning disappear, but are transformed and improved, and are themselves raised to the highest level. Quite diverse and complex interrelationships are created between them that vary individually from one case to another (Zankov, 1977a, 97; cf. Rubinstein, 2002, 449)*

The basis for the study of the development of students' mental activity is the postulate of the diversity of thought forms, their substantial mutual relations, and their inter-conditioned movement. The qualitative changes in thought occur in an upward movement, from the lower mental functions (reactive attention, sensation, sensorimotor intelligence, and associative memory) to the higher mental functions (mediated perception, focused attention, deliberate memory and logical thinking, including analysis and synthesis, abstraction and generalization, which are socially created, voluntarily controlled, semiotically mediated and united in systems with other functions). For Zankov, this means that the concept is developed, expanded, and deepened in the subject's subsequent approximations to the object. This movement was the focus of Zankov's investigation in connection with mental activities, and the quality of the objects of knowledge is the basis of the observation, not the word, that Vygotsky focused on. In this movement of abstraction and generalization, of analysis and synthesis, from the first forms of perception of the ordinary character of the objects, there is a transformation of the object being studied into a "new" object. Each time this movement is repeated, and the process is carried out, new characteristics are found. This is the reason behind the postulate that the study of mental activity of students is the diversity of thought forms.

In his didactic system, Zankov used algebraic symbols for generalization. By using such methods, the system achieves the students' in-depth understanding of relevant connections and dependencies. The mental activity will affect the students' ability to reach a higher level of abstraction and generalization (Zankov, 1968).

Practical activities

Zankov (1977a) states that the development of practical activity constitutes a significant part of a child's general development. Practical object-based activities involve more than pure motor skills and habits. It also reflects the sense sphere, spatial ideas, and reasoning. Overcoming difficulties associated with practical activity also reveals certain emotional and volitional aspects of psychological activity. "A specific characteristic of practical activity is the fact that a unique relationship exists here between thought and action" (Zankov, 1977a, 128). There is thus no distinction between mental activity and practical activity. One cannot be performed without the other. They have their peculiarities, but they are equally a unit. In the practical activities, Zankov is interested in analyzing the means and action procedure in the task, but also the qualitative aspects of the action, speed, precision, self-control, and the nature of the mistakes.

The phases of the students' development activities, observation activity, mental activity, and practical activity are treated as units because one is present in the other. These activities also make clear the emergence from the abstract to the concrete, a procedure that is important for the materialist didactic method. These three development activities form an important unit in Zankov's didactic system. The didactic principles are closely related to properties of the methodological system; in essence, means of implementing the didactic principles. Discovering the true connection between learning and development requires a more accurate determination of the kind of knowledge that is learned and how it is learned by the students.

Russian mathematics in Norwegian classrooms: Challenges

Zankov's didactic system has elements in it that can potentially make significant contributions to school children's development, as it has clear and justified relationships between teaching and the students' development. The "miracle" that the teachers in Zankov's experiments talked about

> *... consists in the fact that our experimental education awakens and develops the children's creative powers and abilities (Zankov, 1964, 6)*

This is in line with Vygotsky: "... learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers" (Vygotsky, 1978, 90). This means that an essential feature of learning is that it creates a zone of proximate development. Zankov says that it is impossible to achieve results, especially in teaching and development, if the teacher does not know the individual student's character and psyche (Zankov, 1964, 4). Among other things this "miracle" and "awakening" is what makes Zankov's system attractive.

Zankov's system is not used in all subjects at primary school level as it was originally developed for. However, Zankov's principles and methods have been used in Norway for the subject of mathematics in particular. Although the focus is perhaps more on learning than development in the education of Norwegian pupils, Zankov's method has nevertheless proven to be potentially effective for teaching and learning mathematical competence. Consequently, this should not be the reason for challenges in implementing the Zankov method in mathematics. What about potential cultural differences between Russian and Norwegian pupils? This could be a plausible explanation, but here we seek explanations for implementation problems regarding Norwegian teachers because of the central role of the teacher in this system. The teacher is the planner, facilitator and mastermind behind the introduction and implementation of the Zankov system.

Lieberg (2015) warns that "Russian mathematics" is not "magic dust" in mathematics education in Norway. He emphasizes that the method is demanding and requires guidance and professional support to teachers who are going to use this method. No adequate research has been carried out in Norway about the teachers' implementation of the system nor the students' results linked to Zankov's system.

Gjære (2022) points out some potential problems with this very implementation. He refers to the observations of a teacher who does not challenge the pupils to work in the ZPD. Part of the problem is that the problems worked on are too simple and that the students are not challenged enough and therefore do not follow the didactic principle of optimal difficulty level in the classroom. This teacher is working in "yesterday's development" according to Vygotsky and Zankov (Zankov, 1990, 12, 94). There is not necessarily a problem with the teacher's loyalty to Zankov's model, but it can still be challenging to implement DEM and thus the ZPD in the classroom.

Other challenges that Gjære (2023) raises in connection with the implementation of DEM is linked to the term "teaching dilemmas" (Lampert, 1985, 181), a concept of Lampert's concerning childrens' attention. Gjære (2023, 5) addresses the following three "dilemmas" that he encountered with some teachers who teach mathematics according to Zankov's model:

- the dilemma of telling (the teacher is telling the students the answer too quickly and showing them methods when there is a lack of response from the students);
- the dilemma of bored students with important tasks (the teacher is sticking to the same discussion when the students are ready to move on);
- the dilemma of keeping pace (the teacher must give all the students appropriate challenges at different levels while the learning work in the class must be continued).

A teacher's workday is full of challenges and choices, including for "the Zankov teachers". Gjære hints that teachers can be controlled too much by the guidance material in order to teach in "the right way" (Gjære, 2023, 6). They can also let themselves be stressed by the demands for teaching with a high level of difficulty and rapid progression. Although these were important and central didactic principles in Zankov's system, there is reason to recall that Zankov himself said that the teacher must teach at a so-called optimal level of difficulty "without making it too difficult" (Zankov, 1965, 19). Furthermore, he also said that one should not be hasty in the classroom:

> *Moving forward at a fast pace does not mean rushing through the lesson ... The fast pace of learning makes it possible to reveal different aspects of the acquired knowledge, deepen it and connect it (Zankov, 1990, 117, author's translation)*

Equally unacceptable are "monotonous repetitions" (Zankov, 1965, 19). A "dilemma" can appear for the teacher: By following the teacher's planning too strictly about, for example, time use, one can end up breaking with Zankov's didactic principles. It is important that the teacher has an overall view of DEM and tries to follow the principles in their daily teaching. The teacher's planning and didactic reflections on the teaching are crucial for success with Zankov's model. The implementation of DEM according to Zankov's didactic principles in Norwegian classrooms depends on the teachers having the necessary training, the required flexibility and creativity, and adequate reflection on Zankov's system and the ZPD concept. Examples of threats to Zankov's system are too high or low a level of difficulty, or a lack of flexibility and patience on the part of the teacher. The challenge of teaching in the ZPD according to Zankov's didactic system should be addressed. Successful implementation of the Vygotskyan and Zankovian ZPD concept is a prerequisite for a successful implementation of Zankov's didactic system. Deep knowledge about the ZDP and Zankov's didactic principles is crucially important for a successful implementation.

Gjære (2023) writes about "dilemmas" that teachers experience during the Zankov DEM lessons and says that "the origins of these dilemmas were found to lie in internal tensions between the components of the DEM system" (Gjære, 2023, 1). Zankov says that the teachers must look at the process of teaching with new eyes. He never mentions "dilemmas" in connection to working with the principles in the ZPD in the classroom or "tensions between various principles" (Gjære, 2023, 8). Going back to the early days of Zankov's experiments, there were "slips and mistakes" and it was not easy for the teachers to shift from former methods to the new form of instruction, "But all the trouble is well compensated" (Zankov, 1964, 6). The teachers may well be experiencing "dilemmas" and challenges, but rather than real conflicting dilemmas of instructions inside of Zankov's didactic system and in the ZDP, these "dilemmas" are more likely to occur when the principles and methods are not followed or are misunderstood. For instance, the principle about fast pace is not about "rushing through class" (Zankov, 1968, 34, author's translation), but more about continuous enrichment, learning something new and even deeper understanding. There are also no contradictions between the principles of high difficulty level and fast pace. On the contrary: a high level of difficulty presupposes a fast pace (progression) and they are "organically connected" (Zankov, 1968, 34, author's translation). Furthermore, the didactic principles constitute a whole, an integrated system, wherein the principles are interconnected. Keeping the pace and planning for development for all students should therefore not be perceived as a dilemma. To reiterate, fast pace does not mean haste or stress in the classroom. This principle was a reaction to the traditional school's "slow pace" resulting in "chewing gum", monotonous repetitions, mental laziness and spiritual apathy, leading to hampering the children's development. In the Zankov system, this principle is easy to misunderstand because of its very name. The principle of theoretical knowledge, in combination with a high level of difficulty and fast paced progress, could lead to an unjustified increase in intellectual load. These kinds of misunderstandings of Zankov's system could contribute to violating the conceptual ideas of the system. In the Zankov system the importance is not only placed upon the principles, but also on how those principles are observed in the teaching methodology. It is therefore likely, or possible, that the implementation problems could also be due to other potentially deeper problems, e.g.:

- lack of adjustment to the new system (a halfway implementation would not do) and being stuck in old didactic methods and thinking;
- lack of deep knowledge of Zankov's didactic system, the didactic principles, the properties of the teaching methods and the indicators for mental development;
- misunderstandings around Zankov's system, thinking that the didactic principles are in

conflict and result in "dilemmas" / do not constitute a whole;

- lack of reflection and planning around the Zankov lesson;
- lack of reflection about the general purpose of Zankov's system;
- lack of professional and didactic knowledge;
- lack of knowledge about children's psychology (pedagogical psychology);
- lack of "pedagogical patience" (tactfulness and sensitivity towards the learner's activity) and the ability to "sacrifice the moment for the future" (F. Schleiermacher, apud Mielityinen-Pachmann & Uljens, 2023, 207); when mental functions are maturing during the work in overcoming problems
- lack of pedagogical and didactic flexibility and creativity (e.g. too attached to textbooks and teacher's guides in relation to the planned lesson);
- lack of motivation because the decision to introduce the model does not lie with the teacher themself but, for example, at a municipal level;
- lack of knowledge of the problem-solving method (cf. Polya, 2009)
- possible cultural differences

The proposed teacher dilemmas in Gjære (2023) most likely occur because the teachers are unconsciously violating Zankov's principles for working inside the ZPD. This violation may well be explained among, or from, the abovementioned deeper problems. The Zankov system does not have built-in dilemmas, but it heavily depends on the teachers' ability to implement the system – a system of elements that is not externally united with each other, but:

> *[The didactic] system is a whole that represents a unity ... An essential feature of a system is its integrity. A system is characterized by the interdependence of its parts, and connections between them (Zankov, 1968, 86, author's translation)*

The Zankov system with its principles and methodology is characterized by integrity, interdependence, and inter-connectivity – not tensions, dilemmas, or contradictions. The implementation of Zankov's system will hardly be perfect and slips and mistakes will occur. What is alarming is if these slips and mistakes are introduced into a new "dilemmic" system. Instead of "telling", there should be guiding, leading questions, hints, discussions, flexible adjustment of the problem, including students' suggestions and questions, etc. Instead of "bored students" (a threat to development according to Zankov), the teacher should have faster-paced progress or a selection of more difficult and challenging problems; spontaneously expand the complexity around the same task; or assess whether it is appropriate to discuss a task in plenary or not. The dilemma of "keeping pace" should be adjusted by giving necessary time for everybody if a problem is presented for the whole class, or selecting fewer problems (Zankov, 1977a; 1990). There should be no rush or haste in the Zankov classroom. An important point about progression (fast pace) is that the students do not get bored; rather it includes variation and enrichment. The idea is maximum learning efficiency for general development of schoolchildren, and the goal is to construct teaching for this development (Zankov, 1968). Zankov states: "This principle [high level of difficulty] is closely related to a fast pace of material flow" and "... general development requires a certain complication of the educational material" as well as "Masticating what is learned is harmful to development" (Zankov, 1963b, 40, author's translation). No dilemma. No tension. Only organically connected and related principles - meaning: "... continuous enrichment of the children with ever-new knowledge ... [and] ... refusal ... from monotonous repetition of the past" because "Moving forward at a fast pace does not at all mean rushing through class" (cf. Zankov, 1968, 34, author's translation). Because in an effective learning system you can ask different questions and use "differentiated methods" within a topic for different students and to a different depth. "Thanks to this, the whole class, including the weakest, can move forward quickly" (Zankov, 1968, 35-36, author's translation). Therefore, the planning for every student's development and fast pace does not constitute a dilemma between these two didactic principles in the Zankov system. The principle of theoretical knowledge requires that the cognitive domain of teaching comes to the fore, both as a powerful means of student development and as a reliable basis for the acquisition of skills. Therefore, the principle of theoretical knowledge (interrelated phenomena, terms, logic, abstraction and generalization) and planning for students' development are also connected principles. Likewise, "... the connection between learning at a high level of difficulty with other 'principles' is expressed in the fact that there is ... the difficulty that finds its expression in mastering theoretical information, or a difficulty that promotes awareness of the learning process by schoolchildren" (Zankov, 1968, 87, author's translation). Zankov writes, for instance, about "difficulty" as "complexity of the educational material" and simultaneously as the "tension of strength" [напряжение сил] of the students, but never about tensions between didactic principles. I can therefore not agree that the Zankov system contains tensions and dilemmas between various didactic principles. Implementation problems must probably be explained by other factors.

Lack of flexibility can be an important reason for "dilemmas" arising in the classroom. "Flexibility in organizing the teaching … is absolutely essential …" (Zankov, 1977a, 38) and is an important property or characteristic of the Zankov system: "The problem-solving experience … is flexible …" (Zankov, 1977a, 202). The teacher must regulate the help and the progression along with the level of difficulty to avoid these "dilemmas". If not, this could be a sign of not working in the ZPD and thereby not implementing Zankov's didactic system.

> *Teachers differ from one another in many ways - cast of mind, character, work style, experience, professional qualifications, and so on. Since the implementation of our experimental didactic system requires a radical reorganization of the teacher's work, flexibility in altering one's general pedagogical approach to teaching and upbringing becomes especially important. Teachers possess this quality to varying degrees. The task consists in identifying the necessary and essential features and studying them as they combine with individual characteristics in the practical work of the teacher who is implementing the experimental didactic system (Zankov, 1977a, 34)*

Some words should also be said about the method of problem-solving in Zankov's experimental system: "Problem solving plays a large part in experiential learning" (Zankov, 1990, 132, author's translation). Zankov refers to G. Polya and his publications (Zankov, 1977a, 183) in which a significant place is given to reasoning processes in the problem-solving. Zankov singled out four features of a problem: the conditions, the question, the data and the unknown. Zankov writes:

> *To work successfully with problem text, the pupil must have a clear understanding of the problem, of its various parts, and of the kind of information contained in each part. He must be able to find the conditions of and question in the problems, regardless of how they are arranged in the text or the form in which they appear. He must also be able to find data in the text, an must understand what he need to look for (Zankov, 1977a, 182)*

An important part of Zankov's methodological system is therefore the problem-solving method. It is quite significant and essential that the Zankov teachers have a solid knowledge of this method when they seek to implement Zankov's system in the classroom, to give the students solid instruction of what a "problem" is and "how to solve it" as Polya writes (Polya, 2009). A teacher's work with the "Car Problem" referred to by Gjære (2023, 7-8) may indicate lack of knowledge of the problem-solving method, not only lack necessary flexibility. In the Zankov system the principles of high level of difficulty (the problem) and the application of theoretical knowledge (concepts) of the problem, and the problem-solving (the method of reasoning, including search activity) is connected. All the didactic principles are included in this method, and failing here is to fail the implementation of Zankov's system at its heart.

When teachers do not succeed in implementing developmental education in mathematics (DEM) according to Zankov's system and are not working in the students' ZPD, we should look for explanations in the teacher's lack of knowledge of Zankov's system (didactic principles, methodology and characteristics of mental development), but also in the teacher's general pedagogical approach to learning and development. Asmolov (2012) claims that the primary school teacher is the master of navigation of the general development of the child. Furthermore, he (Asmolov, 2012, 6) refers to a saying in Russia: "за системой Занкова будущее" ("the future belongs to the Zankov system"). The future will show whether Norwegian primary school teachers are capable of implementing the Zankov system. Zankov is clear when it comes to the implementation of the didactic principles:

> *Our didactic principles are interconnected. However, these connections are not uniform: they operate on different levels and differ in their role and function. The principles of the experimental system are implemented in the construction of the content of primary education, in the methodological construction of work on academic subjects. The experimental system covers all primary education as a whole, and not individual academic subjects or parts thereof. The basis of the system is not an isolated, heterogeneous provision, but principles that are organically connected with each other (Zankov, 1990, 119, author's translation)*

It is like instruments that have their own role but constitute a whole harmonic orchestra. "Every principle is manifested concretely, in keeping with its role in the didactic system, its functions, and the nature of its relationship to other principles" (Zankov, 1977, 62). Just as teaching and development is "organically connected" [органически связанные], so are the didactic principles, principles that form a cohesive whole and involve processes or connections that occur naturally and have a common goal. The didactic principles cannot be implemented separately from other principles. "Each principle is specifically revealed in accordance with its role in the didactic system, its functions, as well as features of its connections with other principles" (Zankov, 1990, 119, author's translation). Importantly, "the implementation of our didactic principles leads to the emergence, growth and deepening of the internal motivation to learn" (Zankov, ibid.). "Thanks to the teaching methodology, the guiding idea of the experimental system and its didactic principles are implemented in the daily activities of the teacher and the teaching of schoolchildren" (Zankov, 1990, 113, author's translation). Lampert's terms "conceptual paradoxes", "teaching dilemmas" and "contradictory aims" (Lampert, 1985, 181) do not apply to Zankov's didactic and methodological system. Instead, the Zankov system is characterized by integrity, uniformity (not in dilemmas) of goal and interconnectivity where the didactic principles are concerned.

Today, there is relatively little international research published in English on the Zankov method. In Russia, the method has been well established since 1995/1996 alongside the Elkonin-Davydov method and the "traditional" method. The Zankov model has had some spread beyond Russia's borders, such as in Norway (since 2009) and Iceland (since 2017). How does a "Russian" education system that was developed in the Soviet Union in 1957 - 1977 function in 21st century postmodern Norway and a different cultural context? The first DEM project in Norway in 2009 seems to have been successful (Gjære & Blank, 2019), but what about the other teachers who followed and used the same method? Some experiences in the use of the Zankov method have been uncovered (Gjære & Blank, 2019; Gjære 2022, 2023). The method is demanding and there are minor and major errors in the implementation of the method. This also happened when Russian teachers tried to implement Zankov's method in the Soviet Union for the first time. It was not easy to change from the old "traditional" methods to the new. "Slips and mistakes" were made, but the problems were "compensated" (Zankov, 1964, 6). It is important to avoid these "slips and mistakes" becoming systematic within the didactic system. The Zankov method offers teachers in primary education a whole system of didactics and methodology as an alternative to Norwegian mathematics teaching, which is often characterized by "traditional ways, focusing on routine skills, memorization of isolated facts and algorithms, relying on textbooks [including explanations and answers and solutions]" (Gjære & Blank, 2019). To implement the didactic system, the teachers need to work systematically and understand the inter-connectivity among the principles. Small "slips and mistakes" by Norwegian "Zankov teachers" in some situations are not certain to destroy their whole implementation of the Zankov system. The implementation depends on whether these "slips and mistakes" are systematically executed inside the didactic-methodological system or are symptoms of more fundamental challenges. A possible, and not unreasonable, explanation for the lack of implementation could be that the teachers do not familiarize themselves with the method well enough (cf. Gjære 2022 and his proposal about "depth" in the implementation of DEM). In that case, this is a very poor starting point for a successful implementation. Another reason could be that the method is regarded as a pedagogical "quick fix" among other teaching methods and strategies that invite "high hopes" but end with "a shot in the dark". Another possible reason could be the teachers' lack of belief in their own students and their ability to learn more than we traditionally expect – stuck in well-trodden didactic and methodological paths and attitudes.

We should be concerned about the long-term effect of teachers' practice in the classroom. This should also be the focus point in future research. We should be able to follow teachers from grade 1-4 using classroom observations, interviews, and questionnaires (self-reporting) over a four-year period to uncover how the teachers work to implement this method. After this period, we should be able to survey the students' results on the national test at the beginning of grade 5. The first DEM project in Norway indicates that the Zankov method has great potential to lift the students' competence and learning outcomes and broaden their horizon in mathematics, constituting an interesting didactic and methodological alternative for Norwegian primary education teachers that can guide low performing students to a higher level on "the ladder of difficulty" and promoting every student's potential and development. To uncover and to utilize this potential, a systematic long-term research project is needed.

A critical factor for teachers' successful practical implementation of the didactic-methodological system of Zankov is a deep knowledge of both the general and specific features of the system. Zankov's system is not primarily a system for learning per se in mathematics, language or other subjects. But through Zankov's development of new specific didactic principles, content, and methodology (characterized by integrity, consistency and interconnectivity in a system as a whole), these subjects can contribute to the optimal effectiveness of the (educational) development of the children. All the children's learning processes include not only the rational, but also the emotional sphere. The children learn new things in a continuous enrichment of their minds because they have an inner drive and motivation to learn. Every lesson is to be interesting and characterized by both a positive attitude, difficulty, and the joy of learning – never boring and monotonous. Moreover, the children should always be aware of why they are learning. All the children are being challenged, and the goal is individual development for all. Even if there is a system of didactic principles, content, and methods to follow, the teacher must never forget flexibility among many other professional, pedagogical, and didactic properties. The key provision of this system is that it is built on the ideas of developmental variable education and the system-activity approach. Zankov put variability at the forefront of his system. Variability for him was expressed in the flexibility of the learning process. But this variability and flexibility does not apply to the didactic principles causing a flawed understanding of his system and the consequent difficulty in implementing his system. According to Zankov's system of developmental education, any child may be able to learn and develop, but not every teacher is ready to teach according to it. Those teachers who want to have a real pedagogical, didactic, and methodological challenge to overcome and master, must work cleverly and creatively and flexible, not rigidly. Zankov's system provides the teacher with a didactic theory and methodology for the development of the childen's personalities and their cognitive and creative abilities. Zankov's system has great potential for the formation of motivation for learning and cognition, but the system's challenge is equally great.

Footnotes

"Proximate" ("nearest", "next") rather than the traditional use of "proximal" is probably closer to the Russian original of Vygotsky's work, (cf. Vygotsky, 2017, 371, note 4). зона ближайшего развития (ЗБР), zona blizhayshego razvitiya (ZBR). ближайшего (blizhayshego), although it could mean "close", "near", "intimate", "nearby", "imminent". "Proximal" in the English phrase is a rather obscure biological term, first used in Mind in Society (Vygotsky, 1978). I use "proximate" except for some citations from other authors and translations. Cf. Barrs (2022, xvii).

References

Asmolov, A. G. (1998). *Vygotsky Today: On the Verge of Non-Classical Psychology. A Volume in Horizons in Psychology*. Series Editor: James Wertsch, Nova Science Publishers, Inc., New York

Asmolov, A. G. (2007). Teoriya Zankova i sovremennoye obrazovaniye [Zankov's Theory and Modern Education], *PRAKTIKA OBRAZOVANIYA*, 3/2007, 14-17

Asmolov, A. G. (2012). Sovremennaya shkola: razvivayushchaya i razvivayushchayasya [Modern school: developing and evolving], № 2 (58) *OBRAZOVATEL'NAYA POLITIKA*, 2-6

Barrs, M. (2022). *Vygotsky The Teacher. A Companion to his Psychology for Teachers and other Practitioner*, Routledge. Taylor & Francis Group. London and New York

Boguslavsky, M. V. (2015). Vital Pedagogy of Leonid Zankov, *Russian-American Education Forum: An Online Journal*, vol 7, issue 3. www.informaticsalliance.com/content/en/?task=art&article=1001153&iid=23

Breive, S. (2020). Student–teacher dialectic in the co-creation of a zone of proximal development: an example from kindergarten mathematics, *European Early Childhood Education Research Journal*, 28:3, 413-423, DOI: 10.1080/1350293X.2020.1755498

Brown, R. (2020) Re-conceptualizing the development of agency in the school mathematics classroom, *Theory Into Practice*, 59:2, 139-149, DOI: 10.1080/00405841.2019.1702394

Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instructions, in Kozulin, A., Gindis, B., Ageyev, V., Miller, S., *Vygotsky's educational theory and practice in cultural context*. Cambridge University Press

Gjære, Å. L. & Blank, N. (2019). Teaching Mathematics Developmentally. *For the Learning of Mathematics*, November 2019, Vol. 39, No. 3 (November 2019), pp. 28-33, FLM Publishing Association

Gjære, Å., Freiman, V., (2022). Expanding a Collective Zone of Proximal Development. Investigating the Potential of Zankov's Lesson with Elementary Students Analyzing Numerical Equalities, in *Mathematics as the Science of Patterns: Making the Invisible Visible to Students Through Teaching*, 151-182, Information Age Publishing

Gjære, Å. L. (2022). Depth as a key issue for implementing DEM: The case of a teacher. I: Proceedings of the Twelfth Congress of the European Society for Research in Mathematics Education (CERME12). *European Society for Research in Mathematics Education*, 1-8.

Gjære, Å. (2023). Challenging of Teaching with Challenging Tasks: Teaching Dilemmas Arising From Implementing a Reform-oriented Approach to Primary Mathematics, *Mathematics Teacher Education and Development*, vol.*25*(2), article 2

Guseva L. G. & Sosnowski, A. (1997). Russian Education in Transition: Trends at the Primary Level, *Ȇducation canadienne et internationale* vol. 26 no. 1, 14-31

Guseva L. G. & Solomonovich, M. (2017). Implementing the Zone of proximate Development: From the Pedagogical Experiment to the Developmental Education System of Leonid Zankov, *International Electronic Journal of Elementary Education, 9*(4), 775-786

Lampert, M. (1985). How do teachers manage to teach? Perspectives on problems in practice. *Harvard Educational Review*, 55(2), 178–195. https://doi.org/10.17763/haer.55.2.56142234616x4352

Lieberg, S. (2015). Russian mathematics is no magic dust ["tryllestøv"] in mathematics education (author's translation). Hadeland (Newspaper). Readers letter. December 18

Longarezi, A. M. & Ferola, B. C. (2023). Desenvolvimento de estudantes no processo de aprendizagem, *Obutchénie: R. de Didat. e Psic. Pedag.*|Uberlândia, MG|v.7|n.2|1-29|mai./ago. 2023, DOI: http://doi.org/10.14393/OBv7n2.a2023-70265

Mielityinen-Pachmann, M. & Uljens, M. (2023). Hermeneutics in the Non-affirmative Theory of Education in *Non-affirmative Theory of Education and Bildung* (chapter 9). DOI: 10.1007/978-3-031-30551-1_9

Newman, F. & Holzman, L. (1993). *Lev Vygotsky: Revolutionary scientist*. London: Routledge

Polya, G. (2009). *How to Solve It? - A New Aspect of Mathematical Method*, Ishi Press International

Radford, L., (2010). The Antropological turn in Mathematics Education and its implication on the meaning of mathematical activity and classroom practice. *Acta Didactica Universitatis Comenianae Mathematics*, 10, 103-120.

Roth, W. M. (2020). Zone of Proximal Development in Mathematics Education, *Encyclopedia of Mathematics Education*, 913-916, Springer

Roth W. M. & Radford L. (2010). Re/thinking the zone of proximal devolpment (symmetrically). *Mind, Culture, Activity* 17(4), 299-307

Rubinstein, S. L. (2002). *Osnovy obshchey psikhologii [Fundamentals of General Psychology]*, Series: Masters of Psychology, Peter

Smagorinsky, P. (2017). Deconflating the ZPD and instructional scaffolding: Retranslating and reconceiving the zone of proximal development as the zone of next development, *Learning, Culture and Social Interaction* 16 (2018) 70–75.

Toulmin, S. (1978). The Mozart of psychology. *New York Review of Books*, 25, 51-57, September 28

Vygotsky, L. S. (1978). *Mind in society. The development of higher psychological processes*. Cambridge, MA: Harvard University Press

Vygotsky, L. S. (1982). *Thought and speech*. In Vygotsky, L.S. *The collected works in 6 volumes*. Vol. 2. Moscow: Pedagogika (in Russian). First published (1934).

Vygotsky, L. S. (1987). *Thinking and speech* (N. Minick, trans.). In R. W. Rieber & A. S. Carton (eds.), The collected works of L. S. Vygotsky: Vol. 1. Problems of general psychology (pp. 39-285), New York: Plenum Press. (Original work published in 1934)

Vygotsky, L. S. (1997). *Educational Psychology*, St. Lucie Press; *Pedagogicheskaia psikhologiia* 1991 Moscow Pedagogika [Pedagogical psychology, 2nd ed.]

Vygotsky, L. S. (2001). *Tenkning og tale [Thinking and speech]*. Oslo: Gyldendal akademisk (Norwegian)

Vygotsky, L. S. (2017). Problema obuchenija i umstvennogo razvitija v shkol'nom vozraste [The problem of learning and mental development at school age], *Changing English*, 24:4, 359-371, DOI: 10.1080/1358684X.2017.1395165

Wood, D., Bruner, J. D., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, 17, 89–100. Retrieved from https://isites.harvard.edu/fs/docs/icb.topic862383.files/Wood1976.pdf

Zankov, L. V. (1963a). The didactic fundations of Teaching (Submitted for Discussion), *Soviet Education*, 5:4, 3-12

Zankov, L. V. (ed.). (1963b). Razvitiye uchashchikhsya v protsesse obucheniya (I — II klassy) [Development of students in the learning process]. Moscow: *Academy of Pedagogical Sciences of RSFSR* (in Russian). Summary in CEAS Abstract Series No. 1-4 (ED 060 227)

Zankov, L. V. (1964). Convincing experience, *Soviet Education*, 6:3, 3-6, DOI: 10.2753/RES1060-939306033

Zankov, L. V. (1965). Experiment with a New System of Primary Education, *Soviet Education*, 7:3, 17-29 https://doi.org/10.2753/RES1060-9393070317

Zankov, L. V. (1968). Didaktika i zhizn' [*Didactics and life]*. Moscow: *Pedagogika* (in Russian).

Zankov, L. V. (1973a). *Didaktik und Leben [Didactics and Life]*. Hannover: Schroedel (in German). Summary in https://files.eric.ed.gov/fulltext/ED133180.pdf

Zankov, L. V. (1973b). The Contribution of Studies in Experimental Psychology to Pedagogical Research, *Soviet Education*, 15:5-6, 146-176

Zankov, L. V. (ed.). (1975). *Teaching and development* ['Obuchenie i razvitie']. Moscow: Pedagogika.

Zankov, L. V. (1977a). *Teaching and development: A Soviet Investigation*, White Plains, NY: M.E. Sharpe.

Zankov, L. V. (1977b). Principles of the experimental didactic system. *Soviet Education*, 19(4-6), 52-64. DOI: 10.2753/RES1060-939319040652

Zankov, L. V. (1990). *Izbrannyye pedagogicheskiye trudy* [*The selected pedagogical works*]. Moscow: Dom Pedagogiki.

Zankov, L. V. (1996). On the issue of correlation training and development! From a report at a teachers' seminar in Moscow in June 1964. Published from the book: *Commonwealth of Scientists and Teachers, Psychological Science and Education* 1996, No. 4 (24-28). Russian

Zaretsky, V. K. (2016), Lev Vygotsky's Principle "One Step in Learning Represents a Hundred Steps in Development": From Idea to Practice. Revue internationale du CRORES: innover dans la tradition de Vygotsky (December 2016) ISSN: 2291-6717, vol 4, no 1, 97-133

Zaretsky V. K. (2021). One More Time on the Zone of proximate Development. *Cultural-Historical Psychology*, Vol. 17, no. 2, pp. 37—49. DOI: https://doi.org/10.17759/chp.2021170204

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The Effect of Writing Operation Scenarios on Higher-Order Thinking Skills

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Abstract

The purpose of this study is to reveal the effect of writing scenarios for solved mathematical operations on students' higher-order thinking skills in mathematics lessons. Explanatory mixed-methods design was employed throughout the research process, collecting first the quantitative data and then the qualitative data set. The study group consisted of 90 third-grade students and 9 teachers teaching at the third grade of the research context. In the study, the teachers and 18 students who took part in the activity expressed their opinions regarding the activity itself. According to the quantitative results, it was found that students' script writing had an effect on their high-level skills. According to the opinions of both teachers and students, the activity influenced the students' higher-order thinking skills in a positive way. In addition, it was observed that the study contributed to students' love of mathematics, writing skills, and higher-order thinking skills.

Keywords:

Operation Scenario, Mathematics Lesson, Writing Skills, Higher-Order Thinking Skills

Introduction

One of the characteristics that distinguishes humans from other living beings is the ability to think. Thinking encompasses a rather complex process. An individual's developmental level and age can give them a way and depth of thinking. This way of thinking can be basic in some children, intermediate in some, and advanced in others (Applegate, Quinn & Applegate, 2002; Davidson, 1969; Sarar Kuzu, 2013).

In many studies, these levels have been divided into different stages such as remembering, understanding, applying, analyzing, synthesizing, and evaluating. Therefore, many studies have been conducted to develop or identify these levels (Abu, Abidin & Aris, 2013; Çakmak Güleç, 2010; Kılıç, Köse, Tanışlı & Özdaş, 2007; Kırbağlar, Özsoy Güneş & Derelioğlu, 2010). However, different variables such as family, school, environment, and friends can affect the development and formation of these stages. Some studies have revealed that family is one of the most effective factors in developing thinking among these variables, and another factor that supports this element is the school (Çiçek, 2002; Keskin, 2020;

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Kol, 2011). In addition, this differentiation contributes to students' creative and critical thinking skills. According to Güneş (2012), the inability to develop students' thinking skills is a problem of many countries. However, especially if the basic skills that should be acquired at school are not acquired on time, it can be quite difficult for the child to find a solution to this problem or to express it in writing and verbally; to solve it with a different superior thinking skill when he encounters a problem in his life after school. In the study of Sevim and Zıhar (2020), it was concluded that the reflective thinking skills of students with high report card grades were higher than those with low report card grades, and there was a positive relationship between thinking skills and self-efficacy. Özdil and Beyhan (2023) concluded that thinking skills are predictors of mathematics success. In this context, studies are being carried out to help children gain higher-order thinking skills during the school period (Şahin & Akman, 2018; Tuğrul, 2006), and various game-based activities come first. Through these activities, children can both play games and develop their thinking skills. The point emphasized here is that the developed activities should be designed in accordance with the children's level and interests. Therefore, focusing on children in the preparation of activities increases the effectiveness of the studies (Ergin, 2005).

In the activities, having the child write the formation, cause and result of an event affects the child's perspective on a subject. These practices also positively affect children's acquisition of self-expression skills both verbally and in writing. Thus, children's scenarioization of a subject (Yılmaz, Üstündağ & Güneş, 2017) helps to develop the ability to visualize and concretize that subject in the minds of children (Latifi, Noroozi & Talaee, 2020). Scenarioization of a subject, event or phenomenon contributes to the development of the child's thinking skills (Gülmez Güngörmez, Akgün & Duruk, 2016; Tok & Sevinç, 2012; Uzunoğlu & Bulut, 2022). When the literature is examined, no studies have been found on whether the scenario writing skill for the process steps has an effect on higher-order thinking skills. One of the reasons why the scenario activity is used in the study is that the student verbalizes mathematical operations and relates them to daily life while writing the scenario. Another reason is that students try to develop their decision-making, imagination, creative thinking, critical thinking and language skills during these processes. Another aspect is that since the solution of the operation is given, the student tells the story of the operation. For this reason, this study aimed to examine the effect of scenario writing activity on the higher-order thinking skills of third grade students. Based on this purpose, the following questions were sought:

1. What is the effect of students writing a mathematical scenario for solved operations on their higher-order thinking skills?
2. What are the teachers' opinions about the activity of students writing a mathematical scenario for solved operations?
3. What are the teachers' opinions about the effect of the scenario writing activity on other areas?
4. What are the students' opinions about the contribution of writing a mathematical scenario for solved operations to their higher-order thinking skills?
5. What are the students' opinions about the scenario writing activity?

Method

This study employed mixed-methods research design. Maxwell (2016) defined mixed-methods as the systematic use of quantitative and qualitative methods together within a single study. Throughout the research, quantitative data and qualitative data were collected sequentially, former being the first, thus it was thought that the study was suitable for the explanatory sequential mixed design. Creswell and Plano Clark (2018) stated that the explanatory sequential mixed design is the collection of quantitative data first, followed by interviews with the participants to reveal the why and how of the quantitative data after it is interpreted. The number of correctly written problem scenarios, incorrectly written scenarios, and scenarios by error types from students and teachers constitute the quantitative part of the research. On the other hand, data on the opinions of students and teachers about the activity constitutes the qualitative part.

Ethical approval was obtained from the Social and Humanities Sciences Scientific Research and Publication Ethics Committee of the Uşak University with the decision dated 08.02.2024 and numbered 2024-39.

Study Group

In selecting the schools, teachers, and students included in the study group, a convenience sampling method was used within the scope of the research. Accordingly, three schools representing low, medium, and high socio-economic status — where the implementation could be carried out — were selected based on accessibility and the willingness of participants to take part in the study. In total, 3 school administrators, 9 teachers, and 90 students were included. The convenience sampling method was chosen because the researchers had previously conducted activities in these schools and had ongoing communication with the school administrations.

Within each participating classroom, 10 students — five boys and five girls — were randomly selected among those willing to participate. While the activities were carried out with all students in the class, data were only collected from these ten selected students.

The school administrators were informed about the purpose of the study. Subsequently, detailed information was provided to the participating teachers, students, and their parents, and parental consent was obtained for student participation.

Although the study group consisted of 90 students, the dataset appears to include data from 1,080 students. This is due to the fact that the analysis was conducted on the basis of individual mathematical operations. Each student wrote a scenario for 12 different math problems. Therefore, 90 students × 12 scenarios = 1,080 entries, which explains the inflated appearance of the dataset size.

Implementation

Starting the Activity

In the process of starting the activity, a two-week introduction and different game-based activities were held with the students. Gifts suitable for their levels were given to them. With these activities, a good rapport was established between the students and the researchers. During these two weeks, the main purpose was to get closer with the student group.

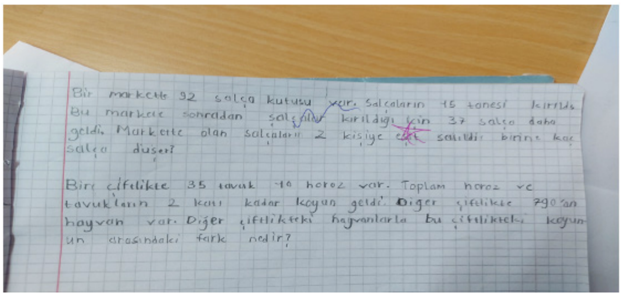
Scenario Writing Activities

In this process, students were given four tasks requiring one operation, four tasks requiring two operations, and three tasks requiring three operations. Operations are at most three-digit operations. Because in the Ministry of National Education (MoNE) (2018) mathematics curriculum, in the M 3.1.2.1. attainment, it is emphasized that "It performs addition with and without carry-over with numbers up to three digits at most". For this reason, the operations given to the students are also the operations that remain within a maximum of three digits. After the data of the pre-test application were collected, the students were informed about the purpose of the study. The following week, five examples were implemented by the researchers. In the third week, the students were given five solutions that required a pilot operation, and after explaining the necessary points, the students were asked to write a scenario related to the process as in Figure 1.

Feedback was given on the scenarios they wrote during the activity. One of the sample scenarios written by the students was written on the board. After the operations were done, the students' scenarios were collected and evaluated. In the evaluation, students' writings were evaluated with criteria such as compliance with spelling rules, expression disorder, suitability for developmental level, concretization, relating to real life, measurement and evaluation, and acquisition of higher thinking skills. As a result of this pilot activity, it was seen that the students did not have a problem with understanding the activity. For this, an evaluation rubric was developed by the researchers. The actual application started in the fourth week. The students were asked to write scenarios for mathematical operations that required one operation andwere developed by the researchers. Suitability of the operations were also confirmed by the teachers. In the fifth week, they were asked to write scenarios for the solution requiring two operations. The evaluation was done in the same way. In the sixth week, a mathematical task requiring three operations was given and they were asked to write a scenario suitable for this operation. Students' scenarios were evaluated according to the criteria in the first and second steps. The class teacher was asked to observe the students during the process and prepare an observation report for each student. The teacher expressed his/her report as an opinion in semi-structured interviews. In the seventh week, the final test was applied to the students. Due to the nature of the method, after the quantitative data of the research were evaluated, the teachers and students were asked in a semi-structured interview whether the activity had an effect on the students' higher-order thinking skills. The activities were carried out by the researchers, and the teachers were present in the class as observers. Thus, negativities such as teachers' biased behavior and memorization by students were prevented. The activity continued for a total of eight weeks, along with teacher and student interviews.

Figure 1

Example of a Student-Written Screenplay

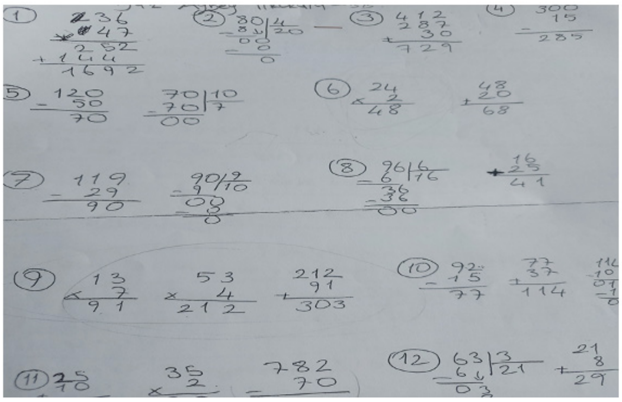


Data Collection Tool

Two different data collection tools were used in the study. The first data collection tool was created by the researchers, consisting of mathematical operations for which five teachers currently working in the third grades have completely agreed on the writing of a solved mathematical scenario. In line with the opinions of the teachers, four tasks requiring one operation, four tasks requiring two operations, and three tasks requiring three operations were used to collect quantitative data with 12 solved mathematical operations for the pre-test application. Examples are shown in Figure 2.

Figure 2

Solved Mathematical Operations Scenario Written by Students



The other data collection tool consisted of the data obtained from the semi-structured interview form conducted with the students who participated in the activity and their teachers. In the development of the form, the opinions of four experts in the fields of classroom teaching, mathematics education, Turkish education and measurement and evaluation were consulted. The questions on which the experts fully agreed on were included in the interview form.

Data Analysis

Quantitative and qualitative analysis was performed in the study. A rubric was developed for quantitative analysis. The rubric developed by the researchers was sent to five academics who are experts in five different fields. In the rubric, the sub-dimensions of originality and fluency of creative thinking skill, which are among the higher-order thinking skills, were considered by reviewing the literature. The sub-dimensions of cause and effect relationship, generalization, questioning, inference, concretizing the abstract concept in associating with current life, associating mathematical language with current language, coherence and fictionalization sub-dimensions took place for language and expression skills. The experts agreed that the study was related to the above-mentioned features of higher-order thinking skills. According to Cohen's Kappa formula, those with 90% and above consensus among academics were included in the rubric. The rubric was scored as 0, 1, 2, 3, 4 and 5 points. If the student did not write anything in the scenario writing activity, they got zero points, if they wrote very little, they got one, if they wrote a little, they got two points. If the student wrote the scenario moderately, they got three points, if they wrote it well, they got four points, and if they wrote it very well, they got five points. The evaluators were given the evaluation criteria. The experts made their evaluations according to these criteria. The quantitative data obtained from the rubric were analyzed in the statistical program. Paired-samples t-test analysis was performed in the analysis of quantitative data. On the other hand, qualitative data were analyzed by descriptive analysis. For these analyzes, themes were determined with the opinions previously received from experts. In the analysis, teachers were coded as T1, T2., and students as S1, S2. Codes and sub-codes were created according to the themes. The codes and sub-codes derived from the analysis were presented to three experts. In calculating the inter-coder agreement, 90% agreement was achieved according to Cohen's Kappa formula.

Findings and Comments

In this section, findings and comments on the sub-problems are given. The findings and comments regarding the sub-purpose of "What is the effect of students writing a mathematical scenario for solved operations on their higher-order thinking skills?" are given below:

Table 1

t-Test of the Effect of Writing a Scenario for a Mathematical Operation on Higher Order Thinking Skills

Variable	Measurement	N	M	Sd	t	df	p
Overall Total	Pre-test	1079	16.74	2.17	-121.625	1078	000
	Post-test	1079	43.46	8.66			
Creative Thinking	Pre-test	1079	2.94	.35	-131.985	1078	000
	Post-test	1079	5.77	.95			
Critical Thinking	Pre-test	1079	7.85	1.09	-140.881	1078	000
	Post-test	1079	19.04	3.45			
Mathematical Language	Pre-test	1079	2.06	.45	-150.814	1078	000
	Post-test	1079	9.54	1.69			
Language and Expression	Pre-test	1079	3.89	.54	-136.766	1078	000
	Post-test	1079	9.48	1.77			

Table 1 shows the effect of writing a scenario for a mathematical operation on higher-order thinking skills. As a result of the paired-samples t-test, a significant difference was found at the $p<.001$ level. The pre-test average was 16.74, and the post-test average was 43.46. It was seen that the activity of writing a scenario for a mathematical operation developed students' creative thinking, critical thinking, relating mathematical language to current language, and language and expression skills.

The contribution of writing a scenario for a mathematical operation to creative thinking skills, one of the higher-order thinking skills, is also observed. In this section, the highest score a student can get is 10. The pre-test score average of the students was 2.94, while the post-test score average was 5.77. Students' creative writing skills developed less than other skills. The dimension that lowers the average score is originality. While students' fluency skills developed, their originality skills did not develop at the same rate.

It has been observed that writing a scenario for a mathematical operation significantly contributes to critical thinking skills, a component of higher-order thinking ($p<.001$). In this section, the highest total score a student can get is 20. In the post-test application, the average of the students was 19.04. It can be said that the activity contributes significantly to students' critical thinking skills.

A significant difference was found at the $p<.001$ level between the pre-test scores and post-test scores of the students in the skill of associating mathematical language with daily life, which is also one of the higher-order thinking skills of writing a scenario for a mathematical operation. It was found that the activity of writing a scenario for a mathematical operation contributed to the students' use of mathematical language in daily life. In the pre-test application, the pre-test score average of the students was 2.06, while the post-test application score was 9.54, meaning that was the skill students developed the most. The maximum score a student can get is 10, and the students' success was close to the maximum score.

Language and expression skills are among the skills that the activity of writing a scenario for a mathematical operation contributes to. A significant difference was found at the $p<.001$ level between the students' pre-test scores and post-test scores. The pre-test score average of the students is 3.89, and the post-test scores are 9.48. The activity contributed to the students' language and expression skills.

The findings and comments regarding the sub-problem of "What are the teachers' opinions about the activity of students writing a mathematical scenario for solved operations?" are given below in Table 2.

Table 2

Teachers' Opinions on the Contribution of Scenario Writing to Higher Order Thinking Skills

Theme	Code	Sub-Code	f
Effect on Higher-Order Thinking Skills	Effect on Critical Thinking Skills	Establishing cause and effect relationships	9
		Questioning	9
		Generalization	9
		Making inferences	9
	Creative Thinking Skills	Originality	3
		Fluency	7
	Relating to Daily Life	Concretizing abstract concepts	9
		Relating mathematical language to everyday language	9
	Effect on Language and Expression Skills	Consistency	7
		Structuring	5

As shown in the table, the teachers stated that writing the scenario of the operation contributed to higher-order thinking skills; they emphasized the findings obtained from quantitative data depending on the codes. This situation reveals the internal consistency of the research.

Four sub-codes were formed depending on the code of the effect on critical thinking skills. One of these is the sub-code of establishing cause and effect relationships. Teachers stated their views as follows regarding this sub-code. In this regard, T1 said, "After the activities, students want to learn the reason for a word or explanation that is said, and they can make comments accordingly. Now I have to tell them the reason for everything I say. They no longer accept anything as right or wrong from the beginning." T3 said, "Now they want to know the reason for everything that is said. Now they want this outside of math class as well. The other day, in the life science class, I gave an example from real life to concretize the subject. The students asked, 'Teacher, why did this happen?' They responded to every reason I gave by saying, 'But if that's the case, then this happens.' I was surprised. This development pleased me greatly." Teachers made explanations about establishing cause and effect relationships in their explanations. According to the teachers' opinions, the students acquired the ability to establish cause and effect relationships in terms of critical thinking skills.

According to the teachers' opinions, one of the higher-order thinking skills that students acquired with scenario writing is the questioning skill. The teachers, who expressed their opinions on the subject, revealed that the students passed through a thinking system without perceiving anything as right or wrong by thinking about the different dimensions of what they learned. In this regard, T6 said, "I asked the problem in math class, after checking the solution of the problem with the students, I had a student do the solution on the board. A few students said, 'Teacher, why do you only want one solution when there are multiple ways to solve this problem?' and I was surprised. When I said tell me, they solved the problem in five different ways. Another student also said, 'Teacher, we can also set up this problem in other ways.' That student also asked the same problem in three different ways without changing the numbers and the plot of the event. I was surprised. Here is the result." Teachers exemplified the questioning skill with those utterances.

One of the skills acquired within the scope of critical thinking skills of the activity of writing scenarios for mathematical operations is the generalization skill. The ability to make inferences is another skill that students acquire within the scope of critical thinking skills.

According to the teachers' opinions, one of the codes formed in relation to the effect of writing operation scenarios on higher-order thinking skills is creative thinking. Sub-codes of originality and fluency were formed depending on creative thinking. In the originality sub-code, according to the quantitative findings, the least developed skills of the students in writing the scenario of the operation are originality. Teachers attribute this situation to the lack of vocabulary, the limitations of the environment in which the students live, the test-solving-oriented course, the insufficient level of parent education, the indifference of the student's parents, and the students' limited time with their peers or the environment outside of school. T7 stated his opinion by saying, "Students interact with a limited number of environments here. Because they do not go to a different place or environment outside of this environment, they think with a limited number of words. That's why they use similar words when writing operation scenarios." T9 said, "We are teaching test-oriented lessons with the students here according to the expectations of the parents. Since the test questions are in the same format and contain similar words, the student thinks in the same format and cannot think creatively." The teacher revealed the effect of test-solution-oriented teaching on creative thinking and emphasized the effect of vocabulary richness on scenario writing.

One of the skills acquired by the students in relation to creative thinking skills along with the activity of writing operation scenarios is fluency. It is an important gain in higher-order thinking skills for students to establish connections between words and concepts and to question words and concepts while writing operation scenarios. T2 emphasized fluency by saying, "With these activities, the students created a very nice integrity within the scenario they wrote. They do not use expressions that will cause expression disorder in the text. As a teacher, I am very happy for the students. I wish such an activity had been implemented." It can be said that it is important for students to organize the event by establishing a relationship between concepts and words in terms of fluency skills. T4 said, "I feel like I'm reading poetry when I read what the students wrote." The teacher approached fluency from a different angle. T6 said, "Students used to write, 'My father gave me money,' and move on. Now they make connections like why he gave the money, what I'm going to do, and create integrity, there is a good flow." The teacher stated the relationship between fluency and integration. He expressed the effect of writing operation scenarios on students' acquisition of fluent expression skills.

Another impact of writing operation scenarios on students' higher-order thinking skills is the skill of associating mathematics with daily life. Sub-codes of concretizing abstract concepts and associating mathematical language with everyday language were formed depending on this code. In the sub-code of concretizing the abstract concept, a more concrete explanation of abstract concepts such as solid, more, less, which were previously given in an abstract way, were emphasized while writing the story of the operation. In this regard, T4 said, "Me and our students used to ask the question in a short way before. For example, we were asking questions like 'What is 12 less than five times 8? Because the layer remained abstract, the students did not understand and memorized it. Instead, my father bought eight boxes of eggs for our house. We put the eggs in the refrigerator. Each box contained five eggs. My mother made menemen with 12 of the eggs. Now, how many eggs do we have in our refrigerator?' stories written that way concretize the process." The teacher exemplified the concretization of abstract concepts in mathematics.

Depending on the sub-code of associating mathematics with daily life, students associated the operation scenarios they wrote with examples from daily life. They reflected examples from their lives, such as going shopping, playing marbles, and the number of students at school, into the operation scenario. In this regard, T1 said, "We used to use only mathematical concepts in operations. We used to write like "25 plus 55 equals how much?". But with this activity, they make associations with examples from daily life. 'Because I kissed the hands of my elders on Eid, my elders gave me 550 liras of Eid pocket money. We went to the market to buy the jersey of my favorite team with the money. My father bargained with the seller. We bought the jersey of my favorite team for 300 liras. How much money is left from my Eid pocket money?' They relate mathematical language to daily life as in the example." The teacher concretized the subject with an example. Students included realistic mathematics education with the activity of writing operation scenarios.

Students' language and expression skills were also examined along with the activity of writing operation scenarios. In this context, consistency and structuring skills are also among the skills acquired by students. Depending on the consistency sub-code, the students revealed the consistency in the operation scenario writing activity, such as the harmony between the given values and the desired ones within the integrity of the scenario, and the sentences being a continuation of each other. In this regard, T2 said, "We didn't pay enough attention to the question writing activity before. We were solving the operations and problems given on the websites on the smart boards. That's why our writing skills were weak. When I asked them to write an essay in lessons other than mathematics, there created pieces of writing unrelated to the subject. For example, in the semester before the event, I had asked the students to describe their families. They had made such a narrative that it consisted of short and meaningless sentences like a telegram. While reading, I had thought what he was talking about here. After the activity, they started to tell the story with a story structure by establishing a relationship between the concepts related to the given topic." The teacher exemplified the consistency of the activity in terms of language and expression.

Structuring is one of the higher-order thinking skills that students acquired in terms of language and expression. Teachers stated that the problems arose from the weakening of students' thinking and writing skills due to the fact that test-oriented lessons were conducted before the activity and ready-made problems were asked to the students because the lessons were conducted from the websites in the digital environment weakened the structuring skills. T9 said, "As teachers, we used to ask students structured questions from test booklets or digital environments. Students were reaching the answers to these questions in a classic way with a single method. With this activity, the students structured the questions very nicely by telling them as if they were a whole story, like an event that happened. In the following process, they started to ask a question by structuring it with different structures. This structuring skill also improved comprehension and narration skills. Moreover, the students are extremely satisfied and happy with this. When they heard you were coming, they couldn't wait for the time to pass." The teacher emphasized the development of the students and the different gains they achieved with the structuring skill.

The findings and comments regarding the sub-problem of "What are the teachers' opinions about the effect of the scenario writing activity on other areas?" are given below in Table 3:

Table 3

Teachers' Opinions on the Effect of the Scenario Writing Activity on Other Areas

Theme	Code	Sub-Code	f
Effects on Other Areas	Effects on Math	Loving math	9
		Overcoming fear of math	8
		Deciding on the solution to the problem	7
		Attracting interest	9
	Effects on Reading and Writing	Originality	5
		Structuring	5
		Loving to write	9
		Fluency	7
	Effects on Other Lessons	Questioning what is learned	9
		Researching the source of information	9
		Making interdisciplinary connections	9
		Transfer of topics	9
	Effects on Affective Traits	Self-confidence	7
		Learned helplessness	5
		Active participation in lessons	7
	Effects on Life Skills	Communication with friends	9
		Participation in activities	9
		Social learning	9
		Taking part in a group	9
	Effects on Comprehension Skills	Decision-making skills	8
		Ability to use information	7
		Transferring information to different areas	8

When Table 3 is examined, it includes the opinions of teachers about the effect of the operation scenario writing activity on other areas. It was found that writing operation scenarios had an effect on mathematics, reading and writing skills, other lessons, affective characteristics, social life skills, and comprehension skills. According to the opinions of the teachers, writing an operation scenario had an effect on life skills.

Regarding the effect on mathematics, it was determined that students had gains such as loving mathematics, overcoming the fear of mathematics, deciding on the solution to the problem, and attracting interest. As is known, mathematics has the characteristic of being a lesson that is feared and not loved enough all over the world. However, according to the opinions of the teachers, the activity of writing operation scenarios increases students' love of mathematics. T3 said, "Well, the students are looking forward to the day you will come for the activity. They want me to continue the same activity. However, due to the nature of scientific research, I cannot do such a thing in order not to harm the validity and reliability of the research. Thanks to this activity, mathematics has become the most loved lesson. I especially think this is because students' thinking skills develop and they get positive feedback from you that their thoughts are correct." He told the story of how the activity turned mathematics from a feared subject to a loved one. T9 said, "I also had a fear of math in the past. I was experiencing this fear even when I started my profession. If such activities were done to us in due time, I could have loved mathematics too." The teacher concretized the subject by giving an example from his own life. In parallel with loving mathematics, overcoming the fear of mathematics is also mentioned.

Decision-making on problem solving is another skill that students acquired in the process. While students can write and read the problem, they cannot decide what to do in the operation, or they make wrong solutions or wait without solving the problem. In this regard, T5 said, "The students write and read the problem, but they could not decide what to do. When the student is told to do multiplication here, he can multiply multi-digit numbers. With the operation scenario, students know very well what to do in problem solving," revealing the contribution of the activity to deciding on the solution to the problem. T7 said, "The decision-making skill has not only developed in mathematics lessons, but it has also affected their decision-making regarding other lessons and daily life." The teacher revealed the contribution of transferring math-related skills to other areas. The opinion that students' love of mathematics and overcoming the fear of mathematics increases their interest in mathematics was expressed by the teachers.

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Regarding the effect of scenario writing on reading and writing, it was seen that it also contributed to skills such as originality, structuring, love of writing, and fluency. Depending on the originality code, the teachers expressed their satisfaction with the students writing their own scenarios for the operations. T6 said, " I was very pleased that the students started to write their own stories with the activities carried out in the mathematics lesson. I think my students have reached the creation stage. There has also been an increase in the number of words my students use. The development in vocabulary increase has improved their ability to write in different ways with their own sentences in reading, writing and speaking skills." In parallel with the originality skill, the structuring skill is also one of the skills that students develop in the field of reading and writing. It is an important contribution that students adjust the flow of the event well and use words and concepts in place. Again, loving to write is one of the characteristics that improved with writing operation scenarios. Writing skills are among the ones that developed when students wrote operation scenarios. In this regard, all of the teachers stated that the students who did not like to pick up a pen and did not like to write before, now try to write. In this regard, T4 said, "Now my students want to write something and want to share what they write with me." The teacher revealed the contribution to writing skills. One of the skills that also developed together with writing skills is fluency.

Another area affected by the activity of writing scenarios for operations in mathematics lessons is its contribution to affective characteristics. In this regard, self-confidence, learned helplessness, and active participation in lessons are among the developing skills. As students participated in the activities and received feedback, their self-confidence developed and, consequently, they got rid of the problem of learned helplessness. Students who overcame the problem of learned helplessness also participated actively in the lesson. In this regard, all of the teachers expressed their views as follows: "Students had a fear and anxiety of mathematics because they experienced learned helplessness. Students with low self-confidence could not actively participate in the lessons. Now that the problem of learned helplessness has been eliminated with this activity, their self-confidence has developed. They actively participate in the lessons by taking the floor and stating that they want to do the operation."

Life skills, which are among the 21st-century skills, are also affected by the operation scenario. Developing skills include communication with friends, participation in activities, social learning, and taking part in a group. With the lack of self-confidence created by the failure in mathematics in the students, learned helplessness occurs, and the student avoids communicating with his friends. As the self-confidence developed with the activities ensures active participation in the lessons, the student communicates with his friends to discuss the subject. T9 said, "My student, who never participated in the lessons before, now participates in the lesson, plays with his friends at recess, makes games with them, I realized that he was a hidden treasure." The teacher exemplified the acquisition of life skills through a student. According to the teachers, another skill that students gain with the scenario writing activity is the social learning skill. While a student is doing activities with his friends in the class, he learns in the group thanks to the feedback given to his friends what he is missing and cannot learn. T8 said, "What I saw during the activity was that the students who did not know were turning the feedback given to their friends into a gain for themselves. When he could not decide, he benefited from these feedbacks and shaped his own scenario while reading his friend's scenario." The teacher explained how social learning takes place in the classroom.

According to the teachers, one of the skills that the activity of writing the scenario of the mathematical operation has given the students is the comprehension skill. With this activity, students can make decisions about both problem solving in mathematics lessons and the subjects and activities of other lessons, and they can take action by thinking about what they can do. T4 said, "In my opinion, the most important skill this activity has given students is decision-making skills. I can say that they have gained such as making urgent and on-site decisions about what they will do and turning to produce solutions." He exemplified decision making. The ability to use information is also one of the skills that the activity contributes to the students. The student acquires new knowledge from the information by transferring what he/she has learned in one field to other fields. Using information in the living area and making it a part of one's life are also among the gains. T1 said, "We had dealt with a topic related to the data learning area in math class the other day. In the next lesson, we did an activity about reading comprehension. When I asked the students a question, he explained what he understood by drawing shapes with graphs." The teacher exemplified the development of comprehension skills.

The findings and comments regarding the sub-problem of "What are the students' opinions on the contribution of writing a mathematics scenario for solved problems to their higher-order thinking skills?" are presented in Table 4 below:

Table 4

Students' Views on the Contribution of Scenario Writing to Higher-Order Thinking Skills

Theme	Code	Sub-Code	f
Effect on Higher-Order Thinking Skills	Effect on Critical Thinking Skills	Establishing cause and effect relationships	12
		Questioning	14
		Generalization	14
		Making inferences	12
	Creative Thinking Skills	Originality	10
		Fluency	18
	Relating to Daily Life	Concretizing abstract concepts	18
		Relating mathematical language to everyday language	18
	Effect on Language and Expression Skills	Consistency	12
		Structuring	10

The opinions of the students about the contribution of the activity to their higher-order thinking skills are included in the table. As in the teachers' opinions, sub-codes were created based on the previously determined codes in the students' opinions. Student opinions on sub-codes are given below.

Depending on the cause-and-effect sub-code related to the critical thinking code, students can reveal the result of a cause by thinking about a subject together with its different aspects. In this regard, S1 said, "We used to immediately say the result when we were asked a question because we were used to the test. Now, while writing the scenario, we think about the operation, 'Why is this solved like this?' Sometimes I can even write more than one scenario for one solution. That's why I feel very happy," revealing the contribution of the scenario writing activity to the ability to establish cause and effect relationships.

One of the higher-order thinking skills that the activity contributes to is the questioning skill. S4, 5, 6,7, 12, 13, 18 said, "I no longer accept anything as right or wrong. I mix the information given to me with what I knew before, and after reading it well, I accept it as right or wrong. For example, I don't immediately accept the answer to a question given in mathematics as correct. I'm checking it" and exemplified the questioning skill. S9, 2, 3, 5, 11, 14, 15, 16 said, "I used to believe everything that was told to me and every solution was correct. Now I'm rolling it around in my head like 'Could this be?' I decide whether it is right or wrong after questioning the information and making sure." The student revealed the contribution of the activity to the questioning skill.

All of the students stated that they could not write sufficiently original scenarios in the scenario writing activity due to the inadequacy of their vocabulary. It was also stated that the inadequacy in reading books was also effective in that. The fact that the lessons in the schools are conducted with a focus on tests was shown as another obstacle to the development of originality. All of the students participating in the study emphasized the contribution of reading books to originality by saying, "We mostly solve tests in lessons. Therefore, our reading of books is limited or non-existent. That's why we have difficulty thinking differently." In addition, while examining the scenarios, it was also observed that the students wrote more original scenarios as the number of operations increased. It was determined that they wrote more original and fluent scenarios in cases requiring two or three operations compared to scenarios requiring one operation. In addition, it was concluded that the test-oriented course negatively affected the students' writing and thinking of original scenarios. Here, the opinions of teachers and students are consistent with each other. This reveals the consistency of the research. Fluency is one of the characteristics of creative thinking. It is the development that students are most happy with. In this regard, S1, 2, 3, 5, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18 said, "We didn't like to write before, so we didn't write the questions. We also had difficulty reading what we wrote. That's why we were thinking limitedly. With these activities, we started to write well and read what we wrote," revealing fluency. Quantitative results also support student opinions.

Relating to daily life is another higher-order thinking skills that students acquire. Concretizing abstract concepts is one of the gains that the activity provides to students. Concepts that are abstract in mathematics are concretized with examples from daily life. In this regard, all of the students who participated in the activity said, "In the previous math class, we used to ask or write questions like 'What is half of 78' as in the tests. Now we make it more meaningful by saying it is divided into two equal parts. Also, while writing the scenario, we go to the market, shop, spend money, get change, share with our friends," concretizing the event. Relating mathematical language to everyday language is one of the gains students had in terms of realistic mathematics education. S5 said, "Now, when I go to the market or shopping, I can calculate my shopping in my mind, and I think whether I would have shopped better if I bought this or that." Language and expression skills are among the higher-order thinking skills that students gain. Consistency has provided effectiveness for students in writing scenarios. Students' opinions also support quantitative data. In the quantitative data, a significant difference was found between the pre-test and post-test in terms of consistency. All of the students said, "We used to think with the logic of test questions. Sometimes we could ask meaningless questions. Now we write the question by relating the reasons by turning it into an event or a story." S12 said, "I feel like a writer, I tell the question as if I'm telling a story," revealing the consistency. Structuring is one of the skills that students acquire. The cause and results of the problem were structured and turned into a scenario. In this regard, all of the students participating in the study said, "We used to conduct mathematics lessons with numbers and concepts. Now, we are trying to tell the mathematical scenario from all aspects, as if telling a story. As the number of operations in the question increased, we started to write better. Because as the number of transactions increases, our perspective expands, and we think about the event differently, so we love to write," the students exemplified the structuring. The researchers' observation and students' opinions support each other. Researchers and different evaluators stated that students structured scenarios with increasing number of operations better. When a focus group interview was conducted with five teachers who were not part of the study group to explore the reasons behind this, the teachers explained that creating short fantasies is easier. However, forming longer fantasies requires higher-order thinking, longer durations of thought, and a more comprehensive approach — which may have led to this outcome. That's why it's better structured. It makes a better description. As the number of transactions increases, the student enters into details, and as the details increase, the student reveals his existing capacity. In this context, student opinions and teacher opinions support each other.

Table 5

Students' Views on the Scenario Writing Activity

Theme	Code	Sub-Code	f
Views on the Activity	Most Liked	Story writing	18
		Teachers' approach	9
		Developing imagination	18
		Gamification	18
		Development of thought	9
	Most Challenging	Originality	18
		Structuring	18
		Written expression	8
		Test format	18
	Suggestions	Reaching other students	18
		Unconditional acceptance	2
		Repetition of the activity	18
		Relating to daily life	18

Table 5 presents the students' views on the activity of writing scenarios for mathematical operations. In the activity, codes of "most liked," "most challenging," and "suggestions" were formed. Sub-codes of story writing, teachers' approach, developing imagination, gamification, and development of thought were formed under the code of "most liked."

The story writing activity was the most liked scenario by all students. The students stated that they liked the activity very much because they perceived writing scenarios as a story writing activity. In this regard, the students expressed that they liked the activity by saying, "What I like the most is writing stories about the operations you give us." Another situation that students liked was the approach of the teachers who carried out the activities with students. All of the students emphasized unconditional acceptance by saying, "You approached us so well that I was looking forward to the day of this lesson. You treated everyone equally without discrimination, you didn't say anything bad or wrong to anyone, you made us find the right by saying 'how about we do it this way'." Another area that students like most about the activity is the development of imagination. In this regard, S15 said, "With the activity, I started to dream. As I dreamed, I realized that I was thinking better. For example, when I do an operation, I imagine myself as if I am living that operation and I am happy, so I loved this activity very much." He associated dreaming with loving math class.

Gamification is a popular feature of writing scenarios for mathematical operations. The students perceived the activity as a game. The development of students' thinking skills along with their imagination skills is one of the skills that students like.

According to the students' opinions in this activity, the most challenging skills were originality, structuring, written expression, and test format. The students stated that they had difficulty writing original scenarios. According to the students, the reasons for this are that; the lessons are conducted in a test format, the lack of vocabulary, and the reasons related to not reading enough books. In this regard, S14, who is studying at a school with a low socioeconomic status, said, "Our lessons are spent solving tests from the smart board in the class. My life consists of this environment. I have never been out of this environment. I've never been on vacation anywhere. I don't read much either. That's why I have to use the same words all the time when writing questions," revealing the reason for the originality problem and the limitations of the activity. Conducting test-oriented lessons and not giving enough space to expression activities also cause students to have difficulty in structuring due to the inadequacy of their vocabulary. Again, the lack of sufficient written expression activities is one of the challenging situations for the activity. Again, the test-oriented course leads to a limited number of written or oral expression activities. Conducting test-solution-oriented lessons makes it easier for teachers. Using ready-made, structured resources on websites in the digital environment does not require additional work for teachers, so it directs teachers to conduct test-oriented lessons. In this regard, all of the students summarized the issue by saying, "We had difficulty writing questions at first because our teacher always had us solve tests." Test-oriented teaching can limit students' higher-order thinking skills.

Students had suggestions for the activity as well. These are the application and reaching of this activity to other students, frequent repetition of the activity, associating it with daily life and unconditional acceptance. All of the students stated that the activity provided them with significant gains, and since they liked the activity, they also suggested that the activity be applied to other students. They wanted this activity to be repeated in the lessons. The reason is that it also contributes to their skills such as language and expression and comprehension outside of mathematics lessons. Again, the students suggested that relating the activity to daily life develops their imagination, so they suggested that mathematics lessons be related to daily life. Another suggestion from the students was an affective suggestion. The students stated that they saw with this activity that the unconditional acceptance of their teachers would increase their success in the lessons, so they wanted unconditional acceptance from their teachers.

Discussion and Conclusion

An individual's ability to develop solutions to the problems they encounter in daily life indicates that they will be successful in expressing themselves and overcoming these problems. In this context, designing a scenario for a mathematically given numerical operation, coping with a problem, looking at the problem from a different perspective, and structuring the operation require higher-order skills. Therefore, it is a very important stage to instill higher-order thinking skills in students (Abosalem, 2016; Baş & Beyhan, 2012; Kosasih, Supriyadi, Firmansyah & Rahminawati, 2022; Muhibbuddin., Artika & Nurmaliah, 2023). In this context, it is seen that the scenario writing activities used in the study are effective in gaining higher-order thinking skills.

Badia & Becerril (2016) concluded in their study that thinking skills develop as the participants write scenarios in teacher education. Valdivia & Martinez (2019) concluded in their study that argumentative writing skills were acquired gradually by prospective teachers. Because when we look at the effect of scenario writing on higher-order thinking skills, it is seen that there was a significant difference at the $p<.001$ level and a difference of 26.72 points between the pre-test average (16.74) and the post-test average (43.46). This situation revealed that scenario writing has an effect on developing students' creative thinking, critical thinking, associating mathematical language with current language, and language and expression skills. This result is consistent with scenario-based studies (Vijayaratnam, 2012; Setyowati, 2020). In addition, it was revealed that scenario writing establishes a strong relationship between higher-order thinking skills and that developing critical thinking skills facilitates associating mathematical concepts with daily life.

According to the opinions of teachers and students, it was determined that, with the sub-codes of establishing cause and effect relationships, questioning, generalization, making inferences, originality, fluency, concretizing abstract concepts, associating mathematical language with current language, and consistency, scenario writing positively affects higher-order thinking skills. According to the opinions of teachers and students, it was revealed that scenario writing has an effect on many other areas such as reading and writing, affective characteristics, life and comprehension skills, besides mathematics. In addition, it was observed that mathematical operations with a large number of operations contributed to students' more creative thinking. This result is consistent with the study conducted by Damsir, Zubaidah, Kusnadi and Rian (2022).

When the opinions of the students about the activities of writing scenarios for a mathematical operation are evaluated, it is seen that their story writing skills have developed, their approaches to their teachers have changed, their imagination skills have improved while looking for a solution to a subject or problem, they can easily gamify a subject, their thinking skills have developed, they have developed more original ideas, their fiction writing skills in their written expressions have developed and they communicate more easily with other students. This result is consistent with the study conducted by Yaman & Süğümlü (2009) in terms of students' participation in the lesson. This situation reveals that students show development both cognitively and affectively. In addition, it was also observed that scenario writing skills enabled students to move away from rote learning and participate effectively in lessons by using their creative and critical thinking skills, as it was handled with a student-centered approach rather than test-oriented lessons. Accordingly, students' self-confidence and self-expression skills have developed through the activities, and students have stated that activity-based applications should be made in other lessons as well.

As a result, it was seen that the scenario writing activity generally developed higher-order thinking skills, and in particular, students' creative writing, critical thinking, structuring, consistency, imagination, problem solving, decision making and associating the subjects covered with daily life. When the current teaching theories related to mathematics lessons are examined in the literature, it is seen that realistic mathematics education (RME) contains the principles that include the above-mentioned skills of the students. In RME, the goals are medium and high level. In RME-based trainings, higher-order skills such as reasoning, communication, critical thinking, and problem solving-creation take place. In addition, it is known that in the theory, associations with daily life are made based on context scenarios (Çilingir-Altıner, 2021; Zulkardi, 2002). Wathne and Carlsen (2024), in their study, concluded that multimodal mathematical reasoning in solving combinatorial problems enhances problem-solving, mathematical understanding, and reasoning skills. In addition, in this theory, students can reach higher-order thinking skills based on their own experiences and by combining mathematics with scenarios related to daily life, and they can include these skills in the learning process (Freudenthal, 1991; Gravemeijer 1994; Demirdöğen & Kaçar, 2010). Therefore, the student can write a scenario-based problem (Çilingir-Altıner, 2021). From this point on, it can be suggested that different theoretical-based studies should be carried out by adopting the RME approach in the development of mathematical scenarios and problems and their integration in the teaching process. Based on the results, the following suggestions can be made:

Suggestions

- Teachers can use scenario writing activities in different lessons to develop students' higher-order thinking skills.
- Teachers can use scenario writing activities in mathematics and different lessons to develop students' affective and social aspects.
- This study was conducted with primary school third grade students. It can also be carried out in other grade levels and lessons. Various studies can be conducted through scenario writing in different lessons.
- One of the limitations of this study is that the parents' opinions could not be taken. Parent opinions on the activity can also be investigated.
- Research can be conducted to reveal the effect of the activity on eliminating the problems caused by students' learning difficulties.

References

Abu, M. S., & Abidin, Z. Z. (2013). Improving the levels of geometric thinking of secondary school students using geometry learning video based on Van Hiele theory. *International Journal of Evaluation and Research in Education (IJERE), 2*(1), 16-22.

Abosalem, Y. (2016). Assessment Techniques and Students' Higher-Order Thinking Skills. *International Journal of Secondary Education, 4*(1), 1-11. doi: 10.11648/j.ijsedu.20160401.11

Applegate, M. D., Quinn, K. B & Applegate, A. J. (2002). Levels of thinking required by comprehension questions in informal reading inventories, *The Reading Teacher, 56*(2), 174-180.

Badia, A. & Becerril, L. (2016). Renaming teaching practice throught teacher reflection using critical incidents on a virtual tranning course. *Journal of Education for Teaching 42*(2), 224-238. http://doi.org/10.1080/02607476.2016.1143146

Baş, G., & Beyhan Ö. (2012). İngilizce dersinde yansıtıcı düşünme etkinliklerinin öğrencilerin akademik başarılarına ve derse yönelik tutumlarına etkisi [Effects of reflective thinking activities on students' academic achievement and attitudes towards English course], *Amasya Üniversitesi Eğitim Fakültesi Dergisi 1*(2) 128-142.

Bravo, A., Porzecanski, A., Sterling, E., Bynum, N., Cawthorn, M., Fernandez, D. S., Freeman, L., Ketcham, Leslie, S., T., Mull, J. & Vogler, D. (2016). Teaching for higher levels of thinking: developing quantitative and analytical skills in environmental science courses. *Ecosphere*, *7*(4): e01290. 10.1002/ecs2.1290.

Cohen, J. (2013). *Statistical Power Analysis For The Behavioral Sciences*. Academic Press.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research (3rd ed.)* Sage.

Çakmak Güleç, H. (2010). Evaluation of Prospective Primary and Pre-School Teachers' Critical Thinking Level, *Education and Science, 35*(157), 3-14.

Çiçek, A. (2002). Linguistic development in the group of 0-6 years, *Erzincan Eğitim Fakültesi Dergisi, 4*(1), 115-124.

Çilingir-Altıner, E. (2021). Gerçekçi matematik eğitimi üzerine bir kuramsal çalışma [A theoretical study on realistic mathematics education]. *Eğitim ve Teknoloji, 3*(1), 48-73.

Damsir A, Zubaidah A, Kusnadi, M. Z. & Rian, V. (2022). Mathematical creative thinking ability, and students' self regulated learning to use an open ended approach, *Malikussaleh Journal of Mathematics Learning (MJML) 4*(1), 52-61.

Davidson, R. L. (1969). Teacher influence and children's levels of thinking, *The Reading Teacher, 22*(8), 702-704.

Demirdöğen, N. & Kaçar, A. (2010). İlköğretim 6. sınıfta kesir kavramının öğretiminde gerçekçi matematik eğitimi yaklaşımının öğrenci başarısına etkisi [The effect of realistic mathematics education approach on the student's success of teaching fraction concept in 6th class]. *Erzincan Eğitim Fakültesi Dergisi, 12*(1), 57-74.

Ergin, H. (2005). Okul öncesi dönemde Bloom'un bilişsel alan sınıflandırmasını kullanarak çocukların düşünme becerilerinin geliştirilmesi [Improving children's thinking skills using Bloom's cognitive domain classification in preschool period], *Hasan Ali Yücel Eğitim Fakültesi Dergisi, 1*, 93-105.

Freudenthal, H. (1991). *Revisiting mathematics education*. Dordrecht: Kluwer Academic Publishers.

Gravemeijer, K. (1994). *Developing realistic mathematics education*. Utrecht: Freudenthal Institute.

Güneş, F. (2012). Öğrencilerin düşünme becerilerini geliştirme [Improving the thinking skills of students], *TÜBAR XXXII*, 127-146

Gülmez Güngörmez, H., Akgün, A. & Duruk, Ü. (2016). Developing elementary students' reflective thinking skills through scenario-based learning, *The Journal of Academic Social Science Studies, 48*(2), 459-475.

Kosasih, A., Supriyadi, T., Firmansyah, M. & Rahminawati, N. (2022). Higher-order thinking skills in primary school: teachers' perceptions of Islamic education, *Journal of Ethnic and Cultural Studies, 9*(1), 56-76.

Keskin, F. (2020). Gelişim özelliklerine bağlı olarak çocukta sözlü mizah anlayışı [Verbal sense of humor in children is depending on characteristic development], *International Social Mentality and Researcher Thinkers Journal, 6*(32), 869-886.

Kılıç, Ç., Köse, N., Tanışlı, D. & Özdaş, A. (2007). Determining the fifth grade students' van Hiele geometric thinking levels in tessellation, *Elementary Education Online, 6*(1),11-23.

Kırbağlar, F., Özsoy Güneş, Z. & Derelioğlu, Y. (2010). Investigation of pre-service science teachers' opinions and knowledge degrees on laboratory safety, *Gazi Eğitim Fakültesi Dergisi, 30*(3), 801-818.

Kol, S. (2011). Cognitive development and language development in early childhood, *Sakarya Üniversitesi Eğitim Fakültesi Dergisi, 21*, 1-21.

Latifi, S., Noroozi, O. & Talaee, E. 2020). Worked example or scripting? Fostering students' online argumentative peer feedback, essay writing and learning, *Interactive Learning Environments, 31*(2), 655-669.

Maxwell, J. A. (2016). Expanding the history and range of mixed methods research, *Journal of Mixed Methods Rsearch 10*(1) 12-27 https://doi.org/10.1177/1558689815571132

Muhibbuddin., Artika, W., & Nurmaliah, C. (2023). Improving critical thinking skills through higher order thinking skills (HOTS)-based science. *International Journal of Instruction, 16*(4), 283-296. https://doi.org/10.29333/iji.2023.16417a.

Özdil, A., & Beyhan, Ö. (2023). Eleştirel, yansıtıcı ve yaratıcı düşünme becerilerinin 10. sınıf matematik dersi tutum ve başarısına etkisi [The effect of critical, reflective and creative thinking skills on attitude and success in 10th-grade mathematics course] *Millî Eğitim, 52*(240), 2705-2740. DOI: 10.37669/ milliegitim.1134973

Sarar Kuzu, T. (2013**)**. Investigation of the text following questions in Turkish course books with respect to their remembering and understanding cognition levels of the revised Bloom taxonomy, *CÜ Sosyal Bilimler Dergisi, 37*(1), 58-76.

Setyowati, R., et al. (2020). Scientific-based learning scenario to improve student's higher order thinking skills: A development concept, *Prosiding Konferensi Ilmiah Dasar, 2*, 224-254.

Sevgi, S., & Zihar, M. (2020). Ortaokul öğrencilerinin yansıtıcı düşünme becerileri ile matematik öz yeterlik algılarının çeşitli değişkenler açısından incelenmesi [Analyzing the reflective thinking skills and mathematical self-efficacy perceptions of middle school students with respect to some variables]. *Kastamonu Education Journal, 28*(6), 2331-2345. doi: 10.24106/ kefdergi.700428

Şahin, M. & Akman, B. (2018). Development of thinking skills in early childhood, *Milli Eğitim, 218*, 5-20.

Tok, E. & Sevinç, M. (2012). The effects of thinking skills education on the creative thinking skills of preschool teacher candidates, *Education and Science, 37*(164), 204-222.

Tuğrul, B. (2006). Drama as a creative process for developing thinking skills in preschool, *Yaratıcı Drama Dergisi, 1*(2), 99-110.

Uzunoğlu, D. & Bulut, B. (2022). Çevrimiçi ortamda yürütülen senaryo temelli öğrenme etkinliklerinin Türkçe öğretimi özyeterliğe, akademik güdülenmeye ve başarıya etkisi [The effect of scenario based learning activities conducted in online environment on Turkish teaching self-efficacy, academic motivation and success], *Ana Dili Eğitimi Dergisi, 10*(1), 60-73.

Valdivia, M. A. & Martínez, M. L. (2019) Improving preservice teachers' scientific argumentative writing through epistemic practices: a learning progression approach, *Journal of Education for Teaching, 45* (2), 169-185, DOI: 10.1080/02607476.2018.1548172

Vijayaratnam, P. (2012). Developing higher order thinking skills and team commitment via group problem solving: A bridge to the real world, Procedia - Social and Behavioral Sciences 66(2012), 53-63.

Yaman, H. & Süğümlü, Ü. (2009). The effectiveness of scenario based-learning approaches on grammar instruction: "types of words" sample, *Dil Dergisi, 144*, 56-73.

Yılmaz, Y., Üstündağ, M. T., & Güneş, E. (2017). Öğretim materyali olarak dijital hikâye geliştirme aşamalarının ve araçlarının incelenmesi [Investigation of digital story development stages and tools as teaching materials] *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 17*(3), 1621-1640.

Zulkardi, Z. (2002*). Developing a learning environment on realistic Mathematics Education for Indonesian Student Teachers.* Published doctoral thesis of the University of Twente. Enschede, the Netherlands: PrintPartners Ipskamp. Available online at http://doc.utwente.nl/58718/1/thesis_

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The Relationship between Cognitive Flexibility and Mathematical Literacy: Insights from Indonesian Elementary Students

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Abstract

This study investigates the relationship between mathematical literacy and cognitive flexibility in solving complex problems among Indonesian elementary school students aged 9–10 n = 78. Utilizing a mixed-methods approach, the research combined quantitative testing and qualitative interviews to provide a comprehensive understanding of this relationship. The findings indicate that students with higher levels of both literacy and flexibility performed significantly better in problem-solving. However, students with high flexibility but low literacy struggled to grasp mathematical concepts while those with high literacy but low flexibility showed rigid problem-solving approaches. Despite these differences, all students demonstrated potential for improvement with adequate teacher support. These results emphasize the importance of tailored educational strategies to enhance both mathematical literacy and cognitive flexibility especially in developing countries like Indonesia.

Keywords:

Cognitive Flexibility, Mathematical Literacy, Problem-Solving Skills

Introduction

Mathematical problem-solving and reading difficulties throughout childhood have significant long-term effects on educational achievement, income wealth and health outcomes in adulthood (Baumann et al., 2024). Therefore, concerns over mathematical literacy have been growing considerably (Baumann et al., 2024; Cordova Jr et al., 2024; Sitopu et al., 2024; Ureña et al., 2024). In today's culture there is an increasing need for individuals to possess the ability to comprehend and analyze mathematical concepts to effectively apply knowledge. The application of mathematical literacy in understanding mathematical concepts requires more than just knowledge of "school" mathematics (Abbas et al., 2024).

Besides mathematical literacy, cognitive flexibility is also crucial in mathematics learning. Learners need cognitive flexibility to navigate life challenges in the information age. Prior studies have investigated cognitive flexibility of elementary school students (Rahayuningsih et al., 2020), devised open-ended tools to examine students' cognitive flexibility (Rahayuningsih et al., 2021) and examined the cognitive flexibility of prospective teachers in conducting learning during the COVID-19 pandemic (Muzaini et al., 2021). Other research explored the relationship between elementary school students' cognitive flexibility and self-efficacy and scrutinized cognitive flexibility in relation to geometrical figure apprehension with the help of new auxiliary elements (Muzaini et al., 2023). However previous studies have predominantly examined cognitive flexibility and mathematical literacy as separate constructs. The interplay between these two cognitive attributes remains unexplored particularly in the Indonesian context where mathematical literacy continues to pose significant challenges. This is evidenced by consistently low PISA scores in mathematics highlighting a critical need for interventions to enhance both mathematical literacy and cognitive flexibility among Indonesian students (Stacey et al., 2011; Fadlila et al., 2021; Machromah et al., 2020). This study aims to address this gap by examining the relationship between cognitive flexibility and mathematical literacy providing insights to inform educational practices in Indonesia.

Past studies have not yet investigated the correlation between cognitive flexibility and the mathematical literacy of elementary school students. Hence, it is imperative to conduct a new study to demonstrate diverse attributes of students' cognitive abilities in comprehending intricate mathematical concepts. To address the issue, the current study was conducted to reveal the correlation between elementary school students' cognitive flexibility and mathematical literacy using literacy-based problem-solving tasks. This study answered two research questions as follows:

- What is the correlation between elementary students' cognitive flexibility and mathematical literacy?
- What are the attributes of students' cognitive flexibility when addressing mathematics problems that involve literacy?

Literature Review

Cognitive Flexibility

Working memory capacity (WMC) helps to keep cognitive processes memory and attention organized based on information relevant to the task at hand (Awh & Vogel, 2008; Conway et al., 2001). WMC differences enable multiple and varied cognitive abilities (Gruszka & Nęcka, 2017; Hambrick & Meinz, 2011; Hicks et al., 2015). Individuals with higher WMC have greater fluid intelligence which is the ability to solve new reasoning problems (Kane et al., 2005). They also exhibit superior ability to execute intricate cognitively challenging procedures in comparison to those with lower working memory capacity (Barrett et al., 2004; Thomassin et al., 2015). An individual with a larger WMC is more adept at adapting to new tasks and can modify their cognitive framework more effectively (Colflesh & Conway, 2007; Rummel & Boywitt, 2014; Weldon et al., 2013) which is a characteristic of cognitive flexibility (Ionescu, 2012).

Cognitive flexibility is the capacity to adapt one's work methods to changing task requirements (Pelczer et al., 2013). Cognitive flexibility can be understood through the lens of three main constructs: cognitive variety, cognitive novelty and change in cognitive framing (Furr, 2009; Spiro et al., 1992). Cognitive variety is the diversity of problem-solving thinking patterns in a group (Eisenhardt et al., 2010) or the diversity of cognitive patterns or views (Furr, 2009). Cognitive novelty relates to ideas connected to learning content and students' overall mastery of the content (Orion & Hofstein, 1994) or the addition of an external perspective (Furr, 2009). Change in cognitive framing is a phenomenon that may occur from the influence of an external perspective such as previous contextual experience. Cognitive framing attempts to address new problems using previously used solutions (Goncalo et al., 2010). Cognitive flexibility is a viable alternative for identifying specific qualities of high achieving mathematical creative abilities for the reasons outlined above. In this research, students' mathematical cognitive flexibility was measured using indicators of cognitive variety, cognitive novelty and change in cognitive framing. Figure 1 presents the indicators used to examine students' mathematical cognitive flexibility, adopted from Rahayuningsih (2023).

Table 1

Indicators of mathematical cognitive flexibility Rahayuningsih et al. (2023)

No	Indicators of mathematical creative thinking ability	Operational Definition
1	Cognitive novelty	Find new strategies for solving a problem. Display a new mindset
2	Cognitive variety	Plan and use various resolution strategies when faced with complex problems and deadlocks. Change the problem-solving strategy when faced with deadlocks Think of different ways to solve the problem. Provide a variety of ways to solve the problem
3	Cognitive framing	Take detailed steps to find a deeper meaning for the answer or solution to the problem.

Mathematical Literacy

To address the 21st century needs, learners need to improve their literacy skills (Haara et al., 2017; Hayati & Kamid, 2019; Manfreda et al., 2021). Mathematical literacy refers to an individual's capacity to utilize mathematical concepts, methods, facts and instruments to describe explain and predict a phenomenon (Slyamkhan et al., 2022). When it comes to learning particularly mathematics learning, the desired outcome for pupils is not only to possess the ability to count but also to use mathematical concepts in addressing real-life issues.

Mathematical literacy plays a critical role in education as it helps students develop the ability to analyze, justify and express creative solutions to problems in various situations and contexts (Liu et al., 2018). The problem-solving process in mathematical literacy goes beyond routine mathematical tasks encompassing the resolution of contextual problems. Context-based exemplary problems can stimulate students to acquire knowledge, enhance perseverance and foster creativity in finding appropriate problem-solving strategies.

Moreover, research highlights a strong relationship between mathematical literacy and cognitive flexibility, a core executive function that refers to the ability to adapt to varying tasks perspectives or rules when solving problems. According to Magalhães et al. (2020), cognitive flexibility significantly contributes to academic achievement particularly in literacy and mathematics even after controlling for variables such as fluid intelligence inhibitory control working memory and planning. This suggests that students with strong cognitive flexibility skills are better equipped to comprehend and apply mathematics across different contexts.

Cognitive flexibility enables students to switch focus between different dimensions of mathematical problems, integrate new information, and apply adaptive problem-solving strategies. This capability is crucial for mathematical literacy as it allows students to:

1. Formulate Problems: Transform real-world situations into mathematically relevant representations.

2. Apply Mathematical Concepts: Flexibly utilize mathematical procedures and concepts to derive solutions.

3. Interpret Results: Relate mathematical outcomes back to the original problem context.

The development of mathematical literacy and cognitive flexibility is interconnected and mutually reinforcing. Cognitive flexibility enhances students' ability to tackle complex problems and make decisions in dynamic contexts a skill essential for mathematical literacy (Diamond, 2013). Magalhães et al. (2020) further emphasize that the impact of cognitive flexibility becomes more pronounced in older students, grades 4 and 6, compared to younger ones. This underscores the growing reliance on advanced executive functions as tasks in mathematical literacy increase in complexity.

Methods

Design and Research Setting

This study employed an exploratory mixed methods research design as described by Vimala Judy Kamalodeen (2016). This approach was selected to comprehensively explore the correlation between mathematical literacy and cognitive flexibility as well as to examine students' cognitive traits when solving literacy-based mathematical problems. The exploratory mixed methods design combines quantitative and qualitative data collection and analysis enabling a nuanced understanding of the relationship between the two variables.

The research was conducted sequentially over a period of 12 months from January to December in five public elementary schools located in Malang Indonesia. At the start of the school term, mathematical literacy and cognitive flexibility tasks were distributed to assess the abilities of the participants. A 4-week observation period was conducted to evaluate students' engagement and clarify task comprehension. The quantitative phase of the study analyzed test scores to establish the relationship between mathematical literacy and cognitive flexibility. In the qualitative phase, interviews were conducted with 14 students representing four categories of cognitive and mathematical literacy profiles: TT High Cognitive Flexibility and High Mathematical Literacy; TR High Cognitive Flexibility and Low Mathematical Literacy; RT Low Cognitive Flexibility and High Mathematical Literacy and RR Low Cognitive Flexibility and Low Mathematical Literacy. This sequential design ensured a robust examination of trends within each group while integrating the findings from both quantitative and qualitative data.

Participants

A total of 78 elementary school students aged 9–10 years were purposively selected as participants. These students represented a diverse socioeconomic background from five public schools in Malang. Inclusion criteria ensured that all participants possessed basic reading and arithmetic skills necessary for engaging with the literacy-based mathematical tasks. Exclusion criteria included students with cognitive impairments or significant learning difficulties as identified by their teachers. For the qualitative phase 14 participants were selected based on their test performance to represent each of the four cognitive and mathematical literacy categories TT TR RT RR. Demographic data including gender, age, socioeconomic status, family income, parental occupation and education and religion were also collected to contextualize the analysis.

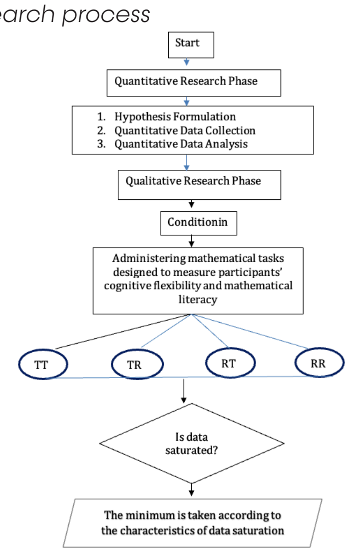
Data Collection

The study utilized four mathematical tasks to assess students' mathematical literacy and four cognitive flexibility tasks to measure their adaptive thinking capabilities. These tasks were distributed during a structured classroom session under the supervision of trained proctors. The tasks were designed to capture both problem-solving accuracy and the strategies employed by students.

1. Mathematical Literacy Tasks
   The mathematical literacy tasks emphasized real-world problem-solving, requiring students to interpret data and apply mathematical concepts. For example: Calculating the number of trees in a park based on given percentages; Determining the volume of water needed to fill a swimming pool; Estimating travel time between two cities based on a map scale and a given speed; Interpreting a bar chart to draw conclusions about students' interest in mathematics at different schools.

2. Cognitive Flexibility Tasks
   The cognitive flexibility tasks challenged students to adapt strategies and think creatively. Examples include: Developing a strategy to win a mathematical game with specified rules; Exploring multiple methods to calculate areas of geometric shapes; Solving a logical problem involving prime numbers; Analyzing height-weight data to create and interpret graphs; The sessions were supplemented with video recordings and interview transcripts to document the students' problem-solving approaches and rationale.

Figura 1.
Flowchart of the exploratory mixed methods research design research process



Research Instruments

In this study two instruments were used: Test 1; 4 test items to measure mathematical literacy skills and Test 2; 4 test items to measure cognitive flexibility. All instruments are valid according to Matteson (2006). Relevant content has been evaluated by experts using content validation procedures (Yusoff, 2019), a common procedure for assessing validity (Huang et al., 2019). The reliability coefficient of the instruments was estimated using the Cronbach Alpha formula. This is the most common internal measure of consistency in social, behavioral and educational sciences and is usually interpreted as the average of all possible split-half coefficients (Mohajan, 2017). The tests were used to measure the subjects' mathematical literacy and cognitive flexibility. The mathematical literacy test consists of four items with a reliability coefficient of 0.59. The cognitive flexibility test also consists of four items with a reliability coefficient of 0.55.

Data collection was carried out by administering the tests to students. The students then completed the tests. Subsequently, the scores from both tests were analyzed using descriptive statistics; mean, mode, median and variance and inferential statistics. Descriptive statistics were used to describe the data while inferential statistics were used to determine whether there were significant differences in the effects of mathematical literacy skills on cognitive flexibility among students. Analysis was performed using the SPSS software package. One of the instruments used is presented below; for further details readers can refer to the appendix of this article.

Mathematical Literacy Tasks

- There are 200 trees in the park. 40% of the trees are mango trees, 30% are coconut trees, and the rest are other trees. How many other trees are there in the park?

- A rectangular swimming pool is 20 meters long and 15 meters wide. If the pool is to be filled with water to a depth of 1 meter, how many liters of water will be needed?

- On a map with a scale of 1:500,000, the distance between two cities is 4 cm. How long does it take to travel between the two cities at 60 km/hour?

- The number of students attending multiple institutions who have an affinity for mathematics subjects is represented in a bar chart. 60% of students attend School A, 50% attend School B, 40% attend School C, and 30% attend School D. Draw a conclusion regarding the interest of students in mathematics at each of the four institutions using this information.

Cognitive Flexibility Tasks

- In a math game, there are 10 cards with numbers 1 to 10. Two players take turns taking one card from the pile of cards. The player who first reaches a total value of 15 by adding up the values of the cards they take will be the winner. Make a strategy to win this game.

- In a geometric drawing, there are several triangles, rectangles, and circles. Calculate the total area of all the flat shapes in different ways.
- A number X is a positive odd number. If X is multiplied by 2 and subtracted by 3, the result is a prime even number. Find the value of X.
- In a data table, there is information about the height and weight of students in a class. Make a graph showing the relationship between the student's height and weight. Give an interpretation of the graph.

Two validated instruments were used to measure the study variables:

1. Mathematical Literacy Test: Consisted of 4 items with a reliability coefficient Cronbach Alpha of 0.59.
2. Cognitive Flexibility Test: Consisted of 4 items, measuring cognitive novelty, variety, and framing, with a reliability coefficient of 0.55.

The validation process involved expert reviews from two mathematics education specialists. They evaluated the content alignment with the curriculum the clarity of instructions and the relevance of the test items. Pilot testing on a small group of students $n = 10$ was conducted to refine the tasks further.

The scores from these instruments were analyzed using descriptive statistics; mean, mode ,median and variance and inferential statistics to examine the relationship between the variables. The analysis was performed using SPSS with normality and linearity tests confirming the suitability of the data for regression analysis. Results revealed a strong correlation between mathematical literacy and cognitive flexibility.

The research followed a systematic flow:

1. Quantitative Phase: Assessment of mathematical literacy and cognitive flexibility using structured tasks. Scores were analyzed statistically to establish correlations.
2. Qualitative Phase: In-depth interviews were conducted with selected participants to explore their cognitive traits and problem-solving strategies.

Integration: Findings from both phases were triangulated to provide a comprehensive understanding of students' abilities.

The mixed methods approach enabled the integration of quantitative results and qualitative insights, offering a detailed perspective on how mathematical literacy and cognitive flexibility interact in elementary school contexts.

Results

Quantitative Findings

Descriptive Statistics

Table 2
Descriptive Statistics of Participants' Mathematical Literacy

Statistical Data	Score
Mean	75.96
Median	80.00
Modus	90.00
Standard Deviation	12.48
Minimum	50.00
Maximum	90.00
Number of Samples	78

Mathematical Literacy Data Interpretation:

The statistical analysis in Table 2 revealed that the majority of students in the sample possessed commendable mathematical literacy, as indicated by a mean of 75.96. This finding suggested that these students already had the capacity to effectively adjust to unfamiliar circumstances, employ diverse problem-solving approaches, and demonstrate mathematical literacy when resolving mathematical issues. However, there existed a range of skill levels across pupils, as seen by a standard deviation of 12.48. A median score of 80.00 signified that 50% of the sample possessed skills that were superior to the norm, while the remaining 50% had abilities that were below average. Notably, a mode of 90.00 indicated the presence of a distinct cluster of individuals in the sample who possessed exceptional mathematical literacy.

Table 3
Descriptive Statistics of Participants' Cognitive Flexibility

Statistical Data	Score
Mean	84.81
Median	85.00
Modus	85.00
Standard Deviation	7.45
Minimum	70.00
Maximum	95.00
Number of Samples	78

Cognitive Flexibility Data Interpretation:

According to the descriptive statistics in Table 3, the average student in the sample demonstrated excellent mathematical cognitive flexibility, with a mean score of 84.81. This finding indicated that students in this study possessed a high level of proficiency in adjusting to unfamiliar circumstances, employing diverse problem-solving techniques, and demonstrating cognitive flexibility when tackling mathematical problems. The students in this sample demonstrated a high level of ability, as indicated by the median value of 85.00. This showed that half of the students possessed above average ability, while the other half had below average ability. Notably, the mode value of 85.00 indicated the presence of a substantial cluster of individuals in the sample who possessed exceptional mathematical cognitive flexibility. While there was some variance in students' cognitive flexibility, as evidenced by the standard deviation of 7.45, this variation was rather little when compared to the average ability. These findings indicated that most pupils in the sample demonstrated advanced mathematics cognitive flexibility skills.

Inferential Statistics

Table 4

Residual Normality Test Result

Data	P Sig	Conclusion
Mathematical literacy on cognitive flexibility	0.051	Normal

The Kolmogorov-Smirnov test was used to assess the normality of residuals in relation to participants' mathematical literacy and cognitive flexibility. The test result in Table 4 yielded a value of 0.051 indicating that the residual data for these two variables followed a normal distribution as Sig. was greater > than 0.05. Subsequently another statistical test was conducted. The linearity test was done to determine the presence of linearity between the two datasets.

Table 5

Linearity Test Result

Data	Deviation from Linearity
Mathematical literacy on cognitive flexibility	0.61

Table 5 shows that the deviation from linearity between mathematical literacy and cognitive flexibility was 0.61, exceeding the threshold of 0.05. The test result suggested a strong correlation between the participants' mathematical literacy and cognitive flexibility.

Table 6

R-Square Analysis Result

Data	R Square	Adjusted R Square
Mathematical literacy on cognitive flexibility	0.631	0.626

According to Table 6 the R-Square value was 0.631 or 63.1%. This figure indicated that 63.1% of the variation in cognitive flexibility dependent variable can be explained by mathematical literacy independent variable whereas the remaining variation was impacted by other variables not considered in the study. Based on the R-Square value it can be inferred that cognitive flexibility strongly affected the mathematical literacy of elementary school students as indicated by an R-Square value ranging from 0.600 to 0.799.

Table 7

Hypothesis Testing

Data	Constant	Regression Coefficient	P Sig.
Mathematical literacy and cognitive flexibility	48.802	0.474	0.000

According to Table 7 the constant value a was 48.802 suggesting that when mathematical literacy was zero the cognitive flexibility remained consistent at 48.802. The regression coefficient b was 0.474 indicating that a 1% improvement in mathematical literacy was associated with a 0.474 increase in cognitive flexibility. If plugged into the equation $Y = a + bx$ the equation $Y = 48.802 + 0.474x$ was obtained. The significance value was 0.000 showing that the alternative hypothesis H1 was accepted and the null hypothesis H0 was rejected as the significance value was less than 0.05. Therefore, it may be concluded that mathematical literacy had an impact on the cognitive flexibility of elementary school students.

Qualitative Findings

Students' cognitive characteristics are categorized into four groups namely: 1 individuals with both high cognitive flexibility and high mathematical literacy TT; 2 individuals with high cognitive flexibility but low mathematical literacy TR; 3 individuals with low cognitive flexibility but high mathematical literacy RT; 4 individuals with both low cognitive flexibility and low mathematical literacy RR. The following sections provide an account of the findings pertaining to each category of students' cognitive characteristics.

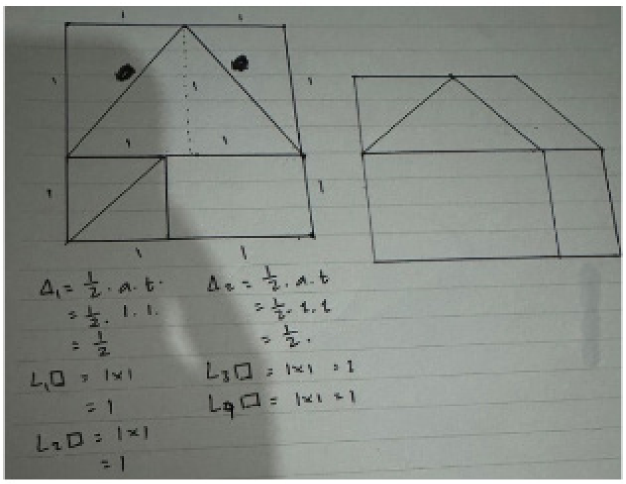
Individuals with both high cognitive flexibility and high mathematical literacy represented by TT

The qualitative data analysis results revealed intriguing findings concerning students' cognitive attributes when addressing mathematical literacy issues. These findings offer a more comprehensive understanding of students' cognitive processes and learning strategies when engaging in intricate tasks. A notable attribute is the students' ability to tackle difficulties in unconventional and inventive manners.

This demonstrates that these students possessed a strong capacity for cognitive flexibility and were unafraid to experiment with novel problem-solving strategies. Cognitive flexibility plays a crucial role in solving mathematical literacy problems, as these problems typically lack a single definitive solution. Consequently, students must identify the most suitable method for the situation. The following excerpts of interviews with research participants corroborate the findings.

> *Interview with Student 1:*
>
> *Interviewer: "Can you tell me about how you solved math problem No. 1 while pointing at the question sheet yesterday?"*
>
> *Students 1: "At first I tried using the method I used to apply in this situation, but it didn't work. Then I tried several other ways, and finally I found a new and easier way to solve it."*
>
> *Interview with Student 2:*
>
> *Interviewer: "What made you confident that your answer to question No. 1 was correct?" pointing to the question sheet*
>
> *Student 2: "I was convinced it was correct because I've tried several different ways to solve it, and they all produced the same answer. Apart from that, I can also explain clearly how I got the answer."*
>
> *Interview with a Mathematics Teacher:*
>
> *Interviewer: " What do you think makes your students so creative in solving math problems?"*
>
> *Teacher: "I think they are used to student-centered learning, where they are encouraged to try new ideas and learn from their mistakes. This helps them develop cognitive flexibility and the confidence to try unusual approaches to solving a problem in math."*

Figure 2
Student worksheet



*Despi*te employing diverse approaches, students in this study consistently exhibited a strong comprehension of the fundamental mathematical principles. This demonstrates that their creativity was not solely reliant on intuition but was also bolstered by extensive knowledge. A skilled problem solver is characterized by their capacity to effectively utilize information in many contexts. In addition to individual cognitive capacities, this investigation also demonstrated the significance of communication skills in resolving mathematical literacy problems. Participants who possessed the capability to elucidate their reasoning and methods in a coherent and organized fashion seemed to have commendable communication aptitude and the proficiency to express their concepts with efficacy. Proficiency in this skill is crucial for effective teamwork and cooperative learning, both of which play a significant role in the problem-solving process. The following sections contain interview excerpts and a student's work result to support the findings.

> *Interview with Student 4:*
>
> *Interviewer: "Can you tell me about how you learned to solve math problems in a different way?"*
>
> *Student 4: "I learn from my friends. When they do math problems in different ways, I try to understand it and apply it to other problems. I also like looking for online tutorials and watching YouTube videos about creative ways to solve math problems."*
>
> *Interview with Student 5:*
>
> *Interviewer: " Have you ever had difficulty solving math problems? How did you handle it?"*
>
> *Student 5: " Yes of course. Sometimes I feel frustrated when I can't solve math problems the way I usually do. But I always try to find another solution. I usually ask my teacher or my friends, or I look for the information on the internet."*
>
> *Mathematics Teachers:*
>
> *Interview with Teacher 1:*
>
> *Interviewer: "What do you think is the most important thing in mathematics instruction?"*
>
> *Teacher 1: "In my opinion, mathematics instruction should help students develop critical and creative thinking skills. I want them to not only be able to solve math problems the right way, but also be able to understand the underlying concepts and apply their knowledge in different situations."*
>
> *Interview with Teacher 2:*
>
> *Interviewer: "How do you encourage your students to dare to try different ways of solving math problems?"*
>
> *Teacher 2: " I provide them with open-ended math assignments, where students don't have just one correct answer. I also encourage them to collaborate with their friends and share ideas with each other. This helps them to learn from each other and develops their confidence to try new things.*

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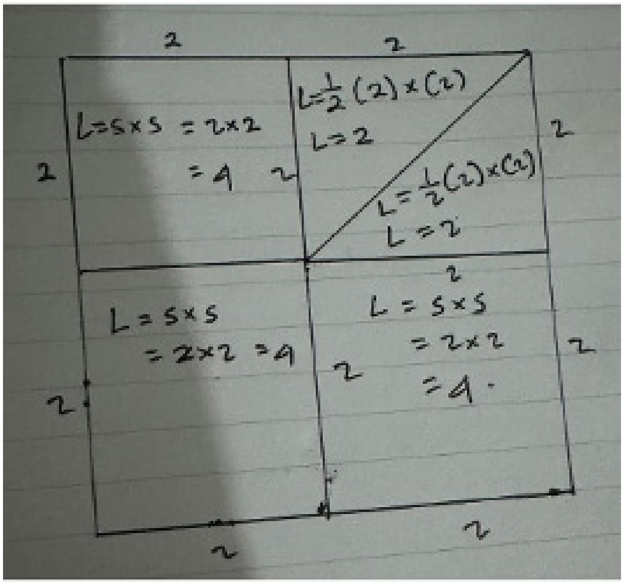
Figure 3
Student worksheet



Individuals with high cognitive flexibility but low mathematical literacy TR

Individuals in the TR group category exhibited strong abilities in adapting to new situations and using various strategies to solve mathematical problems. They possessed the ability to think creatively and come up with novel solutions. They also demonstrated a great level of cognitive flexibility when it came to thinking mathematically. Despite having a high degree of cognitive flexibility, students in the TR category nevertheless struggled to grasp basic mathematical ideas. They found some difficulties in making the connection between the fundamental principles and their problem-solving methods and knowledge as a result. They might therefore occasionally be unable to perform arithmetic problems correctly and consistently.

> *Interview with Student 7 Category TR:*
>
> *Interview: "Can you tell us about how you solved math problem no. 4? I noticed you used a different method than most of your friends."*
>
> *Student 7: "Yes, I like trying different ways to solve math problems. I think it's more interesting and challenging. Sometimes I find a way that is easier and faster than the usual way."*
>
> *Interview: " Have you ever had difficulty solving math problems?"*
>
> *Student 7: "Yes, sometimes I am confused by the concepts taught in class. I understand how to solve the problem, but I don't always understand why it works."*
>
> *Interview: " How did you overcome these difficulties?"*
>
> *Student 7: "Usually I ask my teacher or my friend who is smarter in mathematics. I also look for explanations on the internet or from math books."*
>
> *Interview with Teacher:*
>
> *Interview: "Can you describe the math skills possessed by the student named Reid using a pseudonym Student 7?"*
>
> *Teacher: "Reid has a unique ability to solve mathematical problems. He always finds new and creative ways to solve problems. But he also often makes mistakes because he doesn't always understand the underlying concepts."*
>
> *Interview: "What would you do to help Reid improve his understanding of math concepts?"*
>
> *Teacher: " I would provide him with more varied math assignments, and I would also help him connect math concepts to concrete, real-life examples. I hope that this way he can understand mathematics better and reach his potential."*

Students in the TR group exhibited variability in their ability to articulate their problem-solving strategies in mathematics. Certain pupils possessed the ability to express their thoughts coherently and methodically, whereas others struggled to communicate their ideas with proficiency. This demonstrates that their capacity for communication did not consistently align with their cognitive capacities. Students classified as TR typically had a diminished sense of self-assurance in their mathematical aptitude. This can be attributed to adverse learning experiences in the past or to their struggle in comprehending key mathematical ideas. A lack of self-assurance may impede their motivation to acquire mathematical knowledge and engage in problem-solving activities.

> *Interview with Student 8 Category TR:*
>
> *Interviewer: " Can you explain how you solved problem number 3?"*
>
> *Student 8: " I first tried ... , but it didn't work. Then I tried ... , and finally I found an easier way with ... ."*
>
> *Interview with Student 9 Category TR:*
>
> *Interviewer: "Can you explain why you chose this method to solve problem No. 4?"*
>
> *Student 9: "I'm not sure, but I think this is the easiest and fastest way. I don't really understand the concepts used in this problem."*
>
> *Interview with Student 10 Category TR:*
>
> *Interviewer: "How do you feel about your math skills?"*
>
> *Student 10: "I don't think I'm very good at math. I often make mistakes and don't always understand what is taught in class."*
>
> *Interview with Student 11 Category TR:*
>
> *Interviewer: " Do you like solving math problems?"*

Student 11: "Not really. I feel frustrated when I can't solve math problems correctly. I'd rather do other easier subjects."

Individuals with low cognitive flexibility but high mathematical literacy RT

Several intriguing cognitive traits were discovered in pupils in the RT category, as indicated by the findings of the qualitative study. Students classified in the RT category exhibited a proficient comprehension of fundamental mathematical principles and possessed the ability to accurately employ mathematical terminology. They possessed the ability to carefully comprehend and analyze mathematical problems, effectively identifying pertinent information required to solve them. Although possessing a solid grasp of mathematical principles, students in the RT category struggled with adjusting to unfamiliar scenarios and devising innovative approaches to problem-solving. They exhibited a tendency to adhere to the ways they learned previously and encountered challenges in formulating novel strategies to tackle intricate problems.

Interviewer: "Can you try to explain how you would solve this problem? About 10 circles and triangles?"

Student 12: "Okay. First of all, I need to understand the information given in the problem. There are 10 circles arranged into 5 large triangles and 5 small triangles. Then, I need to know what the problem is asking about, namely the total number of triangles."

Interviewer: "How would you calculate the total number of triangles?"

Student 12: "I remember that the total number of triangles is the sum of the number of large triangles and the number of small triangles. So, I need to calculate the number separately."

Interviewer: "How do you count the number of large triangles and small triangles?"

Student 12: "From the information given in the problem, we know that there are 5 large triangles and 5 small triangles. So, the number of large triangles is 5 and the number of small triangles is 5."

Interviewer: "Good. Then, how do you get the total number of triangles?"

Student 12: "To get the total number of triangles, I need to add the number of large triangles and the number of small triangles. So, 5 large triangles + 5 small triangles = 10 total triangles."

Based on the interview excerpts it can be concluded that: 1) the student comprehended the concept of addition and the correlation between the quantity of large and small triangles and the total number of triangles; 2) the student could identify pertinent information in the problem specifically the number of circles large triangles and small triangles; 3) the student was focused on the learned addition method and did not attempt alternative problem-solving strategies and 4) the student was capable of articulating their reasoning and the sequential steps taken to solve the problem in a clear and organized manner.

Students classified as RT typically possessed proficient communication skills, especially in articulating their reasoning and strategies for resolving mathematical problems. They possessed the ability to express their views with clarity and organization and were capable of offering coherent justifications for their actions. Students in this category also had a strong sense of self-confidence in their capacity to solve mathematical issues, however they might require assistance in identifying the appropriate problem-solving. Although pupils in the RT group showed several restrictions, they demonstrated the capacity to enhance their mathematical skills. Their strong mathematical literacy is a valuable advantage that, with appropriate assistance, can facilitate their comprehension and acquisition of mathematical concepts.

Interviewer: "Can you tell me about what you see in this bar chart?"

Student 13: "This diagram shows the percentage of students in four schools who like mathematics. School A has the highest percentage, namely 60%, followed by School B with 50%, School C with 40%, and School D with 30%."

Interviewer: "Based on this information, what is your conclusion about students' interest in mathematics at these four schools?"

Student 13: "In general, students' interest in mathematics in the four schools varies. School A has the highest interest, followed by School B, School C, and School D which has the lowest interest."

Interviewer: "Can you provide further explanation about the differences in student interests in mathematics among the four schools?"

Student 13: "There may be several factors that cause these differences in student interest. It could be due to different teaching methods, the school learning environment, or even the student's personal interest in mathematics."

Interviewer: "In your opinion, what can be done to increase students' interest in mathematics in these schools?"

Student 13: "Perhaps teachers can use more interesting and interactive teaching methods, such as using games or examples that are relevant to everyday life. Apart from that, schools can also hold extracurricular activities related to mathematics."

Individuals with low cognitive flexibility and low mathematical literacy RR

Several noteworthy cognitive traits were discovered in students in the RR group, as indicated by the findings of the qualitative study. Students classified in the RR category encountered substantial challenges in comprehending fundamental mathematical concepts and resolving mathematical issues. They were often confused by mathematical terms and symbols, and they did not have a solid groundwork on which to build a more complex understanding. As a result, their ability to solve even the most basic mathematical issues was hindered.

Interviewer: "Can you try to explain this?"

Student 14: "I don't really understand this problem. This problem uses a lot of math terms that I haven't learned."

Interviewer: "Can you explain what you understand from this problem?"

Student 14: "I know that X is a positive odd number. If this number is multiplied by 2 and subtracted by 3, the result is a prime even number. But I don't know how to solve the problem."

Interviewer: "What do you usually do when you don't understand a math problem?"

Student 14: "I usually try to memorize the formulas in the textbook, but I don't always understand how to use them."

Interviewer: "How do you usually study mathematics?"

Student 14: "I usually memorize formulas and example questions from textbooks. I also often ask my teacher or friends when I don't understand a math problem."

Students in the RR category demonstrated low cognitive flexibility in mathematics. They got stuck to the methods they learned in class and thus faced difficulty developing new approaches to solving complex problems. This caused them to become easily frustrated and give up when faced with challenging math problems.

Interviewer: "Can you explain how you would solve this problem?"

Student 14: "I remember that the formula for calculating time is distance divided by speed. So, I will use that formula to solve this problem."

Interviewer: "How did you figure out the distance between two cities on a map?"

Student 14: "I measured the distance with a ruler and got 4 cm."

Interviewer: "How did you know the speed?"

Student 14: "The question states that the speed is 60 km/hour."

Interviewer: "How did you convert distance from cm to km?"

Student 14: "I didn't know how."

Interviewer: "Did you try to remember the formula or other way to convert cm to km?"

Student 14: "No, I didn't remember the formula."

Interviewer: "How do you usually solve difficult math problems?"

Student 14: "I usually try to find examples of similar problems and use the same method to solve them."

Students in the RR category experienced challenges in effectively expressing their thoughts and strategies when solving mathematical problems. Frequently, they struggled to articulate the sequential process they followed in a lucid and organized fashion, and they encountered challenges in offering coherent justifications for their solutions. This hindered their ability to learn from their errors and seek assistance from others.

Interviewer: "Can you explain how you got the answer of 6 hours for the time it takes to travel between two cities?"

Student 15: "I used the formula distance divided by speed, and I got 4 cm divided by 60 km/h. Then, I converted cm to km by multiplying it by 0.01."

Interviewer: "How did you know that you should multiply 4 cm by 0.01?"

Student 16: "I recalled that 1 cm is equal to 0.01 km. So, I had to convert cm to km so that the unit is the same as speed."

Interviewer: "Are you sure that your answer was correct?"

Student 16: "I'm not sure. I don't really understand how to convert cm to km."

Interviewer: "Try explaining again the steps you took to solve this problem."

Student 16: "I... I don't remember the steps anymore."

Students classified into the RR group typically had a diminished sense of self-confidence regarding their mathematical skills. They hold the belief that they lacked proficiency in mathematics and lacked the drive to engage in studying and exerting effort in this subject. This belief may be a substantial hindrance to their progress in mathematics. Although students in the RR group had many constraints, they nonetheless demonstrated the potential for growth in mathematics. Given appropriate assistance, these individuals can acquire and comprehend essential mathematical principles, cultivate more efficient approaches to problem-solving, and enhance their self-confidence in their mathematical aptitude.

Student 16: "I'm not good at math. I always get poor scores on math tests."

Interviewer: "Have you ever tried to improve your math skills?"

Student 16: "I don't know how. I've tried to study it more, but I still don't get it."

Interviewer: "Have you ever asked your teacher or friends for help when you were having difficulty in math?"

Student 16: "Sometimes. But they can't help me either."

Interviewer: "What do you like about math?"

Student 16: "I don't like math. I prefer other subjects."

Discussion

This study investigated the cognitive abilities of elementary school students in addressing mathematical literacy problems, focusing on cognitive flexibility and mathematical literacy. The quantitative data from this study demonstrated that mathematical literacy had a significant impact on mathematical cognitive flexibility. Additionally, the qualitative data uncovered several distinct findings concerning students' cognitive traits across different categories.

One intriguing discovery is that students who possessed both advanced cognitive flexibility and strong mathematical literacy demonstrated many cognitive benefits. They were able to generate imaginative and groundbreaking ideas to resolve issues comprehend essential mathematical principles and effectively apply them into the problem-solving process. Additionally, they possessed great communication skills enabling them to articulate their thoughts and strategies in a coherent and organized fashion. Having a strong sense of self-confidence is a crucial advantage for them when it comes to solving mathematical problems. Atagi and Sandhofer (2015) suggests that cognitive flexibility is the ability to adapt to new situations and use various strategies to solve problems. This ability is important in solving mathematical problems because it allows students to find creative and innovative solutions to the problems (Liu et al., 2018).

These findings highlight the importance of integrating educational strategies that foster cognitive flexibility and mathematical literacy in classroom practices. For example, open-ended mathematical tasks can encourage students to explore diverse problem-solving methods (Liljedahl et al., 2016). Collaborative learning where students share and compare problem-solving strategies can also enrich their flexibility and adaptive thinking (Rahayuningsih et al., 2020). These practices are particularly relevant in addressing 21st-century learning demands where problem-solving and adaptability are critical skills.

These findings further suggest that possessing cognitive flexibility and strong mathematical literacy is an optimal combination for becoming a proficient mathematical problem solver. Students possessing these attributes have the capacity to attain exceptional levels of accomplishment in mathematics. This study offers significant understanding into the diverse cognitive attributes that pupils possess when addressing mathematical literacy issues. These findings can assist instructors and educators in comprehending the diverse learning requirements of elementary school students and formulating more efficient learning approaches to enable all pupils to achieve their maximum potential in mathematics.

Students falling into the TR high cognitive flexibility and low mathematical literacy category demonstrated distinct aptitude in solving mathematical issues. These students had the capacity to discover inventive and groundbreaking solutions demonstrating the potential to evolve into adaptable individuals who can effectively address problems. However, they might encounter difficulties in comprehending essential mathematical principles which would frequently hinder their ability to apply their knowledge to problem-solving situations. Consistent with the viewpoint of Rahayuningsih et al. (2020), students with high cognitive flexibility are better at solving complex and non-routine mathematical problems compared to students with low cognitive flexibility. The pupils' communication skills exhibited a range of proficiency with certain individuals demonstrating adeptness in articulating their thoughts while others encountered challenges in doing so. Liljedahl et al. (2016) found that a lack of comprehension of basic mathematical concepts can impede students' ability to apply their knowledge to problem-solving procedures.

Educational strategies must be tailored to address these gaps. Teachers can focus on strengthening mathematical literacy by providing concrete real-world examples that bridge the gap between concepts and their application. Moreover, fostering a growth mindset among TR students is essential. Research shows that students with a growth mindset are more likely to experiment with new strategies and overcome challenges (Rege et al., 2021).

Students' poor confidence in their mathematical skills can serve as an additional obstacle to solving math problems effectively. Gunawan and Muflihati (2022) elucidated that a lack of self-assurance can provide an extra hindrance for individuals when it comes to successfully resolving mathematics issues. Despite their various restrictions pupils classified under the TR category possessed the capacity to enhance their mathematical abilities given appropriate assistance. By imparting a deep understanding of essential mathematical concepts and fostering the acquisition of efficient problem-solving skills one can enhance their self-confidence in mathematics hence facilitating their success in this discipline.

Students classified in the RT category characterized by low cognitive flexibility and strong mathematical literacy exhibited a fascinating amalgamation of skills. They demonstrated a robust comprehension of mathematical concepts and exhibited advanced mathematical literacy skills. Consequently, they were adept at comprehending mathematical difficulties and discerning pertinent information. In addition, they had strong communication skills which enabled them to articulate their problem-solving strategies with clarity and organization. Possessing a strong sense of self-assurance in one's mathematical skills is a valuable advantage when it comes to problem-solving. Students in the RT category however exhibited limited cognitive flexibility. This indicates these individuals would tend to adhere to the techniques they acquired at school and encounter challenges when attempting to discover novel approaches to resolve intricate situations. This inadequacy can impede their ability to tackle complex and unconventional mathematical tasks. The study conducted by Mariano-Dolesh et al. (2022) revealed that students possessing a robust comprehension of mathematical concepts exhibited superior problem-solving skills in complicated and non-routine mathematical tasks in contrast to students having a limited grasp of mathematical concepts. The study conducted by Rege et al. (2021) also showed that students with a growth mindset demonstrated a higher inclination to experiment with novel strategies and push their limits when it came to studying mathematics as opposed to students with a static mindset fixed mindset.

Teachers can support RT students by gradually introducing tasks that challenge their cognitive flexibility such as open-ended questions or multiple-solution problems. By encouraging students to step out of their comfort zone, teachers can foster adaptive thinking and problem-solving capabilities (Newton et al., 2020).

Despite their cognitive inflexibility, students in the RT group would be able to excel in mathematics given appropriate assistance. By facilitating the development of adaptable and innovative problem-solving techniques, individuals can acquire the skills necessary to surmount obstacles and achieve their maximum potential in the field of mathematics. Ismail et al. (2017) discovered that the brain possesses the capacity to undergo changes and growth particularly during critical developmental stages like schooling. By promoting neurogenesis and synaptic plasticity in the brain, individuals with restricted cognitive flexibility like RT students might enhance their mathematical aptitude. Moreover, according to Newton et al. (2020) it is crucial to establish a connection between learning content and personal experience as well as prior knowledge. By instructing pupils in mathematics using circumstances that are pertinent and significant to them they can more readily assimilate these concepts despite their restricted cognitive flexibility.

Conclusion

This study has demonstrated that cognitive flexibility and mathematical literacy significantly influence elementary school students' ability to solve mathematical literacy problems. By answering the research questions, this study confirms that students with advanced cognitive flexibility and a deep understanding of mathematical concepts excel as effective mathematical problem solvers. Specifically, the quantitative findings revealed a strong correlation between mathematical literacy and cognitive flexibility as shown by the R-Square value of 63.1%. Additionally, qualitative findings uncovered distinct cognitive traits across four student categories TT TR RT and RR providing valuable insights into how these traits impact problem-solving performance.

Students with high cognitive flexibility and mathematical literacy TT exhibited exceptional problem-solving abilities and creativity while those with high flexibility but low literacy TR demonstrated innovative thinking but struggled with foundational concepts. Conversely, students with high literacy but low flexibility RT excelled in routine problems but faced challenges adapting to novel situations. Students with low flexibility and literacy RR encountered the most significant obstacles including low confidence and limited comprehension of mathematical concepts. These findings validate the need for tailored instructional approaches to meet the diverse cognitive and learning needs of students.

The study's findings address the first research question by establishing the relationship between cognitive flexibility and mathematical literacy, while the second research question is addressed through a detailed analysis of the unique cognitive attributes of students in each category. This comprehensive understanding underscores the importance of integrating teaching strategies that promote both cognitive flexibility and mathematical literacy in elementary school settings. For example, incorporating open-ended tasks and collaborative problem-solving can foster adaptive thinking and creativity in students.

The implications of this study are particularly significant for educators and curriculum developers. By understanding the diverse cognitive traits of students, educators can design more effective instructional strategies, such as real-world problem-solving tasks and personalized support, to optimize each student's potential. For example, students in the TR group may benefit from focused interventions to strengthen their mathematical foundation, while RT students require opportunities to develop adaptive problem-solving skills. Furthermore, RR students require comprehensive support to build confidence and foundational knowledge.

Future research should explore alternative methodologies, such as experimental designs, to assess the impact of specific teaching interventions on cognitive flexibility and mathematical literacy. Additionally, extending the study to different age groups or educational contexts could provide a broader understanding of how these attributes evolve over time and influence learning outcomes.

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Ethical Considerations

The studies involving human participants were reviewed and approved by Universitas Negeri Malang. The participants provided their written informed consent to participate in this study

Conflict Of Interest

All "The authors declare no conflicts of interest".

References

Abbas, S., Ahmed, Z., Sinha, A., Mariev, O., & Mahmood, F. (2024). Toward fostering environmental innovation in OECD countries: Do fiscal decentralization, carbon pricing, and renewable energy investments matter? *Gondwana Research, 127*, 88–99.

Atagi, N., & Sandhofer, C. (2015). Cognitive Flexibility in Mathematics: Bilingual Children Show Cognitive Advantages. *Proceedings of the Annual Meeting of the Cognitive Science Society*, 37. Retrieved from https://escholarship.org/uc/item/4sp3x32p

Awh, E., & Vogel, E. K. (2008). The bouncer in the brain. *Nature Neuroscience, 11*(1), 5–6.

Barrett, L. F., Tugade, M. M., & Engle, R. W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychological Bulletin, 130*(4), 553.

Baumann, N., Voit, F., Wolke, D., Trower, H., Bilgin, A., Kajantie, E., Räikkönen, K., Heinonen, K., Schnitzlein, D. D., & Lemola, S. (2024). Preschool mathematics and literacy skills and educational attainment in adolescents born preterm and full term. *The Journal of Pediatrics, 264*, 113731.

Colflesh, G. J. H., & Conway, A. R. A. (2007). Individual differences in working memory capacity and divided attention in dichotic listening. *Psychonomic Bulletin & Review, 14*(4), 699–703.

Conway, A. R. A., Cowan, N., & Bunting, M. F. (2001). The cocktail party phenomenon revisited: The importance of working memory capacity. *Psychonomic Bulletin & Review, 8*(2), 331–335.

Cordova Jr, N., Kilag, O. K., Andrin, G., Tañiza, F. N., Groenewald, E., & Abella, J. (2024). Leadership strategies for numeracy development in educational settings. *Excellencia: International Multi-Disciplinary Journal of Education, 21*(2), 58–68.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Eisenhardt, K. M., Furr, N. R., & Bingham, C. B. (2010). CROSSROADS—Microfoundations of performance: Balancing efficiency and flexibility in dynamic environments. *Organization Science, 21*(6), 1263–1273.

Fadlila, N., Wijaya, A., & Hilmi, I. (2022). Quantity content: Developing mathematics PISA-like problems with independence day contest context. *JTAM: Jurnal Teori dan Aplikasi Matematika, 6*(2). https://doi.org/10.31764/jtam.v6i2.7475

Furr, N. R. (2009). *Cognitive flexibility: The adaptive reality of concrete organization change*. Stanford University.

Goncalo, J. A., Vincent, L. C., & Audia, P. G. (2010). Early creativity as a constraint on future achievement. *The Dark Side of Creativity, 7*(14), 114–133.

Gruszka, A., & Nęcka, E. (2017). Limitations of working memory capacity: The cognitive and social consequences. *European Management Journal, 35*(6), 776–784.

Gunawan, G., & Muflihati, D. (2022). Vocational high school students' mathematical problem-solving ability viewed from self-confidence. *AlphaMath: Journal of Mathematics Education, 8*(1), 22–28.

Haara, F. O., Bolstad, O. H., & Jenssen, E. S. (2017). Research on mathematical literacy in schools—Aim, approach, and attention. *European Journal of Science and Mathematics Education, 5*(3), 285–313.

Hambrick, D. Z., & Meinz, E. J. (2011). Limits on the predictive power of domain-specific experience and knowledge in skilled performance. *Current Directions in Psychological Science, 20*(5), 275–279.

Hayati, T. R., & Kamid, K. (2019). Analysis of mathematical literacy processes in high school students. *International Journal of Trends in Mathematics Education Research, 2*(3), 116–119.

Hicks, K. L., Harrison, T. L., & Engle, R. W. (2015). Wonderlic working memory capacity and fluid intelligence. *Intelligence, 50*, 186–195.

Ionescu, T. (2012). Exploring the nature of cognitive flexibility. *New Ideas in Psychology, 30*(2), 190–200.

Ismail, F. Y., Fatemi, A., & Johnston, M. V. (2017). Cerebral plasticity: Windows of opportunity in the developing brain. *European Journal of Paediatric Neurology, 21*(1), 23–48.

Kane, M. J., Hambrick, D. Z., & Conway, A. R. A. (2005). Working memory capacity and fluid intelligence are strongly related constructs. Comment on Ackerman, Beier, and Boyle (2005).

Liljedahl, P., Santos-Trigo, M., Malaspina, U., & Bruder, R. (2016). *Problem solving in mathematics education*. Springer Nature.

Liu, R.-D., Wang, J., Star, J. R., Zhen, R., Jiang, R.-H., & Fu, X.-C. (2018). Turning potential flexibility into flexible performance: Moderating effect of self-efficacy and use of flexible cognition. *Frontiers in Psychology, 9*, Article 354. https://doi.org/10.3389/fpsyg.2018.00354

Machromah, I. S., Sutama, S., Prayitno, H., Faiziyah, N., & Fatmasari, L. (2020). Designing PISA-like mathematics task to assess students' mathematical literacy. *Universal Journal of Educational Research, 8*(12), 4986–4995.

Magalhães, S., Carneiro, L., Limpo, T., & Filipe, M. (2020). Executive functions predict literacy and mathematics achievements: The unique contribution of cognitive flexibility in grades 2, 4, and 6. *Child Neuropsychology, 26*, 934–952. https://doi.org/10.1080/09297049.2020.1740188

Manfreda Kolar, V., & Hodnik, T. (2021). Mathematical literacy from the perspective of solving contextual problems. *European Journal of Educational Research, 10*(1), 467–483.

Mariano-Dolesh, M. L., Collantes, L. M., Ibanez, E. D., & Pentang, J. T. (2022). Mindset and levels of conceptual understanding in the problem-solving of preservice mathematics teachers in an online learning environment. *International Journal of Learning, Teaching and Educational Research, 21*(6), 18–33.

Muzaini, M., Rahayuningsih, S., Ikram, M., & Az-Zahrah, F. (2023). Mathematical creativity: Student geometrical figure apprehension in geometry problem-solving using new auxiliary elements. International Journal of Educational Methodology. https://doi.org/10.12973/ijem.9.1.139

Muzaini, M., Rahayuningsih, S., Nasrun, N., & Hasbi, M. (2021). Creativity in synchronous and asynchronous learning during the COVID-19 pandemic: A case study. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 10*(3), 1722–1735.

Newton, K. J., Lange, K., & Booth, J. L. (2020). Mathematical flexibility: Aspects of a continuum and the role of prior knowledge. *The Journal of Experimental Education, 88*(4), 503–515.

Novak, E., & Tassell, J. L. (2017). Studying preservice teacher math anxiety and mathematics performance in geometry word and non-word problem solving. *Learning and Individual Differences, 54*, 20–29.

Orion, N., & Hofstein, A. (1994). Factors that influence learning during a scientific field trip in a natural environment. *Journal of Research in Science Teaching, 31*(10), 1097–1119.

Pelczer, I., Singer, F. M., & Voica, C. (2013). Cognitive framing: A case in problem posing. *Procedia-Social and Behavioral Sciences, 78*, 195–199.

Muzaini, M., Rahayuningsih, S., Ikram, M., & Az-Zahrah, F. (2023). Mathematical Creativity: Student Geometrical Figure Apprehension in Geometry Problem-Solving Using New Auxiliary Elements. *International Journal of Educational Methodology*. https://doi.org/10.12973/ijem.9.1.139.

Rahayuningsih, S., Sirajuddin, S., & Ikram, M. (2021). Using open-ended problem-solving tests to identify students' mathematical creative thinking ability. *Participatory Educational Research, 8*(3), 285–299.

Rahayuningsih, S., Sirajuddin, S., & Nasrun, N. (2020). Cognitive flexibility: Exploring students' problem-solving in elementary school mathematics learning. *JRAMathEdu Journal of Research and Advances in Mathematics Education, 6*(1), 59–70. https://doi.org/10.23917/jramathedu.v6i1.11630

Rege, M., Hanselman, P., Solli, I. F., Dweck, C. S., Ludvigsen, S., Bettinger, E., Crosnoe, R., Muller, C., Walton, G., & Duckworth, A. (2021). How can we inspire nations of learners? An investigation of growth mindset and challenge-seeking in two countries. *American Psychologist, 76*(5), 755.

Rummel, J., & Boywitt, C. D. (2014). Controlling the stream of thought: Working memory capacity predicts adjustment of mind-wandering to situational demands. *Psychonomic Bulletin & Review, 21*, 1309–1315.

Sitopu, J. W., Khairani, M., Roza, M., Judijanto, L., & Aslan, A. (2024). The importance of integrating mathematical literacy in the primary education curriculum: A literature review. *International Journal of Teaching and Learning, 21*(2), 121–134.

Slyamkhan, M., Ganeeva, A., & Dorel, L. (2022). Interrelation of levels of mathematical literacy in conditions of distance learning. *World Journal on Educational Technology: Current Issues*. https://doi.org/10.18844/wjet.v14i3.7212

Spiro, R. J., Feltovich, P. J., Coulson, R. L., Jacobson, M., Durgunoglu, A., Ravlin, S., & Jehng, J.-C. (1992). Knowledge acquisition for application: Cognitive flexibility and transfer of training in ill-structured domains. *Illinois Univ At Urbana Center for the Study of Reading*.

Stacey, K. (2011). The PISA view of mathematical literacy in Indonesia. *Journal on Mathematics Education, 2*, 95–126. https://doi.org/10.22342/jme.2.2.746.95-126

Thomassin, N., Gonthier, C., Guerraz, M., & Roulin, J.-L. (2015). The hard fall effect. *Experimental Psychology*.

Ureña, J., Ramírez-Uclés, R., Cañadas, M. C., & Molina, M. (2024). Generalization strategies and representations used by final-year elementary school students. *International Journal of Mathematical Education in Science and Technology, 55*(1), 23–43.

Weldon, R. B., Mushlin, H., Kim, B., & Sohn, M.-H. (2013). The effect of working memory capacity on conflict monitoring. *Acta Psychologica, 142*(1), 6–14.

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How Do Teacher Leaders Interact with Teachers? A Qualitative Analysis from a Professional Development Program*

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Abstract

This study aims to examine the processes experienced during the interaction between teacher leaders and their peers. Applying the grounded theory, we present a theoretical model that describes this interactive process in a month-long professional development (PD) program designed for teachers. As a part of the PD program, a total of 150 teachers were tasked with preparing lesson plans in accordance with the principles of Understanding by Design (UbD) and seven teacher leaders, trained and appointed by the researchers, were assigned to guide them. The findings yielded five categories: orientation, improvement, collaboration, communication, and feelings, and a main category, facilitation. It was concluded that the interactions underscore fostering teacher development by promoting professional growth and through structured learning communities, teacher collaboration help promoting educational outcomes as well as student outcomes.

Keywords:

Teacher Leaders, Teacher Leadership, Understanding By Design (Ubd), Professional Development, Grounded Theory

Introduction

In the international research, teacher leadership has widely been appealing to both the researchers as well as practitioners (DeDeyn, 2021; Harris & Muijs, 2003; Kahler-Viene et al., 2021; Little, 2003; Webber & Okoko, 2021) and the term, appearing in the USA in the late of 1980's, emphasizes the critical role of teachers in terms of school improvement and their expanded responsibilities beyond in-class activities (Kahila et al., 2020; York-Barr & Duke, 2004). Despite the elusiveness and lack of consensus on what forms the teacher leadership (Cosenza, 2015; Gratacos et al., 2021), Kahler-Viene et al.(2021) argue that the concept itself is of crucial importance for teachers who both aspire to be a part of their classrooms and extend their professional growth, which coincides with Grimm's (2020) description of the term: "Teacher leadership can be understood as leading students inside the classroom and as leading teacher peers outside the classroom" (p. 455).

An important aspect of teacher leadership is its connection to peer collaboration. In this regard, the use of learning communities or groups has been recognized as an effective

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strategy for fostering professional growth among teachers (Allen & Blythe, 2018). Nevertheless, despite the global approval of such initiatives, research on their dynamics and effectiveness remains limited. The question whether the dynamics of a group work or a learning community is operative or not for a specific objective under the guidance of a teacher leader seems to be vague despite the abundant research in the related literature (Webber, 2021). In addition, although some theories and researchers have attempted to formulate the concept, the very purpose of this study is to reveal the participants' views in terms of teacher leadership as well as the atmosphere in learning communities independent of existing views. It is seen that, as Webber (2021) points out, the notion of teacher leadership is fluid and it is possible that the literature's multiple definitions serve to highlight the importance of it as a flexible notion that may promote better teaching and learning as well as increased community involvement among school community members. As it is not a purpose of the current study to refute or falsify any prevalent theories, the main emphasis will be placed upon the views of the participants.

In this sense, teacher leaders play important roles to help and direct teachers. They foster a positive atmosphere which paves the way for interactions in groups of teachers. The efficiency of the interaction between teacher leaders and their peers' results in more effective classroom instruction, which increases students' acquisition of academic knowledge and abilities, raises student success, and improves school performance as a whole (Cohron, 2009). Through an effective interaction, teacher leaders can have the chance to collaborate with colleagues on authentic teaching strategies that can be benefitted both individually and collectively. It is mostly agreed that in both formal and informal settings, teacher leaders can have a huge impact on other educators through modelling, working together, coaching, developing collegial connections, and advocating for change (Allen & Blythe, 2018). What this study aims to add to the related literature is to offer a more thorough comprehension of how teacher leadership promotes professional development by analysing the interactions between teacher leadership and their peers and to promote educational practices.

Literature: Teacher Leadership

Silva et al. (2000) and Shen et al. (2020) contend that there have been three approaches in the evolution of teacher leadership. In the first step, teacher leadership in educational systems was perceived as a tool to make schools more effective and proficient. To Kahila (2020), during this wave, teachers were perceived as the ones who were promoted to perform administrative and management services such as being the head of a department or the head teacher. In this framework, teacher leaders were viewed as a kind of supervisors with primary responsibility to manage teachers supposedly acting as merely implementers (Pounder, 2006). After this narrow perspective of teacher leadership and "neutering" process of teachers, the second wave, to Silva et al. (2000), put emphasis on the instructional merits and knowledge of teachers. During this wave, teacher leadership embraced unprecedented tasks such as being a leader, curriculum designer, focusing on professional development of teachers. However, this wave, called "remote controlling of teachers" by Darling-Hammond (1998), isolated teacher leaders from their main function of teaching and they somehow were appointed as the ones who designed the curriculum, developed materials for classroom use and maintained their leadership roles out of the classrooms.

The third wave, which is acknowledged as the present-day view of teacher leadership, embraces leadership along with teaching. In this wave, teacher leaders, while performing their main function of teaching, are given the opportunity to unveil their leadership merits (Pounder, 2006). Silva et al. (2000) describe this approach as a means that enables teacher leaders to "slide the doors open to collaborate with other teachers, discuss common problems, share approaches to various learning situations and investigate motivational strategies to bring students to deeper engagement with their learning (p. 721)." This formulation places teacher leadership into a framework where professional development and collegiality come to the forefront and labels teacher leaders as the ones who labour to re-culture schools by improving educational climate in a positive way.

Evaluated and perceived as a process and collaborative phenomenon rather than a managerial or administrative task with the third wave, teacher leadership has become a generic concept, which makes it challenging to have a consensual definition (Pounder, 2006; Harris, 2003; Webber, 2021; York-Barr & Duke, 2004). While Silva et al. (2000) highlight the features of teacher leadership as having skills to develop and foster relationships among colleagues and promoting professional development, York-Barr and Duke's (2004) description puts emphasize on shared impact of teachers on school's stakeholders to enhance teaching and learning process. Similarly, Taylor et al. (2011) argue that teacher leadership is not directly related to managerial or hierarchical position in an organization, rather it focuses on professional and naturally school improvement. Focusing on the idea of change, Wasley (1991, as cited in Harris, 2003) describes the term as a skill to inspire peers to change that could not be performed but for the impact of leaders. Based upon the related literature, Harris and

Jones (2019) put forward the idea that the concept of teacher leadership is something beyond having an official responsibility, on the other hand, it is closely associated with improving pedagogical mastery both in the classroom and outside to guide the peers.

At this point, Harris' (2003) views regarding the concept seem to be noteworthy to review. She suggests that "teacher leadership is about learning together and constructing meaning and knowledge collectively and collaboratively" (p. 314). In this sense, it includes exchanging ideas, perceptions, information, views as well as creating new ideas collectively through sharing opinions, feedback, and understandings, apart from generating collaborative work. As Can (2009) and Kılınç et al. (2015) assert, teacher leadership nurtures the collaboration as well as motivation among teachers. That the teacher-leaders work collaboratively and collectively is also highlighted by Harris and Muijs' (2003) four roles the teacher leaders are supposed to have. To them, apart from the "brokering role" which secures the opportunities for teachers to improve, teacher leadership requires "participative leadership" in which other teachers are assisted for a specific aim and collaboration. The other dimension is about the "mediating role" in which the leaders are considered as consultants for expert opinions in need of assistance. The last, being probably the most significant dimension for the authors, is "forging close relationships" with teachers so that reciprocal learning can take place.

Developed by a group of researchers in Hong Kong (Pang & Marton, 2017), Learning Study Model (LeaS) along with Educational Design Research (EDR) could be the examples of "forging close relationships" among teachers. These teacher professional development approaches employ cyclic or repetitive procedures, meaning that after gathering and analysing data to create instructional practices, the process is repeated and improved upon until the enhancement as well as improvement is confirmed (Holmqvist, 2017). For instance, in LeaS, teachers, coming together under the guidance of a researcher or a teacher educator, collaboratively design research lessons and apply them in a classroom setting. Although the number of teachers participating in a group varies in the model, there is usually a collaboration of three to six peers (Bümen, & Yedigöz Kara, 2023).

As mostly highlighted in the related literature, teacher leadership is not solely concerned with performing managerial or administrative tasks but working collaboratively with peers and helping or leading them to create new ways or strategies to promote learning in the classrooms. In this sense, collegiality, coaching, working together on a strategy, sharing information, giving feedback, observing, generating new ideas, exchanging opinions on how to implement a specified strategy as well as modelling and setting learning targets are the qualities seen during the reciprocal interaction between teacher leaders and teacher peers (Allen & Blythe, 2018; Bolat, 2023; Fairman & Mackenzie, 2015; Harris, 2003; Harris & Muijs, 2003; Neupane, 2021; Silva et al., 2000; Xie et al., 2021; Webber, 2021).

No matter how quality the pre-service training is, it would be unrealistic to expect teachers to be equipped for every obstacle or challenge they may encounter in their professional lives. Therefore, to maintain high education standards as well as qualified teaching workforce, education policies should aim to provide teachers with professional development opportunities, one of the aims of which is to share knowledge and experience among teachers (OECD, 2009, Chapter 3). In this sense, the professional development recognises the need for collaboration among teachers and their peers as "there is growing interest in developing schools as learning organisations, and in ways for teachers to share their expertise and experience more systematically" (OECD, 2005).

Thus, an issue in this study is to investigate the dynamics of group work under the guidance of teacher leaders. Although we identified the key terms, such as collaboration, exchanging ideas, getting continuous feedback, observing peers, orientation, and communication from the related literature, most of the earlier studies did not explore the concept in depth. It is evaluated that this kind of collaboration may yield to some valuable insights. To begin, successful cooperation among educators would improve the quality of instructional methods and learning by promoting the interchange of new instructional approaches, resources, and practices as it fosters a community of support where educators may share knowledge and enhance their teaching practices, resulting in professional development. In addition, analysing about group dynamics under the supervision of teacher leaders offers valuable perspectives on communication techniques, successful leadership approaches, and the influence of teamwork on academic endeavours. In this way, it would be possible to develop effective models that can be utilised for long-term educational progress by having a thorough understanding of how teacher leaders assist group activities. Further, studying these facets would pave the way for the continuous improvement of teaching methods; foster a supportive and cooperative school climate; and, above all, produce high-quality instruction that promotes students' success. Besides, studying how teacher leaders facilitate group work provides crucial insights into how cooperative efforts may be coordinated to provide a supportive and effective learning environment. Gaining insight into how teacher leaders may facilitate group dynamics would also result in

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enhancing teamwork, collaboration and ultimately professional development. These kinds of endeavours essentially help to improve educational leadership practices, foster a collaborative culture, and ensure that the collective experience of educators is utilized and assessed. In this vein, the processes that occur between group members and their teacher leaders have become the subject of the present study. By way of the grounded theory, the present study aims to investigate the interaction between teacher leaders and their peers and to present a theoretical model. In the present study, we intend to provide a thorough and context specific understanding of teacher leadership's unique function in educational practices. This aim does not only align with the related literature but also offers an opportunity to provide concrete evidence to the stakeholders. To this end, answers given by the teacher leaders to the questions below were analysed:

> How have teacher leaders developed professionally during the PD program?

Method

In the current study aiming to examine the processes experienced during the interaction between teacher leaders and their peers in depth and to present a theoretical model describing the process, the grounded theory as a research design was applied. The grounded theory, often regarded as revolutionary among qualitative designs (Walker & Myrick, 2006), came into existence following the release of the book "The Discovery of Grounded Theory" written by Barney G. Glaser and Anselm L. Strauss in the 1960's. Glasser and Strauss (1967) defined the term as "the discovery of theory from data systematically obtained and analysed in social research" (p. 1) and they developed the theory as a response to the extreme positivism which had dominated the field (Suddaby, 2006). They suggested that a grounded theory which is loyal to the realities of life can be withdrawn from varied data. In this sense, it is possible to develop a new theory through giving close attention to the differences between goings-on in life and the comments of people who experience them, namely the differences between daily realities and the actors (Suddaby, 2006). To Corbin and Strauss (1990), the grounded theory both attempts to unearth the related conditions as well as tries to identify the responses of people in terms of changing conditions and their results. Further, as each context is unique and the experiences of the participants are specific, the grounded theory is not a convenient method to make strong generalisation (Corbin & Strauss, 2008). Thus, the findings of the current study will not serve as a tool for generalisation since the views reflected would be the participants' own realities.

Participants

A total of 150 teachers were given the task of developing lesson plans in accordance with the guidelines of UbD instructional design. Seven teacher leaders were chosen by the researchers to assist their groups, each of which consisted of 20-25 teachers. The participants were selected on a voluntary basis and they were chosen from a group of teachers who had leadership experiences in their career, such as contributing to professional learning groups and having a role in teaching training. The teacher leaders were also teachers with previous knowledge and experience on developing UbD-based lesson plans and implementing them in their classes. In the current study, convenience sampling technique, which entails the selection of participants based on their accessibility and availability, rather than through randomization, was administered for the recruitment of teacher leaders. This sampling method was employed due to the practicality and easy access to the participants. While acknowledging its potential and possible biases to some extent, we attempted to reduce these restrictions by setting clear inclusion criteria and procedures.

Study Context

As a part of a professional development program, a total of 150 teachers from various backgrounds were trained about curriculum development and they were assigned to prepare lesson plans in line with their training. In this process, seven teacher leaders were nominated to guide seven different groups. These teacher leaders were trained for a month before the program started and they were appointed to a group of teachers, each consisting of approximately 20-25 participants. In the process, the teachers were requested to prepare lesson plans developed in accordance with an instructional design model, UbD, and the teacher leaders would guide them in developing their designs. With the assistance of teacher leaders to improve the quality variety of their lesson designs, the purpose of this professional development program is to assist teachers in creating lesson plans that are in line with UbD instructional design model. During the program which lasted five months, the teacher leaders and teachers worked together under the supervision of the project team. Starting with a three-day in-person training, the teachers continued the program with online activities including regular live meetings with the project team and the teacher leaders. They also continued their efforts to design unit plans in collaboration with their group members in an asynchronous format. At this point, the process was supported and facilitated by the teacher leaders until they handed the plans designed in line with the principles of UbD to the teacher leaders. Therefore, the teacher leaders oversaw assisting their groups in developing lesson plans that adhere to the basics of the design. In this way, they helped their peers comprehend the fundamentals of UbD instructional design model and learn how to employ them to develop lesson plans. They also facilitated group discussions and collaborative activities to promote peer learning and exchange of ideas among participants. Once the plans were completed and checked by teacher leaders, the plans were implemented in the classes. After the process was completed, the researchers made interviews with the teacher leaders in terms of their experience with the peer teachers.

Data Collection

The semi-structured interview was applied as a method of data collection. In this design, it is aimed to acquire individual responses from participants concerning a specific case or experience they have gone through. It is applied when the subjective knowledge is required or lacking under the guidance of scheduled questions administered by the researchers. The design assures the participants of giving responses to the questions freely or however they want (McIntosh & Morse, 2015). The questions employed in the interviews were meticulously planned and developed so that they would align with the study's aims. Through expert views, we attempted to ensure the suitability and relevance of the questions. Ethical procedures were conducted meticulously throughout the study. Informed consent forms were obtained from the participants, and they were informed about the details of study.

The interviews were conducted with each of the seven participating teacher leaders individually via Microsoft Teams Online Meeting Software and the lengths of the interviews varied between 30-45 minutes. All the interviews were recorded on the system after the participant gave informed consent to record the interview and participated in the study. Eight semi-structured questions were prepared and directed at all the participants in the same order so that consistency could be ensured in all interviews. In some cases, some follow-up questions, when necessary, were also added to the list in accordance with the flow of the interview to obtain more elaborated responses. All the recorded interviews were decoded through Microsoft Office Word software program. To provide internal validity, the questions were presented to the four experts in the field, and they were revised in accordance with the experts' suggestions.

Data Analysis

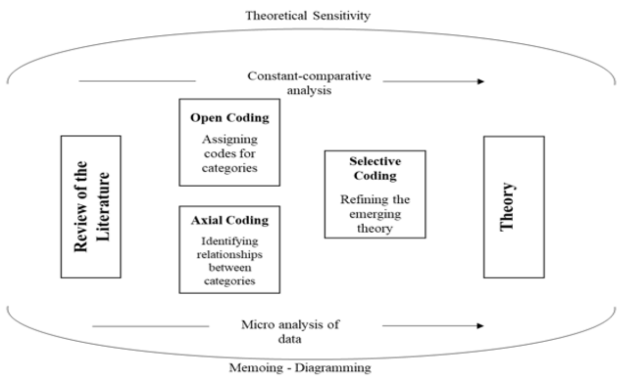
Semi-structured interview questions were asked to the participants and after the interviews with the participants, the data gained were analysed in accordance with the coding process formulated by Corbin and Strauss (1990). Describing the coding process as one of the most important aspects for the grounded theory, Corbin and Strauss (1990) argue that open, axial and selective coding are the three fundamental types while coding. Open coding involves the interpretation of the data analysed line by line even word by word (Urquhart, 2018). By doing this, the analyst gets new insights, and this process paves the way for multiple and generative questions. During the process of axial coding, the categories are connected to subcategories and the interaction among them are analysed. Selective coding is raising the selected codes into categories important to the research problem (Corbin and Strauss, 1990; Urquhart, 2018).

In the open coding process, the researcher analysed the decoded texts line by line, sometimes word by word, using the underlining and note-taking methods. During this phase, 213 reference codes were obtained and to make these codes have suitable categories, axial coding phase was put into practice. In other words, in the axial coding process, the features of the codes were arranged in dimensions and in contrast to the first step, relevant connections were drawn among the codes to identify categories.

Throughout the process, specific procedures were implemented to insure both validity and reliability. To improve reliability, consistent and methodical data collecting, and analysis processes were employed, based on the principles of the grounded theory. Document analysis, opinions and interviews were carried out rigorously for data triangulation, which helped to promote data diversity and confirmation of findings. Coding accuracy was assured using explicit coding methods and standards. Furthermore, constant comparison and iterative processing of theoretical notions were carried out to maintain consistency and coherence. Regarding validity issues, peer review was employed, allowing members to verify that they were consistent with their own experiences and peer discussion was also practised to confirm interpretations and to reduce researchers' biases.

Figure 1

Schematic representation of coding process based on Corbin and Strauss (1990). Adopted from Njenga and Lowry (2018).



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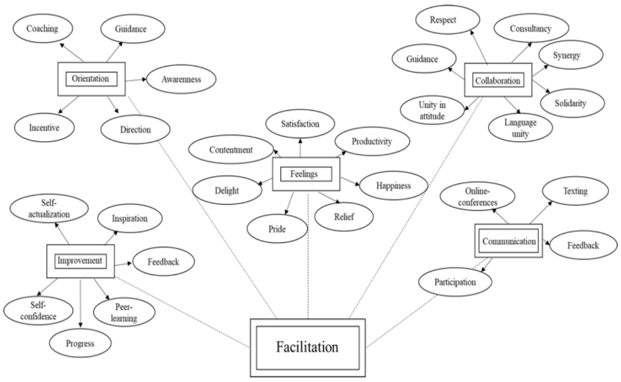
As demonstrated in Figure 1, the data transcribed and transferred to the Word file were analysed based on the coding method of Corbin and Strauss (1990). The codes were obtained from the frequently uttered expressions of the participants, the categories from the common codes, and then the themes were formed. At this stage, when necessary, open coding was reverted to and the generated codes, produced in this process, were reviewed again.

Results

After the analysis that the grounded theory requires, the current qualitative research yielded five categories, namely orientation, improvement, collaboration, communication, and feelings, and a main category, facilitation.

After open and axial coding, the categories were labelled under a related heading as shown in Figure 2.

Figure 2
Theoretical Model



As shown in Figure 2, after identifying the codes in the open coding process, five categories were formed in the axial coding process: orientation, improvement, collaboration, communication, and feelings. This phase was followed by the selective coding process in order to clearly understand and associate the five categories that emerged during the axial coding. According to the relationship between the five categories, facilitation which is related to all other categories emerged as the main category.

Below, the findings related to these categories and the main category are presented with direct quotations from the participants.

Orientation

All the teacher leaders in the current study received the fundamentals of curriculum development and they had necessary qualifications to develop lesson plans in accordance with the principles of the chosen instructional design model, UbD. In this sense, they all had in-service training for a month before they were administered to lead their groups.

Although there were slight differences among their responses, nearly all the teacher leaders were of the opinion that during their leadership, orientation was an important factor in the process. It was perceived as publicising group policies, job tasks, responsibilities, deadlines, procedures and other organisational structures to the members of each group. Under this category, only one teacher stated the phrase "bridge" to describe their roles. Among others, phrases like "awareness", "improvement", "reporter", "tutor", "companion", "mentor", "counsellor", "director", "leader", "advisor" and "instructor" were the ones that were frequently uttered.

The majority of the participants stated that the teacher leadership process helped them acquire and raise a kind of awareness. In this sense, TL5 stated that:

> *"During the interactions among teachers I have noticed that awareness is an important gain. Working with 19 teachers in my group, designing with them improved me and helped me raise a kind of awareness. I learned a lot from each teacher. There were things on UbD that I did not know either. Also, guidance. I felt like a guide who transferred, helped in their design, and learned a lot".*

Improvement

Without any exceptions, all the teachers agreed on the idea that teacher leadership in this process improved their personal and collaborative abilities. It could be concluded from the statements that they improved themselves personally as they were in the positions of consultants, and they were supposed to direct and help the teachers in their groups for the designs. As for the improvement in their collaborative skills, it is apprehended that while negotiating with each other in order to create the best form or design or to reach a consensus among them, they were able to manage the obstacles or difficulties that they encountered as they were acquainted with conferring.

Under this category, the most recurrent phrases were "feedback", "self-confidence", "experience", "progress", "differentiation", "betterment", "gain a different perspective / viewpoint", "inspiration", "self-improvement" and "help". The statements of TL1 were as follows:

> *It (the process) developed me a lot, it was important to be the one who taught, and I was able to express myself with ease. It provided me the feeling of self-confidence, and this improved me a lot. Being able to express myself on the topic was important, I'm not afraid anymore. I was able to give feedback on other people's designs. They made changes in accordance with my suggestions. Performance tasks helped them and me be more competent.*

Collaboration

Nearly all the participants in the study mentioned the presence of collaboration with their leaders as well as their peers during the process. Some of them focused on the significance of cooperation while the others put emphasis on information exchange, contribution, and direction. In this respect it seems that the unity in groups paved the way for the sense of collaboration as mutual respect among the members and teacher leaders created a kind of positive synergy whereby the work performed by the group could be counted more than that of each member's performance. Under this category, the phrases such as "consultancy", "language unity", "information exchange", "synergy", "solidarity", "respect", "integration", "direction", "natural flow", "calmness", "contribution", "interdisciplinary", and "formal procedure" were the most repeated ones.

Except for one teacher leader who was not that satisfied with the sense of collaboration, all the teacher leaders, while describing the process that they led, mentioned the influence and the value of cooperation. The statements of TL2 in this respect were remarkable:

> *It was a very enjoyable process. The team was nice, cooperation was great. We argued amongst ourselves, we went on by consulting each other. It was a naturally occurring process, we tried to answer the questions of the participants immediately. We argued how we can answer the questions of different branches? We cared about unity of language and unity of message. We exchanged information easily. We supported each other. I had an idea regarding my place with other teacher leaders, and the things I learned, I was often consulted. Since I had studied UbD before, I contributed more on the integration side.*

Communication

Although the phrases under this category were sometimes mentioned under the label of collaboration, the participants particularly put emphasis on it and the majority of them expressed the significance of communication exclusively. As the concept itself includes the acts of sharing information, sending and receiving messages from the members of their groups, they attached particular importance to it. In their attempts to guide and lead the members, the teacher leaders stated that they tried to be good and effective communicators as they listened to the others carefully, talked to them in a clear and respectful way and most importantly they respected their ideas. In addition, the effective and healthy communication among the members were also highlighted by the teacher leaders as this contributed to create positive atmosphere by eliminating likely factors of misunderstandings or confusions.

As the members of the groups were in different cities and provinces, the interviews and meetings were mostly conducted through online facilities. WhatsApp, Zoom conferences and texting were among the means of communication. "Generating ideas", "direction", "sharing ideas", "availability", "efficient feedback", "excuses", "moderator", "sincerity", "consulting", "barriers in communication with different groups", "cooperation", "unity in attitude", "peer learning", "interaction" and "correspondence" were mostly repeated phrases in this category. While two of the teacher leaders stated that due to the disintegration and quitting from the groups, they had communication problems with the members and could not get what they expected, most of the teacher leaders were of the opinion that the communication with their groups on the whole was effective. In this sense, TL4's expressions were as follows:

> *There were those who were more active than the other participants. More information was produced through Zoom, WhatsApp, and phone. Private school teachers were more inclined to work and to be creative than state school teachers. There were groups that I had to direct more. Some groups became more instructive and guiding. Our communication was good. We have been trying to find out how to get better.*

Feelings

Without any exceptions, all the teacher leaders in the study highlighted the feelings and emotions that they had gone through during the process. All of them expressed positive feelings overall although two of them stated negativity regarding their emotions. However, these teacher leaders though stated their contentment in general, expressed that while conducting or having some specific tasks, they underwent one or two frustrating experiences which mainly, they said, stemmed from technical problems that they faced during online meetings and delays. They highlighted that they often felt positive emotions and feelings, and this had a profound influence especially on attention, productivity, problem solving and efficient communication.

The most common phrases under this category were "pride", "satisfaction", "happiness", self-actualization", "feeling of competency", "sense of achievement", "self-confidence", "excitement", "productivity" and "helpfulness". TL3's expressions regarding feelings were as follows:

> *The sense of satisfaction and contribution was very high. It was satisfying for me to guide them as they come from different cities and cultures. I didn't have much difficulty. It would be helpful to have an IT officer in the project, for problems experienced in synchronous meetings. Although we already had basic skills, the IT staff could help with the disruptions in the synchronisation.*

Facilitation

After the interactions among the identified categories formed during the coding processes were examined, facilitation emerged as the main category. It has been evaluated that the relationship pattern among the categories could give a way to develop a model whose main point is facilitation. The teacher leaders in the current study mostly emphasised the term since it was recognized as an indispensable condition and tool for both personal and professional improvement. In the current study, teacher leaders guided their groups, and they encouraged them to overcome difficulties, to solve the problems that they encountered during the process, to reach a kind of consensus over diverse opinions and suggestions and also they tried to find out and apply the best strategies to challenges by means of their effective feedback that led to the right way. TL6's statements in this sense are quite compassing:

> *Sometimes, we reached mutual and spontaneous common points with the member teachers. While giving feedback, I felt I had to keep them in the process, motivate them, and at the same time, though not often, I had to correct things that weren't in line with our objectives. Kindness and motivation also helped me sustain and enhance the motivation during the process.*

Another participant's, TL5, expressions were also noteworthy to highlight:

> *I paid attention to my manner while giving feedback to my peers. There were points where I had to restrain myself. I tried to be helpful for their self-improvement. I felt pride and happiness. I learned to be patient. I grew a kind of self-compassion and empathy. I continuously asked myself the question, 'What would you do if you were in their place?'*

Discussion

In this study, we delved into the complex and comprehensive processes that took place during the interaction between teacher leaders and their peers in this study. Five distinctive categories have been established via the study of the coding process: orientation, improvement, collaboration, communication, and feelings. Each of these categories contributes uniquely to the overall theme of facilitation. The data were gained from seven teacher leaders appointed to groups of teachers who were requested to design unit plans in accordance with principles of curriculum development along with the other components of the professional development program that they attended. Forming teacher learning groups, as in this study, has become a widespread practice for the professional improvement as well as the transformation of schools seeking for a change (Allen & Blythe, 2018; Kurt, 2016) since these practices have been recognized as vehicles for bringing peers together in order to catch up present-day developments in their ever-changing environments (Dunne et al., 2000; Sargent & Hannum, 2009; Wood 2007).

One of the categories that the teachers highlighted mostly during the interviews is the concept of orientation. The majority of them stated that their involvement in the process helped them acquire and raise a kind of awareness and a sense of guidance. As Simpson (2021) argues, working with peers and mentors in such groups enhances learning orientation and, in this way, they can learn together and create a kind of common and mutual cognition as well as awareness. Similarly, focusing on promoting and encouraging teacher leadership for school changes, Wang and Ho (2020) highlight that in such practices, teacher leaders inspire others to achieve the common goal. In this sense, teacher leadership is also evaluated as an opportunity, among the members, for their professional development. As Poekert (2012) highlights, there is a significant association between teacher leadership and professional development as "professional development is both a cause and an outcome of teacher leadership" (p. 170).

Through the interviews, the participants also put emphasis on collaboration and communication with their peers. Teacher leaders in such groups often back up the members of their groups by directing, supplying necessary information, demonstrating, monitoring, providing opportunities to exchange different views, providing solidarity and so on (Neupane, 2021). In this context, it has appeared that one of the crucial features of teacher leaders lies in their ability to influence and to direct others through communication in an effective way, which is one of the seven dimensions that Katzenmeyer and Moller (2009) have formulated. The teacher leaders reported that by means of good communication skills, except for minor ones, they almost did not have any challenges. As Ackerman and Mackenzie (2006) state, when the relationships were set, then teacher leaders can have opportunities to influence their peers for instructional and personal development. The Teacher Leadership Exploratory Consortium (2011) which outlines the functions of teacher leaders connotes that communication and facilitation are among the critical skills that teacher leaders can develop. At this point, Ackerman and Mackenzie's (2007) expressions are noteworthy to highlight: Teacher leaders "live for the dream of feeling part of a collective, collaborative enterprise" (p. 237).

From the findings, it was also revealed that teacher leaders' positive mood had a profound impact on their peers as well as on the outcome. As leadership itself is a kind of "emotion-management process" (Fernando & Gamage, 2019, p. 2), the positive moods of teacher leaders improve the members' performance (Humphrey et al., 2008) on the condition that the leaders are effective at influencing their followers' moods in a positive way (Humphrey et al., 2008; Little et al., 2016). As in the words of Goleman et al. (2013), it is the leaders who make emotions "drive in the right direction" (p. 3). In this sense, it is apparent that the concept of emotion is one of the fundamental aspects of teacher leadership as it paves the way for motivating and inspiring peers, having sustainable relations and associations as well as reaching satisfaction and desired outcomes (Cheng et al., 2021).

Similarly, facilitation which also seems to lie at the core of teacher leadership is a significant aspect to be highlighted. After analysing the associations among the categories, the notion of facilitation emerged as an inclusive concept. In this study, the teacher leaders, in a sense, acted as facilitators who set and directed the procedures, uncovered the energy and stimulated their peers, maintained the lively, sincere atmosphere along with providing convenient strategies and support when required. Thus, facilitation has come to a state which is described as identifying and applying certain strategies or moves, unearthing facts, emphasising the crucial points, analysing and guiding. It has become a concept with a multifaceted nature that includes "cognitive, social, emotional, and ethical dimensions" (Allen & Blythe, 2018). In other words, the emergence of facilitation as the main category emphasizes its critical role in moderating relationships between teacher leaders and their peers. In this context, facilitation refers to the sophisticated procedures by which teacher leaders guide, assist, and improve joint undertakings in the educational setting. It is agreed by several researchers (Lowery-Moore, Latimer, & Villate, 2016; Lieberman & Pointer Mace 2009; Tahir et. al., 2020) that teacher leaders can enhance teaching and learning as well as the professional qualifications, and that teachers benefit from collaborative groups. Thus, it has become more apparent that facilitation serves as a way that leads the stakeholders to access a source of encouragement as well as support, a source of information, where the peers always seek to learn, to do more, to exchange opinions, to internalize improvement and are far more motivated to produce. In other words, it became visible that facilitation emerged as the key category for coordinating and maintaining the intricate interactions in this learning environment. In this context, facilitation goes beyond simple coordination; it encompasses the deliberate and competent coordination of procedures that foster teamwork, encourage progress, provide guidance, encourage effective interpersonal relationships, and realize the emotional aspects that fall under the category of feelings.

In this sense, facilitation goes beyond the conventional notion of leadership, focusing on a flexible and dynamic strategy that successfully negotiates the complex issues present in instructional settings. Establishing a clear direction and a common goal that gives cooperative efforts a meaningful path is part of the facilitative function. This is consistent with the orientation category's findings, showing how teacher leaders act as guides to make sure that group actions have a goal and are focused on shared objectives.

Moreover, facilitation also encompasses a kind of devotion to professional improvement. Teacher leaders become somehow agents of change in the groups, using their facilitation abilities to foster an atmosphere that values experimentation, reflection, and collaboration. Therefore, the category of improvement served in this study as a transformational change that teacher leaders triggered to their peers for better teaching practices and methods.

As for collaboration, it can be argued that facilitation played an important role in fostering synergies between teacher leaders and peers. In this sense, it went beyond a mere coordination and assigning tasks and it acted as a notion that includes establishing a setting that promotes the sharing of knowledge, viewpoints, and ideas, which paved the way for a collective attitude nurtured by individuals' contributions.

In accordance with the findings, facilitation has a connection with efficient communication in that teacher leaders not only allowed suitable and free ways to interact but also made sure that these ways suited to the group's requirements, promoting a culture of trust and confidence. In this way, the facilitative leaders made it possible for flowing of varied ideas, minimizing disagreements and creating a friendly atmosphere for progress and improvement.

Other categories derived from the study were orientation and feelings. As for orientation, it can be argued that the facilitative leaders played important roles for determining a clear and attainable direction and target for collaborative endeavours. Further, these leaders guided their peers towards common objectives to establish successful cooperation. The emotional dimension, meanwhile, emphasized on sentiments which the facilitative leaders observed meticulously and respected. They ensured that the feeling of their peers is comprehended, evaluated and incorporated into collaboration.

In this sense, the practical recommendations would be to organize structured orientation programs to define the roles, responsibilities, purposes of collaboration clearly; organize modules and workshops for continuous professional development that focuses on coaching and sharing teaching practices would be another practice and to establish collaborative teams to develop an environment where teacher leaders and their peers exchange their ideas and suggestions.

In summary, these characteristics helped to construct a theoretical model that reflected the many different aspects of the interactions between teacher leaders and their peers. It is evaluated that the model would offer a helpful basis for analysing and organizing such interactions in educational contexts.

Conclusion

Five distinctive categories have been identified from the data obtained: orientation, improvement, collaboration, communication, and feelings. It was concluded that each of these categories contributes uniquely to the overall theme of facilitation. The framework offered in the current study examines in depth the processes that occur during interactions between teacher leaders and their peers. The findings provide a basis for a detailed understanding and perception of teacher leadership as well as an opportunity to extract key insights from group works that highlight the dynamic and constant engagement among members. In this sense, the model presented has revealed emotional, psychological, cognitive, social, personal, and interactional aspects of peer work as well as the potential performance of teacher leaders who have acted as facilitators. It can be concluded that teacher leadership requires some skills that go beyond the traditional framework of leadership. With their new roles, teacher leaders are no longer the ones who merely manage their peers, develop materials for classroom use, simply design, supervise or evaluate the curriculum. Instead, their roles require them to be kind of mentors, facilitators, organisers, emotionally resilient figures, continuous learners, instructors, active participants, effective communicators, observers etc. This connotes that teacher leadership entails organisational, superior communication skills, using convenient teaching strategies, ability to motivate when needed and empowerment of peers.

Suggestions

The current study is naturally subjected to some limitations. To begin, a limited sample size was employed in the study. This may reduce and restrict the possibility of generalization of the findings, since it may not represent the population as it is expected. Further, the teacher leaders assigned to each group have been given the principles of the UbD design which required frequent interactions with the researchers, and this could lead to a kind of bias in their associations. Future studies might be addressed to eliminate any kind of bias and could be designed in such a manner that impartiality would be a major concern. Furthermore, the findings have been gained from the interviews conducted with teacher leaders. In future studies, the opinions of the members of the groups could be taken into account in order to have more thorough and detailed findings in terms of the interaction between teacher leaders and the members. In addition, further studies could be conducted in order to verify the theoretical model developed from this research across a variety of educational contexts. This would allow to increase the generalizability of the findings and give a more detailed views regarding how facilitation works in different circumstances. To illustrate, comparing the learning environments in urban schools where there are a lot of students with different backgrounds and rural schools having difficulty access to technology and many other facilities, could provide an opportunity to apply the model. Additionally, future studies could expand and focus on the idea that how facilitation influences students' achievement apart from the interactions between teacher leaders and peers. They could examine whether learning designs developed in this way could lead to better teaching strategies and better learning outcomes.

Declaration of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Ackerman, R. H., & Mackenzie, S. V. (2006). Uncovering teacher leadership. *Educational Leadership, 63*(8), 66–70.

Ackerman, R. H., & Mackenzie, S. V. (2007). Keeping the teacher in the leader. R. Ackerman & S. V. Mackenzie (Eds.) *Uncovering teacher leadership. Essay and voices from the field*. 237-249. Corwin Press

Allen, D., & Blythe, T. (2018). Aesthetics of facilitation: Cultivating teacher leadership. *International Journal of Teacher Leadership, 9*(2), 48–68.

Bolat, Ö. (2023). The impact of self-esteem on teacher leadership: An experimental design. *International Electronic Journal of Elementary Education, 16*(1), 99–109.

Bümen, N. T., & Yedigöz Kara, Z. (2023). Öğretmenlerin mesleki gelişimi ve etkili öğretim için güncel bir model: Öğrenme imecesi. [A novel model for improving instruction and teachers' professional development: Learning study]. *Yaşadıkça Eğitim, 37*(3), 946–971.

Can, N. (2009). Öğretmen liderliği [Teacher leadership]. Pegem Akademi.

Cheng, T., Chen, J. & Bryant, D.A. (2021). Teacher leaders' emotions mirror teacher professionalism via collegial trust. *Asia-Pacific Educational Research, 30*, 361–373. https://doi.org/10.1007/s40299-021-00551-3

Cohron, W. R. (2009). "The effect of teacher leader interactions with teachers on student achievement: a predictive study." (2009). Electronic Theses and Dissertations. Paper 262. https://doi.org/10.18297/etd/262

Corbin, J., & Strauss, A. (1990). Grounded theory research: Procedures, canons and evaluative criteria. *Qualitative Sociology, 13*, 3-21.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Sage Publication.

Cosenza, M. N. (2015). Defining teacher leadership affirming the teacher leader model standards. *Issues in Teacher Education, 24*(2), 79-99.

Dunne, F., Nave, B., & Lewis, A. (2000). Critical friends groups: Teachers helping teachers to improve student learning. *Phi Delta Kappa Research Bulletin, 28*, 9–12.

Darling-Hammond, L. (1998). Teachers and teaching: Testing policy hypotheses from a national commission report. *Educational Researcher, 27*(1), 5–15.

DeDeyn, R. (2021). Teacher leadership and student outcomes in a US university intensive English program. *Teaching English as a Second Language Electronic Journal (TESL-EJ), 24*(4).

Fairman, J. C., & Mackenzie, S. V. (2015). How teacher leaders influence others and understand their leadership. *International Journal of Leadership in Education, 18*(1), 61-87. https://doi.org/10.1080/13603124.2014.904002

Fernando, P. A. S., & Gamage, P. (2019). Emotional intelligence and employee intention to retain: A case study of an organization in fast moving consumer goods in Sri Lanka. *International Journal of Managerial Studies and Research (IJMSR), 6*(6), 1-13. https://doi.org/10.20431/2349-0349.0606004

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Sociology Press.

Goleman, D., Boyatzis, R. E., & McKee, A. (2013). *Primal leadership: Unleashing the power of emotional intelligence.* Harvard Business Press.

Gratacós, G., Ladrón de Guevara, B. & Rodriguez, I. (2021). A study of teacher leadership concept in institutional documents in Spain. *Research in Educational Administration & Leadership, 6*(1), 241-275. https://doi.org/10.30828/real/2021.1.8

Grimm, F. (2020). The first teacher as the elephant in the room – forgotten and hidden teacher leadership perspectives in Swedish schools. *Research in Educational Administration & Leadership*, *5*(2), 454-483. https://doi.org/10.30828/real/2020.2.5

Harris, A. (2003) Teacher leadership as distributed leadership: Heresy, fantasy or possibility? *School Leadership & Management, 23*(3), 313-324. https://doi.org/10.1080/1363243032000112801

Harris, A. & Jones, M. (2019). Teacher leadership and educational change. *School Leadership & Management, 39*(2), 123-126. https://doi.org/10.1080/13632434.2019.1574964

Harris, A., & D. Muijs. (2003). *Teacher leadership: Principles and practice.* National College for School Leadership.

Holmqvist, M. (2017). Models for collaborative professional development for teachers in mathematics. *International Journal for Lesson & Learning Studies, 6*(3), 190. https://doi.org/10.1108/ IJLLS-12-2016-0051.

Humphrey, R.H., Pollack, J.M., & Hawver, T. (2008). Leading with emotional labor. *Journal of Managerial Psychology, 23*(2), 151-168. https://doi.org/10.1108/02683940810850790

Kahila, S. K., Heikka, J., & Sajaniemi, N. (2020). Teacher leadership in the context of early childhood education: Concepts, characteristics and enactment. *Southeast Asia Early Childhood Journal*, *9*(1), 28-43.

Kahler-Viene, N., Conway, J. M., & Andrews, D. (2021). Exploring the concept of teacher leadership through a document analysis in the Australian context. *Research in Educational Administration & Leadership*, *6*(1), 200-239. https://doi.org/10.30828/real/2021.1.7

Katzenmeyer, M., & Moller, G. (2009). *Awakening the sleeping giant: helping teachers develop as leaders.* (3rd ed.), Corwin Press

Kılınç, A. Ç., Cemaloğlu, N., & Savaş, G. (2015). The relationship between teacher leadership, teacher professionalism, and perceived stress. *Eurasian Journal of Educational Research, 58*, 1-26. https://doi.org/10.14689/ejer.2015.58.5

Kurt, T. (2016). A model to explain teacher leadership: The effects of distributed leadership, organizational learning and teachers' sense of self-efficacy on teacher leadership. *Education and Science, 41*(183), 1-28.

Lieberman, A. & Pointer Mace, D.H., (2009). The role of 'accomplished teachers' in professional learning communities: uncovering practice and enabling leadership. *Teachers and teaching: theory and practice*, 15 (4), 459–470. https://doi.org/10.1080/13540600903057237

Little, W. (2003). Constructions of teacher leadership in three periods of policy and reform activism. *School Leadership & Management, 23*(4), 401-419. https://doi.org/10.1080/1363243032000150944

Little, L. M., Gooty, J., & Williams, M. (2016). The role of leader emotion management in leader–member exchange and follower outcomes, *The Leadership Quarterly, 27*(1), 85-97. https://doi.org/10.1016/j.leaqua.2015.08.007

Lowery-Moore, H., Latimer, R. M., & Villate, V. M. (2016). The essence of teacher leadership: A phenomenological inquiry of professional growth. *International Journal of Teacher Leadership, 7*(1), 1-16.

McIntosh, M. J., & Morse, J. M. (2015). Situating and constructing diversity in semi-structured interviews. *Global Qualitative Nursing Research,* 1-12. https://doi.org/10.1177/2333393615597674

Njenga, K., & Lowry, P. B. (2018). "Information security policy violations: A grounded theory approach to counterfactual balance and tensions," Proceedings of the Dewald Roode Workshop in Information Systems Security 2018, IFIP WG 8.11 / 11.13, Cape Town, South Africa, June 14–15

Neupane, B. P. (2021). Pathways to teacher leadership among English as foreign language teachers in Nepal's public schools. *International Journal of Multidisciplinary Perspectives in Higher Education*, 6(1), 102–122. https://doi.org/10.32674/jimphe.v6i1.2673

Poekert, P. E. (2012). Teacher leadership and professional development: examining links between two concepts central to school improvement. *Professional Development in Education, 38*(2), 169-188. https://doi.org/10.1080/19415257.2012.657824

Pounder, J. S. (2006). Transformational classroom leadership: The fourth wave of teacher leadership? *Educational Management Administration & Leadership, 34*(4), 533-545. https://doi.org/10.1177/1741143206068216

Shen, J., Wu, H., Reeves, P., Zheng, Y., Ryan, L., & Anderson, D. (2020). The association between teacher leadership and student achievement: A meta-analysis. Educational Research Review, 31, 100357. https://doi.org/10.1016/j.edurev.2020.100357

Silva, D.Y., Gimbert, B.G., & Nolan, J. (2000). Sliding the doors: Locking and unlocking possibilities for teacher leadership. *Teachers College Record, 102*, 779-804.

Simpson, J. C. (2021). Fostering teacher leadership in K-12 schools: A review of the literature. *Performance Improvement Quarterly, 34,* 229-246. https://doi.org/10.1002/piq.21374

Suddaby, R. (2006). From the editors: What grounded theory is not. *Academy of Management Journal, 49*(4), 633 – 642. https://doi.org/10.5465/AMJ.2006.22083020

Sargent, T. C., & Hannum, E. C. (2009). Doing more with less: Teacher professional learning communities in resource-constrained primary schools in rural China. *Journal of Teacher Education, 60*(3), 258–276. https://doi.org/10.1177/0022487109337279

Tahir, L. M., Musah, M. B., Al-Hudawi, S. H. V., & Daud, K. (2020). Becoming a teacher leader: Exploring Malaysian in-service teachers' perceptions, readiness and challenges. *Education and Science, 45*(202), 283-310.

Taylor, M., Goeke, J., Klein, E., Onore, C., & Geist, K. (2011). Changing leadership: Teachers lead the way for schools that learn. *Teaching and Teacher Education, 27*(5), 43-53. https://doi.org/10.1016/j.tate.2011.03.003

Teacher Leadership Exploratory Consortium. (2011). Model standards advance the profession. *Journal of Staff Development, 32*(3), 16-24.

Urquhart, C. (2018). *Nitel araştırmalar için temellendirilmiş kuram.* [Grounded theory for qualitative research], (Tranlated by Z. Ünlü & E. Külekçi). Ankara: Anı Yayınevi.

Xie, C., Song, P., & Hu, H. (2021). Measuring teacher leadership in different domains of practice: Development and validation of the teacher leadership scale. *Asia-Pacific Educational Research, 30*, 409–419. https://doi.org/10.1007/s40299-020-00527

Walker, D., & Myrick, F. (2006). Grounded theory: an exploration of process and procedure. *Qualitative Health Research, 16*(4), 547–559. https://doi.org/10.1177/1049732305285972

Wang, M., & Ho, D. (2020). A quest for teacher leadership in the twenty-first century–emerging themes for future research. *International Journal of Educational Management, 34*(2), 354-372. https://doi.org/10.1108/IJEM-01-2019-0038

Webber, C. F. (2021). The need for cross-cultural exploration of teacher leadership. *Research in Educational Administration & Leadership, 6*(1), 17-49. https://doi.org/10.30828/real/2021.1.2

Webber, C. F. & Okoko, J. M. (2021). Exploring teacher leadership across cultures: Introduction to teacher leadership themed special issue. *Research in Educational Administration & Leadership, 6*(1), 1-15.

Wood, D. R. (2007). Professional learning communities: Teachers, knowledge, and knowing. *Theory into Practice, 46*(4), 281–290.

York-Barr, J., & Duke, K. (2004). What do we know about teacher leadership? Findings from two decades of scholarship. *Review of Educational Research, 74*(3), 255-316. https://doi.org/10.3102/00346543074003255

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Leadership Style in Education: Advantages and Challenges

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Abstract

This study aims to provide a comprehensive overview of the various leadership models applied in the education sector, analyzing the strengths and weaknesses of each approach. The models of administrative/managerial, instructional, transformational, distributed, transactional, ethical, contingent and participative leadership are presented, focusing on their contribution to improving the functioning of school organizations. The research highlights that no single model alone can meet the ever-changing needs of school settings and suggests a synthetic approach to leadership that combines the strengths of different models to create a flexible and adaptive leadership style. Integrating managerial and transformational practices, fostering collaboration through distributed and participatory leadership, and maintaining ethical integrity are critical factors in the success of educational organizations. This research contributes to providing a comprehensive comparative analysis of existing leadership approaches in education, bridging the research gap by formulating a theoretical framework that can guide the practical application of leadership in educational settings, enhancing the effectiveness and adaptability of school units to contemporary challenges.

Keywords:

Leadership Styles; Education; Educational Organizations; Principals

Introduction

Management in the educational sector has undergone significant changes since the 1980s, following the broader trends in management science (Katsaros, 2008: 106). In recent years, many leadership models in education have been developed, but there has yet to be a consensus on the most appropriate one for managing educational organizations. None of these models alone seems to be able to fully respond (Saiti & Saitis, 2012: 266, 268-269) to the ever-changing social and educational conditions (Giasemis, 2016: 158).

Understanding leadership theory is central as it offers tools for interpreting and analysing educational leadership practices (Bush & Glover, 2014: 565). Combined with policy, research and practice, theory helps principals broaden their perspective avoiding a limited one based solely on personal experience.

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This research aims to provide an extensive literature review of the various models of leadership in the education sector, examining the differences and similarities between them and the practical challenges they face. This research is necessary due to the increasing complexity of educational organizations and the constant changes in the social and educational environment, which make selecting the appropriate leadership model a critical factor in the success of schools.

There are several categorisations of leadership models in education, with several of them overlapping (Katsaros, 2008: 106). In the literature, several important models are mentioned, such as administrative/ managerial leadership, instructional leadership, transformational, distributed, transactional, ethical, contingent and participative leadership (Bush, 2015: 487; Giasemis, 2016: 149-158; Katsaros, 2008: 106-107; Leithwood & Duke, 1999: 45-72; Tamisoglou, 2020: 67-89; Theofilidis, 2012: 209-223; Varelas, 2023: 12).

Administrative/Management Leadership

Administrative leadership in education, also known as managerial leadership, closely links the concept of leadership to administrative responsibilities and functions. In this context, the leader's power is mainly derived from his/her position in the hierarchy of the educational organization (Katsaros, 2008: 107). This approach assumes that the effective implementation of administrative functions facilitates the work of the organization's members (Leithwood & Duke, 1999: 52-53).

Administrative leadership emphasizes the structure and bureaucratic nature of the school, where the principal recognizes and strictly follows the hierarchy and rules of the organization. The school functions as a hierarchically structured organization where the responsibilities and duties of members are clearly defined, creating a formal linear model that defines relationships and levels of responsibility (Giasemis, 2016: 150-151).

This form of leadership tends to be inflexible and rigid, negatively affecting decision-making effectiveness (Giasemis, 2016: 150). Furthermore, firm adherence to regulations can limit the introduction of innovations and reduce creativity within the school unit (Bush, 2014: 163). Strict adherence to procedures can also hinder the formation of a shared vision and encouragement of staff, which may undermine school improvement and long-term effectiveness (Giasemis, 2016: 151).

Instructional leadership

Instructional leadership is one of the most stable and enduring categories of leadership in the evolving typology of management models. It emerged in the United States of America when research showed that leadership can improve student achievement (Bush, 2015: 487). This model gained prominence in schools in the 20th and 21st centuries and was developed in the 1980s in response to the growing demand for quality education and to narrow the gap between high- and low-achieving students (Shitana, 2018: 135).

Murphy (1990: 170-171) proposed a framework for instructional leadership that includes four main dimensions:

- Developing mission and goals: Principals formulate and communicate clear goals for the school, promoting a shared vision and purpose.
- Managing the educational function: This function focuses on promoting quality teaching, evaluating the teaching process, managing instructional time well, and coordinating the curriculum.
- Promoting an academic learning climate: This includes creating positive expectations, encouraging motivation, and ensuring the active participation of the principal in all school activities.
- Creating a supportive work environment: This approach focuses on creating a safe and organised learning environment, promoting collaboration among staff, and encouraging active student participation.

According to Murphy's analysis, instructional leadership aims to support school units to achieve their primary goal of teaching and learning (Katsaros, 2008: 107). Leaders in this context focus on transforming the school into a learning community to achieve the learning goals set jointly with teachers. Furthermore, implementing instructional leadership promotes a collaborative environment where learning is a shared goal for all teachers (Shitana, 2018: 139).

Despite its significant advantages, instructional leadership has some limitations. A fundamental limitation is the tendency for strict top-down hierarchy and leadership, where the principal is seen as the primary source of guidance and strictly oversees the work of teachers and students (Shitana, 2018: 140). In addition, instructional leadership emphasises the 'what' rather than the 'how' to implement leadership effectively (Bush, 2011: 201). Many principals need more skills and knowledge to effectively implement this approach (Hallinger, 1992: 38), particularly in secondary education, where specialist knowledge is critical to improving the quality of education (Bush, 2015: 487). Finally, instructional leadership focuses on teaching and learning, overlooking other aspects of school life such as sports, socialisation and student wellbeing (Bush, 2007: 401).

These limitations have led to a shift in focus towards other leadership models, such as transformational and distributed leadership (Bush, 2015: 487).

Transformational Leadership

Transformational leadership emerged as a theory in the 1970s and 1980s and became particularly popular in the educational community in the 1990s, reacting to the strict hierarchical management systems of the previous decade (Theofilidis, 2012: 210). Burns and Bass mainly influenced the basic concepts of transformational leadership (Katsaros, 2008: 108).

Burns, in 1978, argued that transformational leadership is manifested when leaders and their subordinates interact in such a way that they mutually elevate each other to higher levels of patience and morality. Through this interaction, individuals develop a shared vision for the Organization, commit to it, and build mutual trust, transforming it into a mantle community (Theofilidis, 2012: 209).

Bass, in 1985, extended Burns' ideas, identifying four critical dimensions of transformational leadership (Papathomopoulos, 2016: 40-41):

- Idealised influence (charisma): The leader evokes respect, trust and admiration.
- Inspired motivation: The leader articulates a clear, attractive vision and inspires subordinates to adopt it.
- Intellectual stimulation: The leader encourages innovation and creativity.
- Personalised support: The leader provides a supportive environment and responds to individual needs, promoting individual professional development.

Leithwood and colleagues, adapting these foundations to the educational context (Papathomopoulos, 2016: 42), developed in 1994 eight dimensions of transformational leadership in education: visioning, identifying goals, providing intellectual motivation, providing personalised support, providing models of best practice, cultivating high-performance expectations, developing a positive school culture and facilitating participation in decision-making (Katsaros, 2008: 109).

Transformational leadership involves a holistic approach to assessing critical factors, such as developing a solid vision and empowering stakeholders. A clear vision must be effectively communicated to engage all stakeholders while empowering teachers, students, parents, and the community is equally important. Leaders must create opportunities for participation and collaboration, fostering a sense of ownership and commitment (Faig, 2024: 10).

Transformational leadership promotes continuous improvement and change at all levels of the education system, inspiring teachers and students to thrive in a collaborative and supportive environment. In the education sector, this leadership model focuses on leading by example, inspiring and developing future leaders who will bring about positive change. A transformational leader ensures that students achieve academically and improve their learning while encouraging teachers to develop leadership skills and promote innovative educational practices (Abdallah & Ismail, 2024: 134-134, 140).

The proper implementation of transformational leadership can provide a solid foundation for educational success and personal growth, contributing positively to society (Faig, 2024: 10). However, the approach has been criticised, as some researchers point out that the constant effort of principals to transform teachers' attitudes can lead to authoritarian relationships, damaging the democratic nature of the school organization (Giasemis, 2016: 155).

To avoid such situations, reliable principal selection processes, ongoing training in administration and human resource management (Papathomopoulos, 2016: 65), and attending training programmes in transformational leadership (Anderson, 2017: 10-11) are necessary. Promoting school autonomy and reducing bureaucracy are also critical to the success of this leadership model (Papathomopoulos, 2016: 65).

Distributed Leadership

Distributed leadership has become one of the most debated topics in academia (Giasemis, 2016: 156). The concept was first introduced in the 1950s by the Australian psychologist Gibb (1954), who used the term to describe leadership as a collective activity shared among members of an organization (Kumari, 2021: 56). According to Gibb, distributed leadership involves a variety of roles and behaviors that can be shared, alternated, or co-exist simultaneously (Theofilidis, 2012: 223).

Distributed leadership differs significantly from the traditional concept of the 'hero leader', based on the idea that leadership is a process distributed throughout the organization. This way, expertise is mobilised at all school levels, creating more opportunities for change and improvement (Shava & Tlou, 2018: 279-280). Despite its distributed nature, the principal remains active, assessing situations, identifying opportunities and making critical decisions while facilitating leadership distribution and promoting vertical and horizontal communication (Theofilidis, 2012: 222-223).

This form of leadership is aligned with the principles of democracy, inclusiveness, and co-responsibility, which have been reinforced in the educational sector in recent years. It recognises the professionalism and contribution of all members of the school community and encourages their meaningful participation (Giasemis, 2016: 162).

Distributed leadership is now considered one of the most essential practices in education for improving the quality of teaching and learning (Kumari, 2021: 56), as it incorporates the participation of many school community members in decision-making and forming a shared vision. This participatory approach increases teacher engagement and leads to better learning outcomes. Research has shown that distributed leadership positively impacts learning outcomes, as leadership exercised collectively by principals and teachers has a more significant impact than other forms of leadership, such as instructional leadership (Giasemis, 2016: 157, 161).

Moreover, distributed leadership helps strengthen teachers' skills and create a climate of mutual trust. This has a positive impact not only on teachers but also on the overall improvement of the school, as it encourages collaboration and active participation in promoting innovation and change in the school environment (Theofilidis, 2012: 222).

Despite its benefits, distributed leadership comes with challenges (Torrance, 2013: 362-366). Power distribution may only sometimes be smooth and often requires time and effort to implement effectively. In addition, problems such as inter-team stress, lack of communication and conflict may arise (Giasemis, 2016: 162-163). Some teachers may be reluctant to take on leadership roles because they need more time or prefer to focus on other responsibilities. Others may need more skills and knowledge to lead effectively (Torrance, 2013: 363, 367).

These challenges are often a reality in the school setting as they relate to the school's culture and the complexity of roles in an ever-changing organization that faces daily challenges. Despite its shortcomings, distributed leadership has the potential to offer solutions and contribute to improving education. Principals and teachers are called upon to work together to shape the school's shared vision and culture (Giasemis, 2016: 163).

Transactional Leadership

Burns introduced transactional leadership in 1978. This model focuses on creating transactional relationships between the leader and employees. It examines how principals use authority and incentives, such as rewards, to shape employee behavior and positively influence organizational performance (Dong, 2023: 21).

In this approach, the principal tries to secure the cooperation of subordinates by providing rewards. Transactional leaders ask employees to perform specific tasks and, in return, offer them rewards when their effort and performance are deemed satisfactory (Saiti & Saitis, 2012: 268).

The relationship of transactional leadership with employees is based on exchanging benefits and achieving mutual goals. Although this approach can improve organizational effectiveness, there is a risk that employee morale may be undermined if leaders focus exclusively on their interests or if employees feel exploited. Transactional leaders must consider employees' needs and interests to build relationships that enhance morale and organizational stability (Dong, 2023: 22).

A key characteristic of transactional leadership is the need for long-term commitment, as the relationships developed are temporary and transaction-based. In this model, educational leaders try to balance exercising authority and working with staff to achieve school goals. However, maintaining good relationships through mutual concessions can negatively affect the quality and effectiveness of the school unit (Giasemis, 2016: 151-152, 159).

Transactional leaders' personal characteristics, such as confidence and determination, play an important role in their effectiveness. They need to have clear goals, communicate effectively, and make decisions that keep the organization competitive. However, overconfidence can make them authoritarian and egotistical, negatively affecting teamwork and cohesion among organization members (Dong, 2023: 22).

Transactional leadership can be seen as a flexible form of leadership, as it is based on exchange between stakeholders in the school community (Giasemis, 2016: 159). Principals who adopt this model can positively influence the organization's performance and achieve high performance. However, their role may need to be improved, hindering innovation and long-term development. The behavior of transactional leaders is influenced by personal and environmental factors such as individual characteristics, work experience and the organization's culture. Training and developing communication and decision-making skills can improve their leadership behavior and increase organizational performance (Dong, 2023: 24).

Ethical Leadership

Ethics comes from the Greek word "ethos", which initially referred to the habits and practices that differentiate a society or group of individuals from others. Over time, the concept has been expanded to describe the behavior and character of individuals who are considered decent and ethical. Ethics can influence by creating positive relationships and making ethical decisions (Özan et al., 2017: 164).

Ethical leadership is a managerial approach that emphasises moral values in both the personal and professional lives of leaders (Göçen, 2021: 38). This leadership model is characterised by the ability of leaders to distinguish right from wrong and act on these distinctions, guiding others through ethical practices to achieve common goals (Özan et al., 2017: 164).

Principals who act ethically gain the trust and support of their employees, as employees assume that these leaders will make ethical decisions regardless of the circumstances (Özan et al., 2017: 162). Ethical leadership creates an environment where the core values are justice, respect, equality, democracy and positive human relations (Ghanem, 2018: 244). Principals are expected to make ethical decisions when resolving various issues, such as conflicts among school community members (Özan et al., 2017: 162).

Ethical leadership in educational organizations includes four main dimensions: the decision-making process, behavioral ethics, the communication process, and the formation of the organizational climate. Principals are required to ensure that their decisions are ethically sound and to act with honesty and fairness. They must encourage knowledge development by adhering to values such as honesty, equity and accountability while shaping a culture that supports ethical behavior and job satisfaction among teachers (Ghanem, 2018: 247-248). Codes of ethics help principals make decisions based on ethical principles, reducing subjectivity (Özan et al., 2017: 162).

Ethical leadership is closely related to the effective functioning of school units (Göçen, 2021: 38). However, its implementation can lead to negative consequences if a principal's level of ethics and authenticity differs from that of the organization and other members of the school community, which can cause conflicts. There is also a risk that basic needs, such as teachers' professional development, may be underestimated and that secondary areas of school life may be emphasised to form a 'common ethic' (Giasemis, 2016: 153-154).

Contingent Leadership

Contingent leadership in the education sector recognizes the complexity and unpredictable nature of the school environment. In this environment, principals must adapt their leadership style to the circumstances rather than following a fixed approach (Bush & Glover, 2014: 567).

This approach is based on the idea that principals must respond to the particular organizational circumstances and challenges of the Organization, adapting their behavior to the needs of each situation (Leithwood et al., 1999: 15). This adaptive attitude requires leaders to be able to assess the situation and choose the most appropriate leadership response (Bush & Glover, 2014: 567).

Yukl (2002: 234) reinforces this view, noting that managerial work is often complex and unpredictable, and therefore, leaders need to constantly adapt their behavior based on specific circumstances. This approach emphasises that leadership cannot be based on predetermined solutions but requires constant evaluation and adaptation to prevailing circumstances. This is particularly critical in times of crisis, where leaders need to carefully analyse the situation and react appropriately rather than following a predetermined model of leadership (Bush & Glover, 2014: 564).

The contingent leadership model is considered pragmatic as it recognises the need to adapt leadership practices to specific circumstances and is not based on fixed values (Bush & Glover, 2014: 567). The complexity of the school environment requires principals to seek coordinated actions to achieve school goals (Muñoz et al., 2023: 42).

Participative Leadership

Participative leadership is characterised by the active participation of team members in the decision-making process. In the educational sector, this approach integrates all school community members into decision-making processes, promoting transparency and fostering a sense of collective responsibility among all stakeholders (Suherni et al., 2023: 496).

An inclusive leader emphasises consultation and shared decision-making, sharing power and encouraging democratic governance. This leadership style allows team members to express their opinions, which enhances their sense of appreciation from their superiors and improves relationships between principals and subordinates (Suherni et al., 2023: 498). Leaders who practice this style create an environment of cooperation and trust necessary to achieve educational goals (Ngotngamwong, 2012: 17-18).

In addition, participative leadership increases teachers' job satisfaction by improving the quality and effectiveness of decisions made (Ngotngamwong, 2012: 17-18). At the same time, it enhances creativity (Suherni et al., 2023: 499) and collaboration (Katsaros, 2008: 111) while boosting employee morale and reducing competition. Subordinates feel their opinions are valued and recognised as necessary in decision-making (Suherni et al., 2023: 499).

Teachers' participation in decision-making creates a sense of ownership, enhancing their commitment to the school's goals. Research has shown that this leadership model improves teachers' productivity, trust and team spirit (Ngotngamwong, 2012: 18) while reducing pressure on principals as responsibilities are shared (Katsaros, 2008: 111).

However, despite its advantages, participative leadership can lead to time-consuming decision-making processes, thus reducing team effectiveness and productivity. In addition, conflicts and negative emotions may arise during discussions among school community members. Also, providing sensitive information to subordinates increases the risk of leaking this information outside the school environment (Suherni et al., 2023: 499-500).

Despite these challenges, participative leadership can meet the demands of modern organizations by facilitating more effective and efficient decision-making (Wang et al., 2022: 1, 10).

Conclusions

The analysis of various models of leadership in education reveals that no one leadership style is sufficient in itself (Saiti & Saitis, 2012: 268-269) to fully respond to the ever-changing social and educational challenges facing school units (Giasemis, 2016: 158). Each model has unique characteristics and advantages that contribute to effective leadership and limitations that can undermine the success of leadership in specific contexts. For example, administrative/managerial leadership offers clarity in structure and hierarchy but can limit creativity and adaptability. Similarly, instructional leadership focuses on improving learning outcomes but often overlooks other critical aspects of school life, such as student well-being.

Rather than focusing solely on one model, educational leaders can choose a synthetic approach combining several styles' strengths. Integrating elements of administrative leadership, which offers stability and structure, with transformational practices, which promote inspiration and innovation, can create a more flexible and adaptive form of leadership (Saiti & Saitis, 2012: 269). This approach allows principals to better adapt to the demands of an ever-evolving educational environment, where complexity and the speed of change require flexible and dynamic leadership skills.

In addition, distributed leadership and participative leadership can play an essential role in promoting collaboration and trust within the school community, while ethical leadership ensures that decisions are made with the moral integrity and well-being of all involved in mind. Contingent leadership enhances the adaptability of leaders, allowing them to choose the appropriate style depending on the circumstances, and transactional leadership provides tools for managing day-to-day operations and maintaining organization and order.

Ultimately, success in instructional leadership does not lie in the selection of a single style but in the ability of leaders to combine best practices from various approaches, creating a flexible and multi-dimensional model of leadership that adapts to the needs of the school and the larger community. This synthetic approach can catalyze improving education quality and educational organizations' success by effectively responding to the complex and multi-dimensional challenges of the contemporary educational environment.

References

Abdallah, R. K., & Ismail, O. A. (2024). Modern Leaders, Revolutionary Results: Steering Transformation in Today's World. In A. K. Abdallah, A. M. Alkaabi, & R. Al-Riyami (Eds.), *Cutting-Edge Innovations in Teaching, Leadership, Technology, and Assessment* (pp. 134-147). IGI Global.

Anderson, M. (2017). Transformational leadership in education: A review of existing literature. *International Social Science Review, 93*(1), 1-13.

Bush, T. (2007). Educational Leadership and Management: Theory, Policy, and Practice. *South African Journal of Education, 27*(3), 391-406.

Bush, T. (2011). *Theories of Educational Leadership and Management* (Fourth Edition). London: Sage.

Bush, T. (2014). Emotional leadership: A viable Alternative to the bureaucratic model? *Educational Management Administration & Leadership, 42*(2), 163-164. DOI: 10.1177/1741143213512742

Bush, T. (2015). Understanding instructional leadership. *Educational Management Administration & Leadership, 43*(4), 487-489. https://doi.org/10.1177/1741143215577035

Bush, T., & Glover, D. (2014). School leadership models: What do we know?. *School Leadership & Management, 34*(5), 553-571. DOI: 10.1080/13632434.2014.928680

Dong, B. (2023). A systematic review of the transactional leadership literature and future outlook. *Academic Journal of Management and Social Sciences, 2*(3), 21-25.

Faig, E. Z. (2024). Strategies for transformative leadership in educational settings: Realizing effective implementation goals. *International Journal of Innovative Technologies in Social Science, 1*(41), 1-12. https://doi.org/10.31435/rsglobal_ijitss/30032024/8102

Ghanem, B. M. (2018). Ethical leadership in education and its relation to education management ethics. *European Journal of Education Studies, 4*(6), 243-256. https://doi.org/10.5281/zenodo.1245865

Giasemis, C. (2016). Educational leadership models and the role of distributed leadership in the educational system. In: A. Petrou, & P. Angelidis (Eds.), *Educational Administration and Leadership: Scientific Basis, Research Approaches and Practices* (pp. 145-172). Athens: Diadrasi.

Gibb, C. A. (1954). Leadership. In G. Lindzey (Ed.), *Handbook of Social Psychology*, pp. 877–917. Cambridge, MA: Addison-Wesley.

Göçen, A. (2021). Ethical leadership in educational organizations: A cross-cultural study. *Turkish Journal of Education, 10*(1), 37-57.

Hallinger, P. (1992). The evolving role of American principals: from managerial to instructional to transformational leaders. *Journal of Educational Administration, 30*(3), 35-48. DOI:10.1108/09578239210014306

Katsaros, I. (2008). *Organization and Administration of Education.* Athens: Ministry of Education - Pedagogical Institute.

Kumari, H. L. (2021). A study on distributed leadership practices and its impact on teaching and learning. *International Journal of Teaching, Education and Learning: PUPIL, 5*(1), 55-72.

Leithwood, K., & Duke, D. L. (1999). A Century's Quest to Understand School Leadership. In J. Murphy, & K. S. Louis (Eds.), *Handbook of Research on Educational Administration: A Project of the American Educational Research Association* (pp. 45-72). San Francisco, CA: Jossey-Bass Publishers.

Leithwood, K., Jantzi, D., & Steinbach, R. (1999). *Changing Leadership for Changing Times*. Buckingham: Open University Press.

Muñoz, G., Weinstein, J., & Sembler, M. (2023). "Contingency", an overlooked factor by school leadership: evidence from primary urban schools in Chile. *Journal of Educational Administration, 61*(1), 41-59.

Murphy, J. (1990). Principal instructional leadership. In L. S. Lotto, & P. W. Thurston (Eds.), *Advances in educational administration: Changing perspectives on the school.* (Vol. 1, Part B; pp. 163-200). Greenwich, CT: JAI Press.

Ngotngamwong, R. (2012). Effect of participative leadership on teacher job satisfaction. *AU Journal of Management, 10*(2), 15-30.

Özan, M. B., Özdemir, T. Y., & Yirci, R. (2017). Ethical leadership Behaviors of school administrators from teachers' point of view. *Foro de Educación, 15*(23), 161-184.

Papathomopoulos, N. (2016). Transformational leadership: conceptual clarifications, research data and critical reflection. In: A. Petrou, & P. Angelidis (Eds.), *Educational Administration and Leadership: Scientific Basis, Research Approaches and Practices* (pp. 37-73). Athens: Diadrasi.

Saiti, A., & Saitis, C. (2012). *Theory, Research and Case Study.* Athens: Self-publishing.

Shava, G. N., & Tlou, F. N. (2018). Distributed leadership in education, contemporary issues in educational leadership. *African Educational Research Journal, 6*(4), 279-287.

Shitana, S. S. (2018). Instructional leadership. *The Namibia CPD Journal for Educators, 135–143.* https://doi.org/10.32642/ncpdje.vi.1265

Suherni, E. S., Wahyudin, A., & Gunawan, A. (2023). Analysis of Adaptive and Participatory Leadership Models Study of Educational Institutional Leadership Models. *Journal of Educational Analytics, 2*(4), 495-502. https://doi.org/10.55927 /jeda.v2i4.6732

Tamisoglou, C. (2020). *Leadership in Education: The role of the school principal.* Athens: Gutenberg.

Theofilidis, C. (2012). *School Leadership and Administration. From Bureaucracy to Transformational Leadership.* Athens: Gregory.

Torrance, D. (2013). Distributed leadership: Challenging five generally held assumptions. *School Leadership & Management, 33*(4), 354-372.

Varelas, A. (2023). *Conflict management in the faculty association: a research approach.* Athens: Topos.

Wang, Q., Hou, H., & Li, Z. (2022). Participative leadership: a literature review and prospects for future research. *Frontiers in Psychology, 13*, 1-12. https://doi.org/ 10.3389/fpsyg.2022.924357

Yukl, G. A. (2002). *Leadership in Organizations* (5th Ed.). Upper Saddle River, NJ: Prentice-Hall.

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A Systematic Literature Review of Literacy Development of K-2 Black Boys

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Abstract

Systemic barriers often prevent young Black boys from full development of their potential, including in the area of literacy. This systematic literature review seeks to better understand the landscape of literacy development of Black boys in kindergarten, first, and second grades by answering the question: What does previous literature indicate about how the U.S. education ecosystem impacts K-2nd grade Black boy's language arts interests and abilities?

We used the Khan framework for this review. Searching three academic databases and an expert consultation yielded 46 relevant works, which were analyzed for their framing (i.e., asset- or deficit-based), focal areas, and findings. We identified seven themes across this body of work: literacy skills assessment, the impact of the use of Black English, inclusive and culturally relevant curricula, interventions and pedagogical approaches, professional development, student engagement, the research agenda. Our findings support an asset-based approach that emphasizes the abilities of young Black boys to flourish academically when appropriate support is provided.

Keywords:

K-2, Early Elementary, Black Boys, Literacy, Asset-Based

Introduction

With an increasing international focus on evidence-based literacy instruction, educators require adequate support to teach racially, culturally, and linguistically diverse students through high-quality methods of instruction. Academic performance, especially in reading, differs between young Black boys and other student groups, with their reading scores being lower than that of boys who are White, Latino, or Asian (Moore & Phelps, 2021). Removing the systemic barriers that result in such gaps in learning opportunities is not only a moral imperative for educators but also a necessary component of supporting all students in reaching their full personal potential.

Prior, related work includes a literature review on Black boys' literacy across K-12 (Tatum et al., 2021). This project expands on that work by (1) including studies published in the last four years, (2) identifying themes for K-2 students specifically, (3) include literature in addition to peer-reviewed studies

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(see below), and (4) focusing on the United States in general, as opposed to focusing on its southern region.

This systematic literature review analyzes literature related to the literacy development of Black boys from kindergarten to second grade, a stage of literacy growth critical for literacy identity development and achievement. Our research question for this study was: What does previous literature indicate about how the U.S. education ecosystem impacts K-2nd grade Black boy's language arts interests and abilities?

The results of this systematic literature review shed light on implications for educators and researchers in supporting Black boys' literacy. We note that some research focuses on what is called African American English, African American Vernacular English, or Black English. For the sake of consistency, we will use the term Black English, regardless of the term used in the original literature.

Methodology

The examination of differences in performance between various groups of students is often framed by deficit thinking (Davis, 2019), the implicit assumption that any performance gaps stem from shortcomings of the children, their families, or communities. This approach tends to blame students – especially those from groups who have been discriminated against – for gaps in academic achievement instead of focusing on the aspects of the educational system that have failed to support the students, including by failing to provide appropriate opportunities to all students. In this systematic literature review, we sought to avoid deficit thinking and instead focused on the assets and strengths that students bring to their education, despite being embedded within systems that often present numerous barriers to their success.

One author identifies as a Black, middle-class, heterosexual, Christian female in her thirties, whose first language is English. She is a former early childhood educator and currently focuses her work on creating racially inclusive environments for students and families. She is the mother of a Black son and daughters. Another author identifies as a White, middle class women. Her background includes time as an English Language Arts teacher and as a curriculum developer. She is currently a researcher focused on improving equity for all students, particularly those from groups who have been historically marginalized.

One author identifies as a cisgender, White, middle-class woman. Her background includes teaching racially, culturally, and linguistically diverse students across grades K-8. She is currently an Associate Professor of Elementary & Literacy Education, and her scholarship and teaching focuses on the preparation and support of K-6 teachers to teach in culturally affirming ways. One author is an education researcher whose path started as a computer scientist in industry, who then moved to academia where she discovered that some of the same issues in industry that are related to identity impact who ultimately studies and chooses computer science as a career path. She approaches her education research through a lens of scientific inquiry, ethics, and fairness to explore how education can be shaped so that all students may flourish.

For our systematic literature review, we used the Khan framework (Khan et al., 2003), which delineates the review in five major steps. We selected the Khan methodology since it offers a clear, systematic framework that ensures thoroughness, consistency, and replicability. The five steps outlined by Khan—framing the research question, identifying relevant literature, selecting studies for inclusion, assessing the quality of those studies, and synthesizing the findings—align with our goals of conducting a comprehensive and unbiased review. By adhering to this established process, we aim to provide a transparent and replicable review that contributes meaningful insights to the field. Each of these steps, which include the results, is discussed in the following sections.

Step 1: Framing the Question

We framed our question based on our knowledge of the field. Given the awareness that racism affects the educational experiences of Black boys (Carey et al., 2022; Nyborg & Curry, 2003; Staggers-Hakim, 2016), we wanted to better understand literacy development among Black boys. We wanted to learn what the literature indicates about how the educational ecosystem impacts K-2nd grade Black boys' language arts interests and abilities. Thus we framed our research question accordingly to What does previous literature indicate about how the U.S. education ecosystem impacts K-2nd grade Black boy's language arts interests and abilities?

Step 2: Identifying Relevant Work

To identify relevant work, we specified the following process a priori. We selected three databases given their extensive materials in education research literature: SCOPUS, EBSCO, and ERIC-EBSCO. We did not limit results by date of publication.

We defined the following search string to give to each of the identified databases:

- ("Black boys" OR "African American boys" OR "African-American boys") AND
- ("Early elementary" OR "Kindergarten" OR "first grade" OR "second grade" OR "early childhood" OR "1st grade" OR "2nd grade" OR "K-2") AND

- (“communication” OR “writing” OR “reading” OR “vocabulary” OR “letter recognition” OR “phonics” OR “phonemics” OR “syllables” OR “sight words” OR
- “literacy” OR “reading” OR “language arts” OR “high frequency words” OR “reading fluency”)

Step 3: Assessing the Quality of the Articles

One of the researchers conducted the search in July 2024. Using our keyword search against all three databases resulted in 1,946 articles. The researcher then first removed the duplicates (n = 230), and the resulting 1,716 articles were assessed for quality and relevance. Two articles were excluded because they were not written in English.

Our team met to define the criteria for the quality assessment that would align with the research question as:

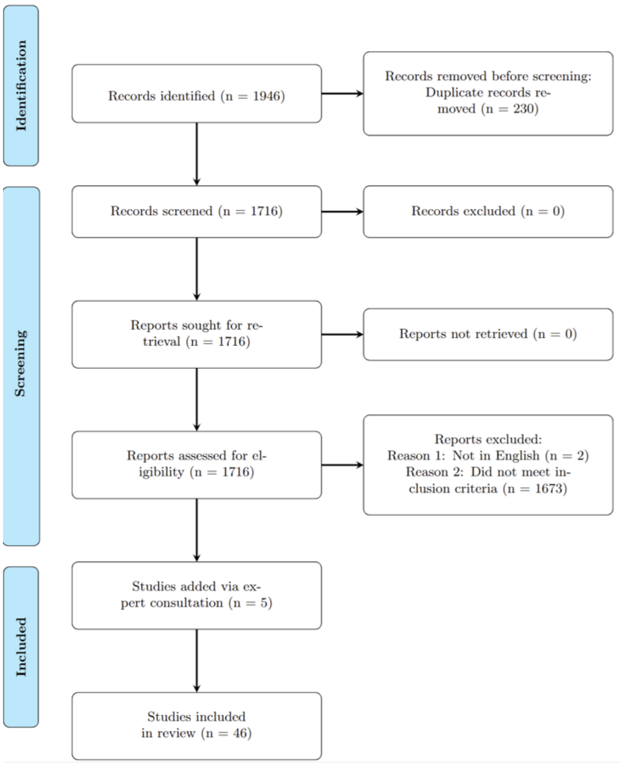
- focused on the United States
- focused on Black boys, in whole or part
- focused on kindergarten, first, and/or second grade
- addressed literacy, including oral and/or written communication, reading, vocabulary, and so forth
- described challenges and/or opportunities for learning success

Note that as a team we collectively and intentionally made the choice to include some articles in addition to peer-reviewed studies, such as research-based position papers. (We define a research-based position paper as a piece that incorporates prior research in the articulation of a position, in contrast to other position papers or opinion pieces, which may not make reference to prior research.) We made this decision since we recognized that important contributions might stem from these sources, including the possibility of more research-based position papers written after the global reckoning on racial justice and increased racial awareness that arose after the 2020 murder of George Floyd as well as the possibility for historical bias in publishing.

Step 4: Summarizing the Evidence (Results)

The result of this process was a set of 41 articles. We supplemented the systematic review with an expert consultation, an addendum to a traditional literature review process that may provide additional useful insight into the topic (Morris et al., 2018), which resulted in the addition of 5 articles. Thus, there are a total of 46 articles in the dataset.[1] This methodology is summarized in the PRISMA diagram (see Figure 1), created according to the PRISMA methodology (Page et al., 2021).

Figure 1
PRISMA diagram.



Once the set of papers was determined and the criteria for the quality assessment was defined, the set of papers was divided among the authors. We used a spreadsheet to record key information about each item in the set, using the following list of questions:

- Did it assume an asset-based or a deficit-based approach to the study of Black boys?
- Did it focus on the engagement of caregivers?
- Did it focus on the socio-economic status of caregivers?
- Did it focus on the behavior of Black boys?
- Did it focus on Black English?
- If specified, what aspect(s) of literacy did it examine (e.g., vocabulary, oral language, writing)?
- If a study: what type (e.g., qualitative) was it?
- If a study: what was the context?
- What are the key findings (for a study) or concepts (if not)?

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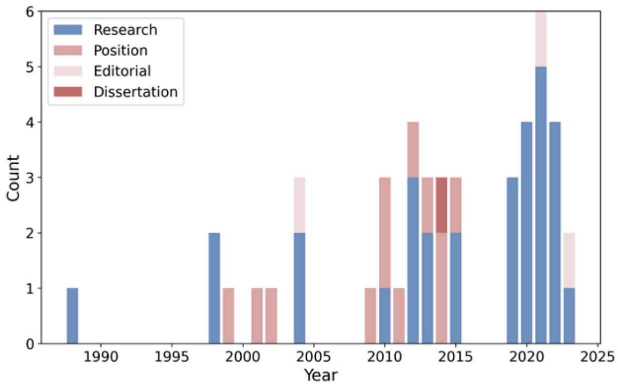
Figure 2

Type of paper by year of publication.



We classified papers as either research articles, position papers, editorials, or dissertations (see Figure 2). While one article appeared in the 1980s (Brutten & Miller, 1988), papers started appearing more regularly in late 1990s, with growth in this area from 2019 through 2024–in particular of research articles. We also note that the analysis was conducted in mid-2024, and we anticipate that more articles have been published in the remainder of the year. Position papers were more common before 2016, and none are in the dataset after that date. We also found approximately equal counts of position papers (*n* = 12), qualitative studies (*n* = 11), and quantitative studies (*n* = 10), with fewer mixed methods studies (*n* = 6), editorials (*n* = 3), literature reviews (*n* = 3), and dissertations (*n* = 1); see Table 1.

Table 1

Count of papers by type.

Type	Count	References
Position Paper	12	Brown and Donnor (2011), Diller (1999), Hughes-Hassell et al. (2010), Husband (2012b, 2014), Jones (2002), Ladson-Billings and Gomez (2001), Rashid (2009), Walton and Wiggan (2014), Weddington (2010), Wood and Jocius (2013), and Wright et al. (2015)
Qualitative Study	11	Curenton et al. (2022), Everett and Moten (2022), Ford et al. (2021), Frieson and Scalise (2021), Pressley et al. (2004), Sherbine (2019), Sherfinski (2023a, 2023b), Stevenson and Ross (2015), Wynter-Hoyte and Smith (2020), and Yoon (2015)
Quantitative Study	10	Brutten and Miller (1988), Craig et al. (1998a, 1998b), Fitton et al. (2021), Gibson and Cartledge (2012), Holt and Asagbra (2021), Noltemeyer et al. (2019), Russell and Drake Shiffler (2019), Washington et al. (2019), and Winsler et al. (2013)
Mixed Methods Study	6	Hamilton and DeThorne (2021), Henderson et al. (2020), Matthews et al. (2010), Tatum and Muhammad (2012), and Washington and Craig (2004)
Literature Review	3	Husband (2012a), Husband and Kang (2020), and Tatum et al. (2021)
Editorial	3	Hale (2004), Parker (2023), and Thomas (2019)
Dissertation	1	Younger (2014)

Descriptive Statistics

When examined by focus area, one-third (33%, *n* = 15) focused on the usage of Black English and 26% (*n* = 12) focused on student behavior. Additionally, 20% (*n* = 9) focused on caregiver engagement and 9% (*n* = 4) focused on caregiver income (see Table 2). Note that there is some overlap among these, so that an item may appear in more than one of these categories.

Table 2

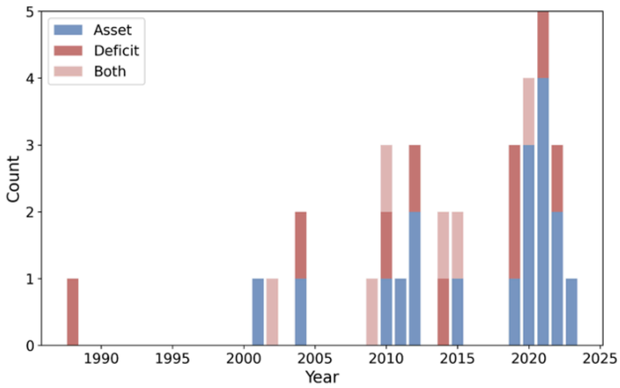
Count of papers by caregiver engagement, student behavior, caregiver income level, and use of Black English

Type	Count	References
Caregiver engagement	9	Hale (2004), Holt and Asagbra (2021), Husband and Kang (2020), Matthews et al. (2010), Pressley et al. (2004), Stevenson and Ross (2015), Weddington (2010), Wright et al. (2015), and Wynter-Hoyte and Smith (2020)
Student behavior	12	Brown and Donnor (2011), Hale (2004), Hamilton and DeThorne (2021), Holloman (2022), Husband (2012a), Husband and Kang (2020), Matthews et al. (2010), Sherbine (2019), Sherfinski (2023a), Stevenson and Ross (2015), Tatum et al. (2021), and Wynter-Hoyte and Smith (2020)
Caregiver income level	4	Craig et al. (1998a), Fitton et al. (2021), Matthews et al. (2010), and Winsler et al. (2013)
Use of Black English	15	Brown and Donnor (2011), Craig et al. (1998a, 1998b), Diller (1999), Fitton et al. (2021), Frieson and Scalise (2021), Hamilton and DeThorne (2021), Jones (2002), Russell and Drake Shiffler (2019), Sherbine (2019), Sherfinski (2023b), Tatum et al. (2021), Washington and Craig (2004), Weddington (2010), and Wynter-Hoyte and Smith (2020)

We determined the count of papers per year that had, where applicable, asset or deficit framing. To do this, the reviewers considered whether gaps in student performance were implied to be the fault of the student (indicating a deficit framing) or whether the strengths that students bring to their educations were emphasized, indicating an asset framing.

For some papers, this question of framing was not applicable (*n* = 12, 26%), both framings were used (*n* = 6, 13%), or the paper was unclear in its framing (*n* = 1, 2%). For the remainder of the papers, an approach of asset framing was more common (*n* = 18, 39%) than deficit framing (*n* = 9, 20%). As Figure 3 shows, asset-based framing is concentrated in more recent years, while deficit framing has been approximately consistent across time.

Figure 3
Framing (i.e., asset-based or deficit-based) of papers in the dataset; excludes papers where the categories are not applicable.



When we considered the aspects of literacy covered in the papers (see Table 3), general literacy (*n* = 24 or 52%) was the primary focus. A focus on reading (*n* = 11 or 24%) was the next most common, with fewer papers focusing on oral literacy (*n* = 6 or 13%), writing (*n* = 2 or 4%), and both writing and oral literacy (*n* = 3, 7%).

Table 3
Papers by aspect of literacy.

Type	Count	References
General literacy	24	Brown and Donnor (2011), Diller (1999), Everett and Moten (2022), Fitton et al. (2021), Ford et al. (2021), Gibson and Cartledge (2012), Holloman (2022), Holt and Asagbra (2021), Husband and Kang (2020), Jones (2002), Ladson-Billings and Gomez (2001), Matthews et al. (2010), Pressley et al. (2004), Rashid (2009), Russell and Drake Shiffler (2019), Sherbine (2019), Sherfinski (2023a), Stevenson and Ross (2015), Tatum and Muhammad (2012), Tatum et al. (2021), Walton and Wiggan (2014), Weddington (2010), Win-sler et al. (2013), and Wright et al. (2015)
Reading only	11	Curenton et al. (2022), Henderson et al. (2020), HughesHassell et al. (2010), Husband (2012a, 2012b, 2014), Noltemeyer et al. (2019), Thomas (2019), Washington et al. (2019), Wood and Jocius (2013), and Younger (2014)
Oral literacy only	6	Brutten and Miller (1988), Craig et al. (1998a, 1998b), Frieson and Scalise (2021), Hamilton and DeThorne (2021), and Washington and Craig (2004)
Writing and oral literacy	3	Hale (2004), Sherfinski (2023b), and Wyn-ter-Hoyte and Smith (2020)
Writing only	2	Parker (2023) and Yoon (2015)

Thematic Analysis

After reviewing all papers in the dataset, the authors met to determine what themes had emerged across the papers. We determined that there were seven main themes (as described below), based on our reading of the literature.

Literacy Skills Assessment

One theme that emerged from this dataset concerns the assessment of Black boys' literacy skills. Washington et al. (2019) investigated the literacy skills of Black elementary school students living in a low-income area via a longitudinal study. Language skills were similar for boys and girls, but older girls outperformed boys in reading skills. Similarly, Brutten and Miller (1988) found that the genders were similar in their levels of disfluency but that Black children were less disfluent than White children. Interestingly, Winsler et al. (2013) found that Black boys in elementary school who did not speak English at home were more likely to qualify for the gifted program than their peers who did. Washington and Craig (2004) found that some language assessments do not accurately assess Black students due to the students' use of Black English. Nonetheless, the researchers found that their screening protocol for preschool and kindergarten students was accurate in identifying language impediments in children who speak Black English.

Literacy and Black English

Several articles explored Black English and its interaction with the literacy development in Black children. Weddington (2010) disputes the common notion that the use of Black English is responsible for negative impacts on literacy development, instead suggesting that systemic issues are responsible. Weddington suggests that training teachers in culturally responsive instruction and developing teachers' belief in the potential of all students to succeed are key to reducing gaps in achievements. Weddington's work aligns with a study that found that indicators of Black English found in student writing did not predict literacy scores (Fitton et al., 2021).

Similarly, Craig et al. (1998b) found that comprehension tasks were not correlated with the use of Black English. In fact, one ethnographic case study showed how children leverage their Black Language ability in ways that confirm their identities and showcase their literacy (Frieson & Scalise, 2021). And Craig et al. (1998a) conducted an investigation with Black students (aged 4 to 6.5) to determine the average communication units for students who spoke Black English. They found that older children's language during free play contained longer communication units. A study by Wynter-Hoyte and Smith (2020) found that it was possible to integrate Black English and academic English in a writing workshop for first-grade students to encourage the development of positive racial and linguistic identities, which can be seen as a point of reference to the acceptance of Black English.

More specific to Black boys, Hamilton and DeThorne (2021) drew on a framework of culturally and linguistically responsive classroom management to demonstrate how one Black boy received more behavior-related warnings related to his use of Black English. However, in a study of Black first grade boys by Russell and Drake Shiffler (2019) found that an intervention designed to improve their phonological awareness – particularly in instances where Black English may differ from academic English – showed promise for improving students' literacy skills.

Inclusive and Culturally Relevant Curricula

In the context of a review of the literature, Tatum and Muhammad (2012) found that the instructional methods used by teachers significantly influence the reading performance of Black boys. Wynter-Hoyte and Smith (2020) pleaded with educators to abandon the excuse of needing to meet learning standards as the reason for continuing to teach curriculum that centers whiteness and creates a limited historical narrative of Black people.

Sherfinski (2023b) demonstrates how two Black kindergarten boys push back on semi-scripted curriculum instruction during a writer's workshop to draw on their personal and cultural resources and engage in playful, holistic learning. They argue that when educators do not individualize scripted curriculum, Black boys in particular are harmed. On the other hand, in a survey of the characteristics of a high-achieving school that serves Black students, Pressley et al. (2004) noted, among many other factors, that literature by and about Black Americans was common in the curriculum. This practice suggests cultural awareness and an intentional effort to promote a curriculum that mirrors student demographics.

Many articles focused on the impact of culturally responsive curriculum, including texts. Curenton et al. (2022) propose a theoretical model for fostering racial literacy via storybooks. In this model, books that are racially affirming prompt conversation, which in turn prompts both positive identity as well as positive emotional regulation. The result of this process is racial literacy. Wood and Jocius (2013) posit a need for critical literacy with Black boys that includes using culturally relevant texts, a collaborative learning environment, and critical conversations about the text. Wright et al. (2015) stress the need for Black boys to have 'mirror' books – or books that reflect who they are. Similarly, Wood and Jocius (2013) discuss how children should see protagonists that are of the same cultural background. Henderson et al. (2020) offer recommendations for primary educators to critically analyze their classroom libraries for culturally diverse texts. For example, educators can consider the extent to which materials mirror their students' identities.

Stevenson and Ross (2015) propose a theoretical model for how the use of racially affirming storybooks can lead, via conversations of topics related to ethnic-racial socialization (e.g., cultural pride) to positive racial identity, positive emotional regulation, and racial literacy. In contrast, Parker (2023) argues that a lack of wide-ranging literacy tasks negatively impact Black boys as writers. Husband (2012b) proposes that teachers should use culturally relevant literature that reflects Black culture, in both broad and specific contexts, along with increasing the number of texts with male characters.

Interventions and Pedagogical Approaches

Several studies report on interventions that show promise for promoting literacy among young Black boys. In one study, community members provided dialogic reading intervention to Black boys in pre-kindergarten and kindergarten in a rural community (Holt & Asagbra, 2021), leading to significant improvement in the boys' literacy skills. Walton and Wiggan (2014) identified readers theater as a promising practice for supporting the literacy, particularly the reading fluency, of Black boys. Husband (2012a) also suggests using readers theater to allow Black boys to be active participants in their learning. Further, Husband suggests that Black boys would benefit from alternative reading support systems, particularly literacy programs for Black boys that are led by Black men. Tatum and Muhammad (2012) identified the need to use historical framings to approach literacy instruction with Black boys through literary presence, literary pursuits, and literary character.

Using a graphic organizer, connecting to students' interests, and including more comprehension strategies in lessons are all methods found to be beneficial for promoting literacy among young Black boys (Younger, 2014). In a small (n = 4) study of Black boys, Gibson and Cartledge (2012) found that a fluency-building activity improved fluency but not comprehension.

Quality Professional Development for Teachers

Ladson-Billings and Gomez (2001) argue that careful work in teachers' professional learning communities – where teachers themselves identify the ways in which their schools can present barriers to some students – are the key to improving learning outcomes for all students. This position is supported by, for example, a case study of a Black kindergarten boy (Sherfinski, 2023a), which showed that White teachers' lack of training could amplify the effects of microaggressions in the classroom. Similarly, White teachers have reflected on how their limited experiences could shortchange their Black students and how attention to the needs of these students could result in improved outcomes (Diller, 1999).

Other work supports the importance of quality professional development as well. Holloman (2022) found that the reading comprehension scores of 2nd and 3rd grade Black boys improved when professional development emphasizing culturally responsive teaching and a professional learning community were implemented. Ford et al. (2021) conclude from a case study of a gifted and talented Black third-grader that teachers require cultural competence in order to provide equitable learning experiences to all students, including those from minoritized backgrounds. Attending a grade-level meeting, consulting with other colleagues, and having a tutoring program for the students and a professional development program for the teachers are all promising practices for increasing the literacy levels of Black boys (Younger, 2014).

Student Engagement

Jones (2002) suggests reasons why Black boys have low reading interest, including educators' low expectations and educators' biases against Black English while they simultaneously blame Black families for the state of education for Black children. Similarly, Hale (2004) identified practices that may constitute systematic barriers to the success of Black children. These practices include the reassignment of curricular topics from higher to lower grade levels, school leaders' lack of awareness of students' backgrounds, and unequal preschool educational experiences. Hale (2004) also identified family support and ensuring success in early reading as keys to supporting the success of these young students. Husband (2012a) argues that prescriptive curriculum is a factor in early childhood and elementary Black boys' declining interest in reading.

Other articles examine how best to engage Black boys in literacy. Via a case study, Everett and Moten (2022) explored how engaging, meaningful texts enabled Black boys to advance their literacy skills. To help motivate second grade Black boys to engage in reading, Thomas (2019) introduced the first book in a series either during read-aloud or independent reading, included the follow-up books in the series in the classroom library, prioritized student commentary in chapter discussions, and assigned students the role of organizing and caring for the classroom library. Hughes-Hassell et al. (2010) offer recommendations for supporting Black boys as readers during 2nd to 5th grade, as they progress to becoming transitional readers, in order to address declining interest in reading due to factors such as a lack of culturally responsive texts. Sherbine (2019) uses a posthumanist lens to analyze ethnographic data of three Black boys' literacy engagement during a literacy workshop to demonstrate how these second graders diverge from narrow definitions of literacy, arguing for a broadening of the conceptualization of literacy to allow for more just literacy instruction.

Rashid (2009) cataloged the characteristics of early childhood education programs that best meet the needs of Black boys; these attributes include high expectations, individualized literacy activities, higher levels of physical activity – especially culturally relevant activities – in the classroom, and an asset-focused approach. Similarly, Husband (2014) identified a framework for better engaging Black boys in elementary school in reading, with three focal areas: curriculum, pedagogy, and the institution. Within the curriculum category, Husband (2014) identified promising ways to improve engagement, such as using curriculum with themes that tend to appeal to boys, including content related to real-life experiences. Pedagogical strategies include adopting active learning strategies such as movement and singing, and institutional factors include not overemphasizing the acquisition of basic literacy skills.

The Research Agenda

A few pieces commented on research that involves Black boys and literacy. Tatum et al. (2021) provide an overview of the research (from 1999 to 2020) on Black male literacies, demonstrating key foci and suggesting several avenues for future research: developing a vision for the literacy of Black men, conduct more research (both qualitative and quantitative) across many kinds of contexts, and promote appropriate theoretical frameworks.

A recent literature review found fewer than two dozen research studies focused on literacy and young Black boys (Husband & Kang, 2020), suggesting the need for much more research in this area. The literature that does exist was categorized by Husband and Kang (2020) as reflecting five major themes: (1) the importance of culturally responsive texts, (2) a stress on critical literacy (e.g., focusing on social justice), (3) offering opportunities for student choice and collaborative work, (4) implementing some specific instructional strategies, such as phonemic awareness, and (5) considering the larger school context (e.g., disproportionate discipline).

Johnson (2022) argued that researchers should frame research goals focused on the expertise, abilities, and insights of Black children – in contrast to some research which can be overly-focused on, for example, (perceived) behavior problems. Similarly, Brown and Donnor (2011) argue for a necessary new narrative on Black men's literacy that moves away from framing Black boys as at-risk and in need of behavior modification strategies.

Yoon (2015) determined that social and cultural aspects of language were not

consistently measurable on the classroom assessments for Black kindergartens, suggesting that more research is needed in this area to ensure that appropriate assessments exist.

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Step 5. Interpreting the Findings, Including Recommendations

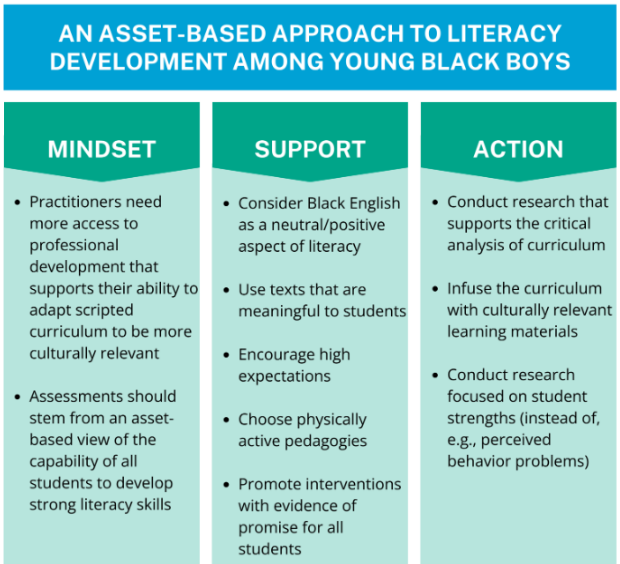
As the results section shows, the major themes in the literature around Black boys' literacy development are:

1. literacy skills assessment,
2. impact of the use of Black English,
3. inclusive and culturally relevant curricula,
4. interventions and pedagogical approaches,
5. professional development,
6. student engagement, and
7. the research agenda.

We note that, as the previous section suggests, there is often some overlap between these categories, such as work suggesting that more research related to assessment is needed (Yoon, 2015), thus showing an overlap between the themes of literacy skills assessment and the research agenda.

Figure 4

A summary of principles of an asset-based approach to literacy development among young Black boys.



The themes identified in this set can be categorized into three broad groups: mindset, support, and action; see Figure 4. While, once again, there can be some overlap of categories, we conceive mindset as involving topics related to professional development and literacy skills development. Professional development should focus on providing teachers with the evidence that supports a mindset focused on taking an asset-based approach that sees the potential for all children to learn despite external obstacles and structural barriers. Practitioners also need more access to professional development that supports their ability to adapt scripted curriculum to be more culturally relevant. Similarly, the assessment of literacy skills should stem from an asset-based view of the capability of all students to develop strong literacy skills, and such assessment in turn provides further evidence for an asset-based mindset that encourages the potential in all students to develop robust literacy skills.

The broad grouping of support includes the themes of the impact of Black English, interventions and pedagogical approaches, and student engagement. The studies in the dataset suggest that Black English's impact on the literacy development of Black boys is either neutral or positive and should be treated as such. Boys who can code switch bring a distinct strength to their studies. Thus, Black English use is a practice that can be supported. Supporting promising pedagogical approaches and fostering student engagement involves choosing texts that are meaningful to students, encouraging high expectations, choosing physically active pedagogies, and promoting interventions with evidence of promise for all students.

The third broad group is action, which focuses on the themes of inclusive and culturally relevant curricula and the research agenda. Such curricula is a key part of supporting the literacy development of Black boys, and this relates to, as previously mentioned, the use of texts that are meaningful to students. And one of the most important results of the analysis of the body of research is that there simply is not enough of it, as Tatum et al. (2021) argue. Thus, a key area for action is promoting more research into the literacy development of young Black boys.

Cross-cutting all of these themes is concern with an asset-based approach. Many papers display a deficit-based approach in the introduction to the work by, for example, presenting the difference in test scores between Black boys and other children in a way that suggests that Black boys are lacking, deficient, or problematic. In many cases, the remainder of the paper does not have a deficit lens and, in fact, often appears focused on providing improved opportunities for Black boys to counteract systemic inequities. Study authors can benefit from introducing their work in ways other than with a deficit frame.

This does not mean that, for example, statistics showing differential performance cannot be included. Rather, it means framing them to suggest that historical and systematic factors – not individual Black boys or their families or communities – are responsible for the difference. Similarly, the use of Black English is sometimes blamed for differing performances in literacy skills, but the evidence in this dataset suggests that this is not in fact the case. Likewise, student engagement may be approached from the deficit-based perspective of focusing on the behavior problems of individual students or it may be approached from an asset-based perspective that focuses on how meaningful texts can positively engage students in their own literacy development.

We note a possible limitation to this study: as a literature review, it relies on the work of previous researchers, who – as with all researchers – bring their own potential for bias into their work. Therefore, some of the gaps in what is known about the literacy development of young Black boys may be due to these biases as well as to biases in the educational system.

Conclusion

This systematic literature review identified seven major themes – forming three broad categories – that sketch the landscape of what is known about the literacy development of Black boys in the early elementary grades.

One benefit of a systematic review of the literature such as this one is that it makes possible distillation of lessons learned from a variety of research studies and other work. This distillation, in turn, can then be leveraged to improve literacy instruction for Black boys. This improvement might include, for example, integrating literacy instruction with learning in other subject areas. Our work in this systematic literature review was motivated in part by the desire to better understand literacy development in young Black boys as a precursor to work on a series of storybooks that could promote that literacy development but also promote inclusivity in computing education for all children, especially Black girls.

Acknowledgments

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Footnotes

[1]The included studies are Brown and Donnor (2011), Brutten and Miller (1988), Craig et al. (1998b, 1998a), Curenton et al. (2022), Diller (1999), Everett and Moten (2022), Fitton et al. (2021), Ford et al. (2021), Frieson and Scalise (2021), Gibson and Cartledge (2012), Hale (2004), Hamilton and DeThorne (2021), Henderson et al. (2020), Holloman (2022), Holt and Asagbra (2021), Hughes-Hassell et al. (2010), Husband (2012b, 2012a, 2014), Husband and Kang (2020), Jones (2002), Ladson-Billings and Gomez (2001), Matthews et al. (2010), Noltemeyer et al. (2019), Parker (2023), Pressley et al. (2004), Rashid (2009), Russell and Drake Shiffler (2019), Sherbine (2019), Sherfinski (2023b, 2023a), Stevenson and Ross (2015), Tatum and Muhammad (2012), Tatum et al. (2021), Thomas (2019), Walton and Wiggan (2014), Washington and Craig (2004), Washington et al. (2019), Weddington (2010), Winsler et al. (2013), Wood and Jocius (2013), Wright et al. (2015), Wynter-Hoyte and Smith (2020), Yoon (2015), and Younger (2014).

References

Brown, A. L., & Donnor, J. K. (2011). Toward a New Narrative on Black Males, Education, and Public Policy. *Race, Ethnicity and Education*, *14*(1), 17–32. https://doi.org/10.1080/13613324.2011.531978

Brutten, G. J., & Miller, R. (1988). The disfluencies of normally fluent black first graders. *Journal of Fluency Disorders*, *13*(4), 291–299. https://doi.org/10.1016/0094-730X(88)90020-4

Carey, R. L., Polanco, C., & Blackman, H. (2022). Black Adolescent Boys' Perceived School Mattering: From Marginalization and Selective Love to Radically Affirming Relationships. *Journal of Research on Adolescence: The Official Journal of the Society for Research on Adolescence*, *32*(1), 151–169. https://doi.org/10.1111/jora.12706

Craig, H. K., Washington, J. A., & Thompson, -Porter Connie. (1998a). Average C-Unit Lengths in the Discourse of African American Children From Low-Income, Urban Homes. *Journal of Speech, Language, and Hearing Research*, *41*(2), 433–444. https://doi.org/10.1044/jslhr.4102.433

Craig, H. K., Washington, J. A., & Thompson, -Porter Connie. (1998b). Performances of Young African American Children on Two Comprehension Tasks. *Journal of Speech, Language, and Hearing Research*, *41*(2), 445–457. https://doi.org/10.1044/jslhr.4102.445

Curenton, S. M., Harris, K., Rochester, S. E., Sims, J., & Ibekwe-Okafor, N. (2022). Promoting racial literacy in early childhood: Storybooks and conversations with young black children. *Child Development Perspectives*, *16*(1), 3–9. https://doi.org/10.1111/cdep.12440

Davis, L. P. M. (2019). What Is Deficit Thinking? An Analysis of Conceptualizations of Deficit Thinking and Implications for Scholarly Research. *NCID Currents*, *1*(1). http://dx.doi.org/10.3998/currents.17387731.0001.110

Diller, D. (1999). Opening the Dialogue: Using Culture as a Tool in Teaching Young African American Children. *The Reading Teacher*, *52*(8), 820–828.

Everett, S., & Moten, T. (2022). Looking Back and Learning Forward: Cultivating Robust Literacy Instruction and Joy among Black Elementary Boys. *Language Arts*, *99*(5), 313–324. https://doi.org/10.58680/la202231791

Fitton, L., Johnson, L., Wood, C., Schatschneider, C., & Hart, S. A. (2021). Language Variation in the Writing of African American Students: Factors Predicting Reading Achievement. *American Journal of Speech-Language Pathology*, *30*(6), 2653–2667. https://doi.org/10.1044/2021_AJSLP-20-00263

Ford, D. Y., Wright, B. L., & Tyson, C. A. (2021). Lance and Other Gifted and Talented Students of Color Matter: Five Models and Theories to Guide Early Childhood Educators in Advancing Equity. *Gifted Child Today*, *44*(1), 48–56. https://doi.org/10.1177/1076217520940754

Frieson, B. L., & Scalise, M. (2021). Linguistic artistry and flexibility in dual-language bilingual classrooms: Young Black children's language and literacy practices. *Bilingual Research Journal*, *44*(2), 213–230. https://doi.org/10.1080/15235882.2021.1942323

Gibson, L., & Cartledge, G. (2012). The Effects of Fluency Instruction on the Oral Reading Fluency and Comprehension of First-Grade African American Males with Reading Risk. *The Journal of Special Education Apprenticeship*, *1*(2). https://doi.org/10.58729/2167-3454.1012

Hale, J. E. (2004). How schools shortchange African American children. *Educational Leadership*, *62*(3), 34–39.

Hamilton, M.-B., & DeThorne, L. (2021). Volume and Verve: Understanding Correction/Behavioral Warnings in Teacher–Child Classroom Interactions Involving an African American Kindergarten Student. *Language, Speech, and Hearing Services in Schools*, *52*(1), 64–83. https://doi.org/10.1044/2020_LSHSS-19-00105

Henderson, J. W., Warren, K., Whitmore, K. F., Flint, A. S., Laman, T. T., & Jaggers, W. (2020). Take a Close Look: Inventorying Your Classroom Library for Diverse Books. *The Reading Teacher*, *73*(6), 747–755. https://doi.org/10.1002/trtr.1886

Holloman, B. (2022). *Improving Literacy for Elementary School Black Boys through Culturally Responsive Pedagogy and Professional Learning Communities* [Ed.D., Fordham University]. https://www.proquest.com/docview/2662724348/abstract/D0F838169F5446FFPQ/1

Holt, Y., & Asagbra, E. (2021). Implementing Dialogic Reading Intervention Through Community-Based Participatory Research: A Tutorial. *Language, Speech, and Hearing Services in Schools*, *52*(1), 4–15. https://doi.org/10.1044/2020_LSHSS-19-00100

Hughes-Hassell, S., Koehler, E., & Barkley, H. (2010). Supporting the literacy needs of African American transitional readers. *Teacher Librarian*, *37*(5), 18–23.

Husband, T. (2012a). Addressing Reading Underachievement in African American Boys through a Multi-Contextual Approach. *Reading Horizons: A Journal of Literacy and Language Arts*, *52*(1). https://scholarworks.wmich.edu/reading_horizons/vol52/iss1/2

Husband, T. (2012b). Why Can't Jamal Read?. *Phi Delta Kappan*, *93*(5), 23–27.

Husband, T. (2014). Increasing Reading Engagement in African American Boys. *Multicultural Learning and Teaching*, *9*(2), 157–170. https://doi.org/10.1515/mlt-2013-0002

Husband, T., & Kang, G. (2020). Identifying Promising Literacy Practices for Black Males in P-12 Classrooms: An Integrative Review. *Journal of Language and Literacy Education*, *16*(1). https://eric.ed.gov/?id=EJ1253935

Johnson, W. F. (2022). Conducting racial awareness research with African American children: Unearthing their sociopolitical knowledge through Pro-Black literacy methods. *Journal of Early Childhood Literacy*, *22*(3), 408–432. https://doi.org/10.1177/14687984221123000

Jones, L. (2002). Why Jamal still can't read. *Black Issues in Higher Education*, *4*, 52–55.

Khan, K. S., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, *96*(3), 118–121.

Ladson-Billings, G., & Gomez, M. L. (2001). Just Showing up: Supporting Early Literacy through Teachers' Professional Communities. *Phi Delta Kappan*, *82*(9), 675–680. https://doi.org/10.1177/003172170108200908

Matthews, J., Kizzie, K. T., Rowley, S. J., & Cortina, K. (2010). African Americans and Boys: Understanding the Literacy Gap, Tracing Academic Trajectories, and Evaluating the Role of Learning-Related Skills. *Journal of Educational Psychology*. https://doi.org/10.1037/a0019616

Moore, J. S., & Phelps, C. (2021). Changing the narrative on African American boys: A systemic approach to school success. *Improving Schools*, *24*(2), 112–123. https://doi.org/10.1177/1365480220962865

Morris, A., Onwuegbuzie, A., & Gerber, H. (2018). Using Expert Interviews within MODES in Online and Offline Spaces to Extend Comprehensive Literature Review Processes. *The Qualitative Report*, *23*(8), 1777–1798. https://doi.org/10.46743/2160-3715/2018.3039

Noltemeyer, A. L., Joseph, L. M., & Kunesh, C. E. (2019). Effects of Supplemental Small Group Phonics Instruction on Kindergartners' Word Recognition Performance. *Reading Improvement*, *56*(3), 149–160.

Nyborg, V. M., & Curry, J. F. (2003). The Impact of Perceived Racism: Psychological Symptoms Among African American Boys. *Journal of Clinical Child & Adolescent Psychology*, *32*(2), 258–266. https://doi.org/10.1207/S15374424JCCP3202_11

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Parker, K. (2023). *The Writing Lives of Black Boys*. ASCD.

Pressley, M., Raphael, L., Gallagher, J. D., & DiBella, J. (2004). Providence-St. Mel School: How a School That Works for African American Students Works. *Journal of Educational Psychology*, *96*(2), 216–235. https://doi.org/10.1037/0022-0663.96.2.216

Rashid, H. M. (2009). From Brilliant Baby to Child Placed at Risk: The Perilous Path of African American Boys in Early Childhood Education. *Journal of Negro Education*, *78*(3), 347–358.

Russell, J., & Drake Shiffler, M. (2019). How Does a Metalinguistic Phonological Intervention Impact the Reading Achievement and Language of African American Boys? *Reading & Writing Quarterly*, *35*(1), 4–18. https://doi.org/10.1080/10573569.2018.1535774

Sherbine, K. (2019). Wrestling with Competency and Everyday Literacies in School. *Journal of Language & Literacy Education*, *15*(2), 1–22.

Sherfinski, M. (2023a). Microaggressions and the Complexities of Smartness in Kindergarten. *Journal of Research in Childhood Education*, *0*(0), 1–21. https://doi.org/10.1080/02568543.2023.2264931

Sherfinski, M. (2023b). Relational aspects of writer's workshop in kindergarten: Learning from Black boys who used their creativity and strength to speak back to the scripted curriculum. *Journal of Early Childhood Teacher Education*, *44*(3), 577–597. https://doi.org/10.1080/10901027.2022.2125463

Staggers-Hakim, R. (2016). The nation's unprotected children and the ghost of Mike Brown, or the impact of national police killings on the health and social development of African American boys. *Journal of Human Behavior in the Social Environment*, *26*(3–4), 390–399. https://doi.org/10.1080/10911359.2015.1132864

Stevenson, A., & Ross, S. (2015). Starting young: Emergent Black masculinity and early literacy. *Journal of African American Males in Education (JAAME)*, *6*(1), 75–90.

Tatum, A. W., Johnson, A., & McMillon, D. (2021). The State of Black Male Literacy Research, 1999–2020. *Literacy Research: Theory, Method, and Practice*, *70*(1), 129–151. https://doi.org/10.1177/23813377211038368

Tatum, A. W., & Muhammad, G. E. (2012). African American Males and Literacy Development in Contexts That are Characteristically Urban. *Urban Education*, *47*(2), 434–463. https://doi.org/10.1177/0042085911429471

Thomas, K. L. (2019). Building Literacy Environments to Motivate African American Boys to Read. *The Reading Teacher*, *72*(6), 761–765. https://doi.org/10.1002/trtr.1784

Walton, C. W., & Wiggan, G. (2014). Readers Theater and the "Receivement Gap": The Impact of Theater-Based Instructional Strategies on African American Male's Reading Achievement. In *African American Male Students in PreK-12 Schools: Informing Research, Policy, and Practice* (Vol. 2, pp. 283–302). Emerald Group Publishing Limited. https://doi.org/10.1108/S2051-231720140000002031

Washington, J. A., Branum-Martin, L., Lee-James, R., & Sun, C. (2019). Reading and Language Performance of Low-Income, African American Boys in Grades 1–5. *Reading & Writing Quarterly*, *35*(1), 42–64. https://doi.org/10.1080/10573569.2018.1535777

Washington, J. A., & Craig, H. K. (2004). A Language Screening Protocol for Use With Young African American Children in Urban Settings. *American Journal of Speech-Language Pathology*, *13*(4), 329–340. https://doi.org/10.1044/1058-0360(2004/033)

Weddington, G. (2010). It's Not the Language: Alternative Explanations of the Education Gap for African American Children. *Topics in Language Disorders*, *30*(1), 48. https://doi.org/10.1097/TLD.0b013e3181d0a103

Winsler, A., Gupta Karkhanis, D., Kim, Y. K., & Levitt, J. (2013). Being Black, Male, and Gifted in Miami: Prevalence and Predictors of Placement in Elementary School Gifted Education Programs. *The Urban Review*, *45*(4), 416–447. https://doi.org/10.1007/s11256-013-0259-0

Wood, S., & Jocius, R. (2013). Combating "I Hate This Stupid Book!": Black Males and Critical Literacy. *The Reading Teacher*, *66*(8), 661–669. https://doi.org/10.1002/trtr.1177

Wright, B., Counsell, S., & Tate, S. (2015). "We're Many Members, but One Body:" Fostering a Healthy Self-Identity and Agency in African American Boys. *Young Children*, *70*, 24–31.

Wynter-Hoyte, K., & Smith, M. (2020). "Hey, Black Child. Do You Know Who You Are?" Using African Diaspora Literacy to Humanize Blackness in Early Childhood Education. *Journal of Literacy Research*, *52*(4), 406–431. https://doi.org/10.1177/1086296X20967393

Yoon, H. S. (2015). Assessing children in kindergarten: The narrowing of language, culture and identity in the testing era. *Journal of Early Childhood Literacy*, *15*(3), 364–393. https://doi.org/10.1177/1468798414548778

Younger, Q. (2014). *Factors contributing to the underperformance of African American boys in k-3 reading* [Ed.D., Walden University]. https://www.proquest.com/docview/1526442442/abstract/E07B04F9AEB24B11PQ/1

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What Do Future Primary School Teachers Know about Conscious Consumption and How Do They Behave?

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Abstract

Unconscious consumption of resources by individuals leads to many economic, social and environmental problems. Therefore, conscious consumerism and consumer education are criticallly important to develop knowledge and skills to make informed and rational choices taking social values and goals into account. Based on that, the research was conducted as a descriptive case study to assess pre-service primary school teachers' awareness of 'conscious consumer'. The study was conducted with a cohort of 60 pre-service teachers enrolled as second-year students in primary education programs. The results showed that the participants had insufficient knowledge about the conscious consumer. Their conceptualisations were primarily manifested through limited and superficial patterns of behaviour. Their practical behaviour related to conscious consumer in everyday life appeared to be limited. In addition, the definitions and behaviours articulated by the participants were largely consistent with the principles of rational consumption. Importantly, almost all the pre-service teachers did not demonstrate behaviours associated with ethical and socially responsible consumption in their daily lives, highlighting a lack of prioritisation of these dimensions.

Keywords:

Conscious Consumer, Pre-Service Primary School Teacher, Rational Consumption, Consumerism

Introduction

In the modern world, people tend towards consumption frenzy under the influence of many factors such as media and environment. Both irresponsible consumption of natural resources and unconscious purchasing behaviors lead to serious problems on a global scale. According to Fromm (2002), after the 20th century, capitalism increases consumption by keeping the desire to spend at a high level in individuals. The fact that the economic order needs individuals who constantly consume and constantly demand (İnsel, 1997) also fuels consumption. In consumer societies, consumption can become a tool and directs the individual to continuous purchasing. Beyond mere purchasing, it also leads to the unconscious consumption of resources. However, according to Bauman (2006), individuals leave aside a critical view of consumption and participate in the economic system by consuming.

There are 17 global goals for Sustainable Development (United Nations [UN], 2024). Goal 12 on sustainable development emphasizes the sustainability and effective use of natural resources (The Global Goals, 2024). Within the scope of responsible production and consumption, global goals such as sustainability of natural resources, reduction of global food waste, recycling, reduction of waste production can also raise awareness on conscious consumption. Situations such as unequal sharing of resources in the world, limited access to resources, global hunger problems, waste, deterioration of ecological balance, ozone depletion, radioactive wastes, pollution of clean water resources lead to various problems. The ecosystem and the sustainability of natural resources are endangered for these reasons. Unconscious consumption of resources by individuals leads to many economic, social and environmental problems. In order to solve these problems, new consumption habits need to be acquired and learned (Avallone et al., 2012). In this context, it is necessary to focus on the concept of conscious consumer. According to the Turkish Language Association Current Turkish Dictionary (2024), the concept of 'conscious' is defined, as 'one who is aware of his/her own actions; one who acts knowingly; conscious'. The concept of 'consumer' is defined as a person who makes a purchase in order to satisfy his/her personal desires, wishes and needs (Solomon et al., 2013). The concept of 'conscious consumer' is defined as a person who complies with the concepts of truth, honesty and equality in the choices he/she makes and considers the benefit and goodness of the whole world in the decisions he/she makes (Gogia, 2014). A conscious consumer is a person who is aware that when he/she consumes the product he/she needs, this consumption will have a direct impact primarily on himself/herself and then on the society and the world in which he/she lives (Kozinets & Handelman, 2004). A conscious consumer is a sensitive person who provides a balance between personal satisfaction and environmental protection with the responsibility he undertakes and considers the effects of his actions on future generations and the environment (Cavalcante et al., 2017). Research has shown that whether consumers purchase products by taking into account environmental characteristics, they may pay more to purchase environmentally sensitive products (Davis, 1993; Crane, 2011; Menon & Menon, 1997). Many studies can be conducted to raise consumer awareness. Within the scope of Law No. 6502, which was announced in the Official Gazette in 2013 in Türkiye, it is stated that 'necessary additions will be made to the curricula of formal and non-formal education institutions on raising consumer awareness by the Ministry of National Education (MoNE) by taking the opinion of the Ministry' (Türkiye Official Gazette, 2013).

Conscious consumption is also included in primary school programs. Considering that children are the consumers of the future, they need to gain awareness at primary school ages. said it is undeniable that the first stages of education are critical periods for children to acquire most of the gains and skills. Thus, it is of great importance that primary school teachers, whom children encounter first, gain such awanress during pre-service taining. Considering that pre-service primary school teachers will be the teachers of the future, it is crucial for them to be role models for children at the primary school level to acquire conscious consumer habits. According to Ersoy and Sarıabdullahoğlu (2010), the consumption habits that children acquire at an early age form the basis for the consumption behaviors that children will exhibit in later ages. The consumption habits of today's youth, who are the adults of the future, are vital for the sustainability of societies (Aydıner-Boylu et al., 2019).

A certain amount of research exists in the literature of sustainable consumption education (García-González et al., 2022; Rahmawati & Indartono, 2018). In a study examining consumption desire among children, it was emphasized that exposure to social media advertisements has an important role in shaping primary school children's desires (Methlouthi & Nefzi, 2023). Therefore, it is important for teachers and teacher candidates who raise children to be aware of the concept of conscious consumer. The concept of conscious consumer has an important place in the Ministry of Education Curriculum. Topics related to conscious consumerism (Güvenç, 2017) were also studied in the curriculum. The literature also includes studies on conscious consumerism education (Ersoy & Papatğa, 2015). They generally address the environmental awareness dimension of the concept of conscious consumer (Akdoğan & Durmaz, 2021) and examine the concept of conscious consumer holistically (Bozyiğit & Madran, 2018). Polat and Kır (2020) examined conscious consumerism in their research and found a statistically significant difference in conscious consumerism levels according to education levels, referring to a higher level of consciousness among participants with higher education than the ones with lower education levels.

In this context, is the current study aims to assess pre-service primary school teachers' awareness of the concept of 'conscious consumer'. The following research questions will be addressed throughout the study:

- RQ1: What are the cognitive structures of pre-service school teachers in relation to the concept of 'conscious consumer'?
- RQ2: How do pre-service school teachers

conceptualise the term 'conscious consumer'?

- RQ3: What behaviours do preservice teachers exhibit in relation to conscious consumption and what is their level of conscious consumption?

Conceptual framework

The concept of conscious consumption can be considered in five main dimensions: "socially responsible consumption", "rational consumption", "environmentalist consumption", "ethical consumption" and "voluntary simple consumption" (Buğday & Babaoğul, 2016a).

Socially responsible consumers are individuals who adopt communal living rather than individualism and prefer social ideals rather than selfishness (McCarty & Shrum, 2001). Due to the rapid increase in global consumption, many global problems such as resource depletion, pollution, global warming, poverty and species extinction are emerging. It is indispensable for individuals to take responsibility for solving such environmental and social problems. It plays a major role for individuals to have and practice socially responsible consumption behaviors by staying away from popular consumption logic, empathizing and having awareness.

Rational consumption encompasses consumption behaviors that are rational, measured, in accordance with the rules of reason, and logic. For example, before purchasing a product, a conscious consumer makes a logical decision according to the options, taking into account what is available. According to Buğday and Babaoğul (2016a), a consumer in the context of rational consumption is a conscious consumer who makes plans and decisions by considering the resources at hand, taking the opinions of his/her relatives and social environment, and reviewing the options.

The ecosystem we live in has a tremendous diversityincluding a balance in it. However, many environmental problems arise with consumption. These environmental problems lead to the rapid consumption of resources. Therefore, society needs to have environmental awareness. The consumption and purchasing behaviors of individuals with this awareness are directly proportional to the responsibility they take towards the environment. As individuals assume responsibility towards the environment, their purchasing and consumption behaviors will be shaped according to their needs.

Conscious consumers adopt ethical consumption habits. It can be said that the ethical rules expected to be followed within the scope of ethical consumption are important. There are documents and certificates expected to be in a purchased product together with the approvals by the institutions that supervise this. Production should be carried out in accordance with the laws and rules, original and certified products should be preferred, and purchasing processes should be carried out in accordance with the rules. All these are indicators of consumption awareness. According to MacIntyre (2007), ethical consumers are individuals who fulfill their responsibilities to make the world more livable.

Today, with the influence of popular culture, social media and mass media, individuals are directed towards excessive consumption, and advertisements support this tendency. However, in order to use natural limited resources effectively and efficiently in terms of consumption, it may be necessary to turn to minimalism. From this point of view, it is necessary to stay away from consumption habits that include need-oriented, low consumption, a simple life, and expensive expenditures for vanity purposes.

Method

Research model

Case study is widely recognized as a predominant research strategy in the field of social research. The case study method is a preferable choice over other methods when: (1) the main research questions focus on "how" and "why," (2) the researcher has little or no control over behavioral events, and (3) the study examines a contemporary phenomenon. (Yin, 2014, p. 2),

This study aims to comprehensively elucidate the nuances of pre-service school teachers' awareness regarding the contemporary issue of conscious consumer, focusing on the "how" aspect. Yin categorizes case studies as explanatory, exploratory or descriptive according to epistemological status (Yin, 2014). In a descriptive case study, the purpose is to 'describe' a phenomenon in detail in its real-world context (Priya, 2021, p. 96), and in some respects, a descriptive case study tests whether and in what way a case may be described when approaching it from a certain perspective (Scholz & Tietje, 2002, p. 12). In this regard, the research was conducted as a descriptive case study.

Participants

The study was conducted with a cohort of 60 pre-service teachers enrolled as second-year students in primary education programs during the spring semester of the 2023-2024 academic year. All participants gave their informed consent for inclusion before they participated in the study. Pertinent details concerning the study group are outlined in Table 1.

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Table 1

Participant Characteristics

	Their perception of themselves as conscious consumers			
	Always	Never	Partially	Total
Female	15	7	28	50
Male	3	6	1	10
Total	18	13	29	60

According to Table 1, of the male participants who participated in the research, 6 do not consider themselves to be conscious consumers, while 3 consider themselves as conscious consumers. The male participant identified as PsST34 does not consider himself to be a conscious consumer, stating: 'I am not a conscious consumer because I lack knowledge about saving and what considerations are necessary when shopping'. Conversely, the male participant with code PsST12 justifies his identity as a conscious consumer by stating: 'Yes, I consider myself a conscious consumer because I do not buy unnecessary things.

Of the female participants, 15 consider themselves to be conscious consumers, while 28 indicate that they exhibit partially conscious consumer behaviour. The participant identified as PsST32 categorises herself as partially conscious, explaining: 'I do not consider myself to be fully conscious because there are instances where I buy items that I recognise as unnecessary'. In contrast, the participant with code PsST22 describes herself as a conscious consumer, articulating, "I am a conscious consumer because I consciously check product expiration dates, only purchase essential items and avoid waste."

Data collection and data analysis

Two primary data collection instruments were used in the current research to gather information: a structured form and a scale. The first instrument was a structured form, consisting of three sections developed by the researchers. The first section focused on demographic variables and aimed to capture essential characteristics of the participants. The second section of the form contained four open-ended questions designed to explore participants' cognitive frameworks and conceptual associations in relation to conscious consumer. a) The first question used a word association test centred on the stimulus concept 'conscious consumer'. Participants were instructed to list the first 10 concepts that came to mind in relation to this stimulus. b) The second question asked participants to provide their own definitions of the concept of 'conscious consumer' in their own words. This qualitative approach aimed to elicit different perspectives and understandings of the term. c)The third question explored participants' daily practices and behaviours that were consistent with being a conscious consumer. This qualitative inquiry sought to uncover specific actions and choices that participants make in their daily lives reflecting conscious consumer behaviour. d) The fourth and final question asked participants to critically evaluate their self-perceived status as conscious consumers based on their consumption habits. Participants were asked to justify their answers, giving reasons and examples to support their judgements. In the third section of the data collection, participants were asked to design an informative poster on conscious consumption habits. The structured format of this task included a drawing area for visual representation on one side of the paper, while the reverse side provided space for participants to explain the rationale and intended messages of their poster designs.

The Conscious Consumer Scale, developed by Buğday (2015), serves as the second data collection instrument in this study. It is designed to assess an individual's level of conscious consumer through a structured framework consisting of 25 items divided into four subdimensions: environmentally conscious consumption, ethical consumption, voluntary simple consumption, and socially responsible consumption. Each item in the scale is presented in a 5-point Likert format, with statements that address different consumer behaviours.

As for the analysis of the data collected from the first data collection instrument, content analysis was used as the methodological approach. This involved consolidating similar data under pre-defined concepts and themes, guided by both theoretical frameworks and insights gained from participants' responses, to create a comprehensive code list prior to data collection (Yıldırım & Şimşek, 2008). Responses from the word association test, which aimed to elucidate participants' cognitive structures regarding conscious consumption, were systematically categorised into different codes and thematic categories. In addition, common themes and frequencies across definitions provided by participants were subsequently tabulated for clarity. In addition, the posters created by the participants were carefully examined both individually and categorically based on their thematic content. Events, phenomena or circumstances depicted in the posters were systematically coded and reported. In cases where the visual representations were ambiguous or insufficient for coding purposes, supplementary written explanations provided by the participants were included. Finally, an attempt was made to contextualise participants' perceptions and insights through exemplary poster images and associated narratives.

Findings

The aim of the study was to assess pre-service primary school teachers' awareness of the concept of 'conscious consumer'. To this end, the cognitive structures of these pre-service teachers towards the concept were first explored using a word association test. A total of 60 students participated in the test, generating 468 unique concepts related to conscious consumer, with an average of 7.8 concepts per student.

Analysis of the data from the word association test revealed that these concepts could be categorised into 8 different thematic categories. During the categorisation process, synonymous terms were treated separately, irrelevant terms were excluded from consideration and concepts mentioned only once were grouped in a separate category. The concepts grouped in this category represented 13.2% of the total number of concepts identified. Table 2 provides detailed insights into the categorised concepts and thematic categories derived from the word association test on the cognitive structures related to the concept of 'conscious consumer' among participants.

The word association test yielded concepts associated with the "conscious consumer" term, categorized as: (1) behavioral actions towards consumption; (2) affective qualities towards the concept; (3) affected elements; (4) negative consequences; (5) consumed resources; (6) purchase priorities; (7) perception towards the concept; and (8) supportive practices. The distribution of these categories and their respective concepts is detailed as follows:

In the first category, 99 instances were linked to behaviors associated with the conscious consumer concept, encompassing 15 distinct concepts. Analysis revealed that participants associated conscious consumer with behaviors such as savings, production, avoidance of unnecessary expences, list-making. Within the second category, 71 occurrences pertained to affective qualities associated with the conscious consumer concept, encompassing 12 unique concepts. Participants attributed qualities such as frugality, awareness, rationality, necessity, responsibility, and sensitivity to conscious consumer. The third category comprised 76 instances related to entities affected by the conscious consumer concept, encompassing 12 distinct concepts. Participants acknowledged that conscious consumers impact global and local elements such as the environment, economy, and future societal well-being. In the fourth category, concepts (f = 31) were delineated that relate to potential negative consequences arising from the absence of conscious consumer behaviors. Participants referenced adverse outcomes such as waste, scarcity, global warming, natural disasters, and drought. The fifth category pertains to consumed resources. Participants associated the concept of conscious consumer with resources such as water, money, electricity, clothing, food, and energy. In the sixth category, participants linked the concept of conscious consumer with terms related to conscious consumption practices, including expiration dates, product quality, user manuals, and warranty documents. Within the supportive practices category, the concept of conscious consumer was correlated with practices such as recycling, eco-friendly products, and sustainability initiatives.

In addition, the word association test identified 62 concepts (e.g. analysis, opportunity, government, credit card, public transport, homemade, bargain, etc.) that were repeated once and categorised as 'other'.

Following the identification of participants' cognitive frameworks regarding the concept of conscious consumer, their definitions were subjected to content analysis. The components within these definitions were categorised and presented in tabular form. Table 3 shows the frequencies of the components found in the definitions of conscious consumer as articulated by the participants.

The analysis of the definitions revealed that the concept was articulated through specific behavioural dimensions. Participants articulated 12 different behaviours a total of 93 times to define the concept. For example, 23 participants characterised conscious consumers as individuals who "consume or use products only when necessary". For example, participant PsST12 defined the concept as "a person who consumes or uses products according to their needs". In addition, participants emphasised the environmental awareness of conscious consumers. Participant PsST19 explained the concept as "someone who takes environmental factors into account when making decisions", while PsST31 described it as "a person who has environmentally friendly shopping habits". Several participants chose to delineate several behaviours when defining the concept. For example, PsST5 characterised conscious consumers as "people who avoid waste, use products consciously and prioritise environmental protection". Similarly, PsST38 described the concept as "individuals who are knowledgeable about and assertive in exercising their consumer rights, while consistently demonstrating environmental awareness".

As part of the research, participants were asked about their day-to-day practices that are consistent with conscious consumption. Table 4 shows the specifics of these behaviours as reported by the participants.

An analysis of the conscious consumer behaviours exhibited by the participants in their daily lives revealed 32 different behaviours, with a total of 201 occurrences. A review of the table suggests that these behaviours are predominantly in line with rational consumption practices and environmental awareness. Participants frequently highlighted behaviours such as separating recyclable materials, purchasing goods and services based on immediate needs, practicing resource conservation (e.g. water, electricity, natural gas), avoiding environmentally harmful products, minimising waste, checking expiry dates, comparing prices and keeping shopping lists. Conversely, behaviours such as keeping income-expenditure accounts and checking contracts were each reported by a single participant.

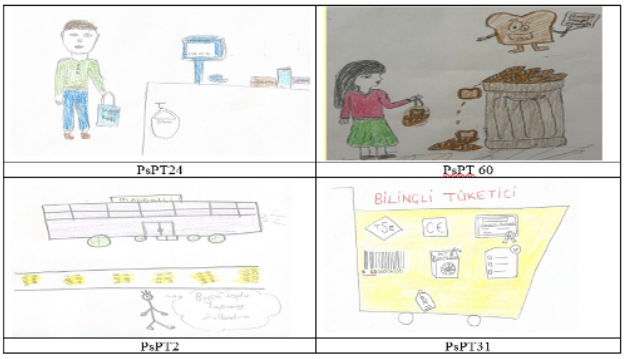
Posters created by participants to illustrate their conscious consumption habits were coded based on the events, facts and behaviours depicted, and these codes are detailed in Table 5.

The data derived from the drawings on conscious consumption habits are categorised into five thematic areas: saving, recycling, purchasing priorities, consumer rights, environmental awareness. The participants mainly depicted behaviours such as saving water, preferring recyclable products, shopping consciously based on needs, checking product expiry dates, commitment to environmental protection, using renewable resources and a preference for sustainable products. Explanatory examples from their statements illustrate these behaviours. For example, respondent PsPT45, on the subject of saving, stated: "A conscious consumer saves energy and protects the environment by opting for solar-powered water heaters". PsPT44 emphasised the theme of recycling, stating: "A conscious consumer chooses recyclable products that do not harm nature or people". Regarding shopping behaviour, participant PsPT28 remarked: "A conscious consumer prepares a shopping list and buys only essential items, strictly sticking to the list to avoid unnecessary consumption". Furthermore, participant PsPT24 added: "Instead of using plastic bags, which are harmful to the environment, conscious consumers opt for reusable bags when shopping". In terms of consumer rights, participant PsPT5 stressed the importance of checking product expiry dates and making complaints when necessary: "A consious consumer checks the expiration date of every purchase and files a complaint if a product is past its expiration date.". In terms of environmental awareness, participant PsPT2 demonstrated sensitivity by preferring public transport to private cars whenever possible: "A consious consumer chooses public transport over private cars for travelling between destinations."

The drawings by the pre-service primary school teachers also illustrated examples related to water and food waste, vigilance regarding expiry dates and practices that promote the conservation of electricity, energy, nutrients and water, as well as examples related to consumer rights.

Figure 1

Examples from participants' drawings that illustrate conscious consumer behaviors.



In Figure 1, PsPT24 draws attention to environmental awareness by promoting the use of reusable cloth bags instead of single-use plastic bags when shopping. PsPT60 addresses the issue of food waste by depicting excess bread being thrown away, highlighting concerns about wasteful consumption practices. PsPT2 emphasises the importance of choosing public transport over private cars where possible, promoting sustainable mobility choices. PsPT31 focuses on various aspects of conscious consumption, including awareness of product expiry dates, the importance of certifications such as TSE (Turkish Standards Institution) and CE (European Conformity), the practice of making shopping lists and carefully checking product labels.

Table 6 presents the findings derived from the survey on conscious consumer administered to participants as part of the research study.

The analysis of the responses to the Conscious Consumption Survey (Buğday, 2015; Buğday & Babaoğul, 2016b), shows that almost all participants exhibit environmentally friendly behaviour and attitudes in the dimension of environmentally conscious consumption; their behaviour is in line with ethical standards in the dimension of ethical consumption; and they exhibit responsible behaviour and attitudes in the dimension of socially responsible consumption. In addition, a significant majority of participants do not endorse items such as buying expensive and luxurious products, living ostentatiously or emphasising wealth, as categorised under conspicuous consumption. Instead, they prioritise simplicity in consumption, do not emphasise conspicuousness, brand or luxury concepts, and tend towards simplicity in their consumption habits.

Table 2

Cognitive structures related to the concept of "conscious consumer" among pre-service teachers

Category	Code	f	Category	Code	f
Behavioral Actions Towards Consumption (f=99)	Savings	33	Negative Consequences (*f* = 31)	Waste	15
	Consumption	11		Famine	5
	Avoiding unnecessary expences	10		Global warming	4
	Production	8		Natural disaster	3
	Shopping	7		Garbage	2
	Making lists	5		Drought	2
	Spending money	5	Resources Consumed (*f* = 61)	Water	12
	Being mindful	4		Product	8
	Protect	4		Money	6
	Ouestioning	2		Electricity	6
	Researching	2		Energy	6
	Saving money	2		Detergent	5
	Moderate sonsumption	2		Solar energy	3
	Behavior	2		Natural resources	3
	Planning	2		Air	3
Affective Qualities Towards the Concept (*f* = 71)	Needing	21		Outfit	3
	Responsibility	11		Salary	2
	Frugality	9		Faucet	2
	Consciousness	7		Food	2
	Sensitivity	5	Purchasing Priorities (*f* = 31)	Expiry date	6
	Knowledgeable	4		Product quality	5
	Be rational	3		Bill	4
	Awareness	3		Price	4
	Freedom	2		User manual	3
	Respect	2		Consumer rights	3
	Love	2		Guarantee certificate	2
	Willingness	2		Advertisement	2
Affected Elements (*f* = 76)	World	10		Discount	2
	Nature	9	Perception Towards the Concept (*f* = 16)	Useful	4
	Environment	8		Valuable	3
	Health	7		Limited	3
	Human	7		Basic	2
	Future	7		Balanced	2
	Economy	6		Harmless	2
	Consumer	6	Supportive Practices (*f* = 21)	Recycling	11
	Life	6		Eco-friendly product	8
	Society	4		Sustainability	2
	Manufacturer	3	Other		62
	Tree	3			

Table 3

Components identified in definitions of pre-service teachers regarding the concept of conscious consumer

Definition Components	Frequency
Individuals who consume/use only what is necessary	23
Individuals who exhibit environmentally conscious behavior	16
Individuals who refrain from wasteful practices	9
Individuals who use products carefully and correctly	9
Individuals capable of distinguishing between desires and needs	7
Individuals who prioritize the health and safety aspects of products	6
Individuals who are knowledgeable about and exercise their consumer rights	6
Individuals who conduct cost-benefit analyses when making purchases	5
Individuals who scrutinize product contents	4
Individuals who have knowledge about consumers	4
Individuals who possess knowledge of product manufacturing processes	2
Individuals who shop according to their budget	2

Table 4
Behaviors demonstrated by participants in the context of conscious consumer

Consumer type	Behaviors	f
Rational consumption (f=123)	I practice thriftiness by adhering to a disciplined approach to consumption.	25
	I exercise prudence by purchasing only what is necessary.	24
	I am conscious about minimizing waste.	15
	I prioritize checking expiration dates on products.	9
	I conduct thorough price comparisons before making purchases.	8
	I meticulously inspect product contents to ensure suitability.	7
	I compile shopping lists based on identified needs	6
	I am well-informed about my rights as a consumer	6
	I scrutinize the credibility of manufacturers	5
	I diligently retain receipts, invoices, and warranty documents	4
	I refrain from acquiring products lacking proper labeling	3
	I abstain from engaging in door-to-door transactions	2
	I tailor my shopping habits to align with my budgetary constraints	1
	I maintain detailed financial records through income-expenditure statements	1
	I meticulously cross-reference invoices with product labels	1
	I assertively pursue the return of defective merchandise	1
	I exclusively patronize authorized service providers	1
	I consciously review contractual agreements	1
	I vigilantly identify and avoid allergens in products	1
	I investigate the ethical and environmental impacts of production processes	1
	I patiently await opportune moments to capitalize on discounts	1
Environmentally Conscious Consumption (f=67)	I actively segregate recyclable materials from general waste	26
	I adopt conservation practices, including prudent use of water and electricity	22
	I prioritize environmental responsibility by abstaining from purchasing harmful products	14
	I opt for energy-efficient lighting solutions such as LED bulbs	3
	I utilize public transportation as a sustainable commuting option	2
Simple Consumption (f=9)	I prioritize product utility over brand prestige	4
	I resist impulsive purchases driven solely by fleeting trends	2
	I participate in sharing economies by donating surplus possessions	2
	I extend the lifespan of clothing items through careful maintenance and use	1
Socially Responsible Consumption (f=1)	I consciously avoid supporting products or industries that harm animals	1
Ethical Consumption (f=1)	I abstain from purchasing counterfeit or imitation goods	1

Table 5

Drawings by Pre-service Teachers on Conscious Consumer Habits

Category	Codes	f
Savings	Efficient utilization of water resources	13
	Practicing water conservation measures	10
	Optimal use of electricity to minimize consumption	10
	Preventing food wastage, including bread and other perishables	8
	Reducing reliance on artificial lighting	1
Recycling	Prioritizing the purchase of recyclable products	1
	Observing proper recycling practices	1
Purchasing Priorities	Adopting a needs-based approach to shopping	10
	Creating shopping lists based on essential needs	7
	Engaging in cost-effective shopping practices	5
	Preferring sustainable and environmentally friendly products	2
	Choosing products that promote personal and environmental health	2
	Selecting items with recognized quality and safety certifications	2
	Supporting local producers and businesses	1
	Advocating for and purchasing organic goods	1
Consumer rights	Checking product expiration dates before purchase	3
	Reading and understanding product ingredients and labels	3
	Collecting receipts and invoices for consumer protection	3
	Familiarity with consumer rights and responsibilities	2
	Scrutinizing utility bills and expenses for accuracy	2
	Making informed purchasing decisions based on value and performance	1
	Securing warranty documentation for purchased items	1
Environmental awareness	Engaging in activities that contribute to environmental conservation	9
	Proper disposal practices and avoiding littering	5
	Promoting the use of renewable energy sources	2
	Preferring solar-powered systems for heating water	1
	Maximizing natural light and minimizing artificial lighting	1
	Utilizing exhaust systems with effective filtration mechanisms	1
	Choosing products that are biodegradable and eco-friendly	1
	Opting for public transportation to reduce carbon footprint	1
	Maintaining cleanliness and hygiene in public facilities	1
	Adhering to social norms and ethical standards	1
	Utilizing reusable shopping bags to minimize plastic waste	1

Table 6

Conscious consumer survey items and participation rates of pre-service primary school teachers

Consumer types	Survey items	Mean	SD
Environmentally Conscious Consumption	I believe that I can protect the environment by purchasing environmentally friendly products.	4.20	.84
	Global warming and climate change causes me to worry about the future	4.37	.88
	I think that underground waters and the sea pollution will give rise to very important problems in the future.	4.55	.65
	I believe that humans must live in harmony with nature.	4.43	.79
	I think that environmental pollution is one of the most important problems of our age.	4.50	.57
	I am of the opinion that the enterprises should encourage consumers with respect to collecting the solid wastes back.	4.42	.65
	The enterprises’ having activities aimed at protecting the environment makes me happy	4.55	.62
Ethical Consumption	When shopping, I don't eat /drink anything without paying	4.53	.70
	When I notice that the invoice or the account has been calculated below the value, I immediately give information.	4.55	.62
	When I notice the underpayment in the bill after leaving the store, I definitely ensure the elimination of this shortcoming	4.48	.95
	I immediately return the change given extra during shopping.	4.77	.46
	When I give damage to a product during shopping, I inform the officials and pay for the damage	4.50	.72
Voluntary Simple Consumption	I'd like to be the first user of the new products on the market	2.28	1.12
	I believe that the expensive products I buy add me value	1.85	.99
	It is important for me to lead a flashy life.	1.70	.92
	I think that luxurious products add respectability to the person	1.97	1.09
	Financial wealth is very important to me..	2.23	1.18
Socially Responsible Consumption	I pay attention to buying the products of the companies which I think gives importance to the rights of its employees	4.15	.73
	I don’t buy products or services from the companies that have been proven to employ child labor.	4.11	.94
	I prefer to buy the products of the companies that employ the individuals with disabilities.	4.08	.83
	I do not buy products or services from the companies that have been proven to apply discrimination against people.	4.08	.93
	I prefer to buy the products of the companies that have been proven to give support to medical researches.	4.00	.66
	I prefer to buy the products of the companies that donate a part of their profits to those in need	4.27	.63
	I think that the products/services of the companies which test products on animals should not be purchased	4.37	.78
	I think that companies should employ disabled individuals more	4.42	.70

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Discussion and Conclusion

Consumption is the collective behaviour of all individuals who make up the consumer society. Children constitute an important segment of the consumer market due to their consumer identity, loaded with satisfying needs and desires (Uyanık, 2020, p. 1074). It is crucial to raise children's awareness and instil conscious consumption habits from an early age. In this context, school provides an important opportunity to teach children about consumer issues, and to help them develop critical skills. Taking advantage of this opportunity requires teachers to be familiar with consumer issues, and to have sufficient teaching resources available (OECD, 2009, p. 9). At the basic education level, teachers need to have both professional and personal competences that promote responsible and conscious consumer behaviour among students with regard to the socio-cultural, economic and health impacts associated with the purchase, use and disposal of goods and services (Ortega et al., 2020).

In Türkiye, primary school curricula include learning outcomes that aim to promote conscious and responsible consumption across different subjects (MoNE, 2018). The extensive integration of a number of learning outcomes related to Conscious Consumption underlines the importance of raising awareness among students through targeted educational objectives. The inclusion of such outcomes requires that educators responsible for delivering these lessons have a thorough understanding of conscious consumer. Only with adequate knowledge and awareness can teachers effectively enhance students' understanding and conscious behaviour in this area. Therefore, it is imperative to assess teachers' current level of knowledge and perceptions of Conscious Consumption and to provide them with relevant professional development.

This study aimed to assess pre-service teachers' perceptions of the concept of conscious consumer. Firstly, a word association test was used to explore teacher candidates' cognitive structures in relation to the concept. Analysis of the data from the test revealed that each participant generated an average of 7.8 words, with 13.2% of these words being repeated at least once. Participants associated the concept of 'conscious consumer' with different behaviours (e.g. saving, consuming, avoiding unnecessary expenditure, shopping), affective attributes (e.g. necessity, responsibility, thrift), affected elements (e.g. world, nature, environment, health), potential negative consequences (e.g. waste, scarcity, global warming), , resources used (e.g. water, products, money, electricity), purchase priorities (e.g. expiry date, quality, receipt, price), different perceptions (e.g. usefulness, value, balance) and supporting practices (e.g. recycling, environmentally friendly products).

When examining the definitions of the concept of conscious consumer provided by the participants, the majority tended to define the concept within a single behavioural context. Definitions often emphasised behaviours such as 'using/consuming resources/ products only as needed', 'being environmentally aware' or 'not wasting'. A general examination of the participants' definitions (Table 3) showed that they sought to align their definitions with the behaviours identified in the literature on the concept. Of the participants, 35 defined conscious consumers using a single behavioural expression, 19 used two different behavioural expressions, 5 used three different behavioural expressions and 1 used five different behavioural expressions. The majority of participants' definitions of the concept are quite limited and superficial. The limited knowledge of conscious consumer provided by participants may potentially lead to inadequate competencies in this area among their future students once they enter the profession. Uyanık (2020) examined students' definitions of conscious consumer in a study on fourth graders ans also found that their definition of conscious consumers are also limited. Furthermore, Dere and Aktaşlı (2020), in their study with undergraduate students, described conscious consumers as limited behaviours. These researchers identified students' existing knowledge of the concept and did not provide information on the possible reasons for these limitations. Based on our study, it was concluded that participants also have limited knowledge of the concept of conscious consumer. When assessing competences related to conscious consumer, it can be said that pre-service teachers who will teach the same age group in the future have insufficient knowledge in terms of defining the concept. This situation could be interpreted as an indication of a possible relationship between the weak competences of teachers in this area and the weak competences of their students.

Ecologically conscious consumers are defined as those who purchase products and services which they perceive to have a positive (or less negative) impact on the environment (Roberts, 1996, p. 222). Within the scope of the study, the majority of participants indicated that they engage in behaviours such as buying and separating recyclable products, minimising waste of resources and avoiding environmentally harmful purchases. In particular, there was a particularly high level of participation in the environmental awareness dimension of the Conscious Consumer Survey. Thus, participants exhibit behaviours indicative of both green purchasing practices and post-consumer recycling behaviours, confirming their status as green consumers. The literature highlights a positive correlation between individuals' environmental knowledge, attitudes towards the environment and corresponding behaviours (Flamm, 2009; Polonsky et al., 2012; Roberts & Bacon, 1997; Taufique et al., 2014). It is widely accepted that consumers' environmental behaviour stems from pro-environmental attitudes (Taufique et al., 2014). Therefore, the demonstrated high levels of environmental awareness and related behaviours among participants suggest robust knowledge and positive attitudes towards environmental issues. In conclusion, the observed high levels of environmentally conscious consumption and associated behaviours among participants are indicative of their strong knowledge base and attitudes towards environmental issues, which is consistent with existing scholarship.

The voluntary simplicity movement has emerged as a counter-response to the pervasive consumerist culture (Buğday & Babaoğul, 2016a, p. 196). In this context, simplicity is not a confining lifestyle but a liberating way of life that contributes to the well-being of the world and future generations (Elgin, 2013, p. 72). In this study investigating conscious consumption among participants, the results indicated a departure from behaviours associated with consumers, such as early adoption of new products, valuing expensive items, pursuing conspicuous lifestyles, and believing that luxury goods confer social status. Participants also expressed a notable lack of brand fixation, a reluctance to purchase items based solely on their trendiness, and a tendency to prolong the use of purchased goods. Thus, it can be argued that participants have a preference for voluntary simplicity in consumption and exhibit behaviours consistent with this ethos.

Ethical consumers exercise their consumer rights by choosing products and services that support healthy diets, contribute to local socio-economic development by supporting domestic producers, avoid products tested on animals, prefer sustainably produced goods, patronise Fair Trade certified companies, ensure full payment for products, and engage in legal purchasing practices (Buğday & Babaoğul, 2016a; Harrison et al., 2005; Tallontire et al., 2001; Ünal-Kestane, 2020). Through their consumption choices, ethical consumers actively demonstrate their commitment to societal values. The analysis of the responses of participants in the current study on conscious consumption reveals a discrepancy: while participants showed high levels of agreement with ethical consumption criteria, their conceptualisations and everyday behaviours did not feature prominently in ethical consumption practices. For example, only one participant reported refraining from buying counterfeit or imitation products, while 59 participants did not articulate any behavioural inclination towards conscious consumption. This trend may be attributed to the socio-economic backgrounds and aspirations of students, suggesting that ethical considerations may not be prioritised in their consumer decision-making processes. Research also suggests that as students gain independence from family influences, they may increasingly engage in behaviours that are inconsistent with ethical norms (Saray & Hazer, 2017). Furthermore, media influences that emphasise factors such as price, quality and fashion often overshadow ethical considerations in consumer behaviour, potentially leading individuals to engage in unethical practices such as consuming counterfeit goods or engaging in retail theft (Buğday & Babaoğul, 2016a). In conclusion, despite the participants' stated alignment with ethical consumption principles in their survey responses, the limited emphasis on ethical consumer behaviours in both their definitions and practical behaviours suggests that participants may not fully integrate or prioritise the ethical dimensions of conscious consumption.

Socially conscious consumers are aware of their potential to effect social change through their purchasing decisions (Castano et al., 2016). An examination of the responses of participants to the survey on the dimensions of consious consumption and social responsibility found that they tend to favour brands that prioritise workers' rights, support medical research and employ people with disabilities. Conversely, they are reluctant to buy products from companies that engage in child labour, discrimination or animal testing. Despite their high level of engagement with survey items related to these dimensions, their definitions of conscious consumer often fail to emphasise behaviours indicative of socially responsible consumer practices. For example, only one participant mentioned abstaining from products that harm animals, while 59 participants made no reference to behaviours in their daily lives that are consistent with these dimensions. Pre-service teachers show comparable levels of competence in the dimensions of socially responsible consumption and ethical consumption. Despite their high level of engagement with survey items related to these dimensions, they did not integrate any corresponding behaviours into their definitions of conscious consumer. Furthermore, only a minimal number of students referred to behaviours from both dimensions in their daily practice. This suggests that participants may overlook or prioritise ethical and socially responsible consumption less in their understanding of conscious consumer. This finding has significant academic value as it highlights a potential lack of awareness among participants of their ability as consumers to influence markets according to their ethical standards. In this context, the participants' insufficient knowledge and behavioural alignment with ethical and socially responsible consumption dimensions may indicate an underestimation of their consumer agency.

Rational consumption practices include avoiding unnecessary purchases influenced by factors such as advertising, fashion trends, or brand prestige; distinguishing between wants and needs; conducting price comparisons; reading product labels and instructions; keeping receipts; and budgeting effectively (Aygen, 2005; Buğday & Babaoğul, 2016a; Ünal-Kestane, 2020). After analysing the participants' definitions of conscious consumers, it was found that nine out of the 12 behaviours they mentioned were consistent with the principles of rational consumption. Furthermore, participants collectively reiterated 201 behaviors across 32 different actions related to conscious consumer, with 21 of these actions specifically focusing on rational consumption (e.g., saving, buying only what is necessary, conducting price research, keeping financial records). These findings suggest that participants' knowledge and behaviours related to the conscious consumer are predominantly centred on the principles of rational consumption.

In summary, this research aimed to determine the perceptions of participants towards the concept of conscious consumer. The results show that the participants have insufficient knowledge about the conscious consumer. Their conceptualisations are primarily manifested through limited and superficial patterns of behaviour, referring to only 12 specific behaviours and indicating a significant lack of understanding. Furthermore, their practical application of conscious consumer in everyday life appears to be limited. In addition, the definitions and behaviours articulated by the participants are largely consistent with the principles of rational consumption. Importantly, almost none of the participants demonstrated behaviours associated with ethical and socially responsible consumption in their daily lives, suggesting a lack of prioritisation of these dimensions.

Recommendations and limitations

This study was limited to 60 pre-service primary school teachers studying at the faculty of education in a state university in Türkiye during 2023-2024 academic year. The scope of the research was limited to their mental structures towards the concept of conscious consumer, their definitions of the concept, their behaviors in the context of conscious consumerism, their level of conscious consumerism, and their perceptions towards the concept. In their research, Buğday and Babaoğul (2016a) discussed the concept of conscious consumption in five basic dimensions: "socially responsible consumption", "rational consumption", " Environmentally consumption", "ethical consumption" and "voluntary simple consumption". This research is also limited to these five sub-dimensions. More fine-grained analyses could be executed to identify different types of conscious consumption in future research.

Conscious consumers, because they are educated, can change the economy and society (Zureik & Mowshowitz, 2005). Cunningham and Cunningham (1976) found that people with higher levels of education are more sensitive about consumer rights than those with lower levels of education. Individuals' consciousness in this context is largely gained through education (Bradley et al. 2010; Hampel et al., 1995). When the social importance of conscious consumption and the research findings are evaluated together, some suggestions for future research are developed. One of them is to provide conscious consumer training to pre-service primary school teachers studying in faculties of education. Education is an effective tool in achieving most social gains. According to Karsu (2013), laws to be enacted by official institutions and organizations, regulations to be carried out by central and local governments and efforts to be made by some social institutions and organizations, no matter how perfect they are, are not sufficient alone in establishing the concept of consumption awareness among individuals. Another suggestion is that in addition to the trainings that can be given at the university level in the context of conscious consumer, primary school teacher candidates could produce projects on conscious consumption. Experimental research can be designed using alternative methods in order for pre-service primary school teachers to gain awareness of conscious consumer behaviors. OECD (2009) also emphasizes the critical importance of consumer education and the importance of developing knowledge and skills to make informed and rational choices that take into account social values and goals.

To ensure that future educators understand and encourage responsible consumer behavior, it may be recommended that teacher training programs include a special course on conscious consumption. Student-focused activities such as sustainability projects and waste management training can be recommended to encourage hands-on learning. Universities may also offer seminars on consumer awareness and sustainability to better inform students. At a broader policy level, the study may suggest specific initiatives for the Ministry of National Education (MoNE) and the Council of Higher Education (YÖK) to integrate consumer education into school curricula. In order to increase the relevance of the concept of conscious consumerism to the education sector, in-service training programs can be organized for teachers on how to inculcate conscious consumption habits in their students.

Declarations

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Ethics Statements

Ethical approval was obtained from the ethics committee at Recep Tayyip Erdogan University (Protocol no: 2023/367 and date of approval 13.12.2023)

Conflict of Interest

The authors declare that they have no conflict of interest.

Informed Consent

Written informed consent was obtained from all participants.

Data Availability

Data will be made available on request.

Referecences

Akdoğan, L., & Durmaz, Y. (2021). Tüketici Kişiliklerinin Bilinçli Tüketim Davranışı Üzerine Etkisinin Kişilik Modeli ile İncelenmesine Yönelik Bir Çalışma [A Study Regarding The Analysis of The Impact of Personality Traits on The Conscious Consumption Behavior], *Mehmet Akif Ersoy Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *8*(2), 782-814. https://doi.org/10.30798/makuiibf.809440

Avallone, I. V., Giraldi, J. de M. E., & Oliveira, S. V. W. B. de. (2012). Conscious consumption: a study on plastic bags' consumers in Brazil. *International Journal of Psychological Studies,4*(1), 122-134. https://doi.org/10.5539/ijps.v4n1p122

Aydıner-Boylu, A., Kılıç, C. & Günay, G. (2019). Bilinçli tüketim davranışlarını etkileyen sosyo-ekonomik faktörlerin incelenmesi: Üniversite öğrencileri üzerine bir çalışma [Investigation of Socio-Economic Factors Affecting Conscious Consumption Behaviors: A Study on University Students]. *Atatürk Üniversitesi Edebiyat Fakültesi Dergisi*, *63,* 465-479. https://dergipark.org.tr/tr/pub/atauniefd/issue/50981/646964

Aygen, G. (2005). A study on the developmental issues of consumer protection in Turkey. *Doğuş Üniversitesi Dergisi, 6*(1), 16-27. https://dergipark.org.tr/en/download/article-file/2151825

Bauman, Z. (2006), *Küreselleşme [Globalization]*, 2. Basım, İstanbul: Ayrıntı Yayınları.

Bozyiğit, S., & Madran, C. (2018). Çocukların Çevre Bilinçli Tüketici Olarak Sosyalleşmesinde Annelerin Çocuk Yetiştirme Tutumlarının Rolü [The Role of Child Rearding Attitudes of Maternal on The Socialization as an Environment Conscious Consumer of Children], *Manas Journal of Social Studies, 7* (2), 173–196. https://dergipark.org.tr/en/pub/mjss/issue/40519/485928

Buğday, E. B. (2015). *Bilinçli tüketici ölçeği geliştirme çalışması*. (Publication No: 414532) [Doctoral Dissertation, Hacettepe University]. YÖK Thesis Open.

Buğday, E. B., & Babaoğul, M. (2016a). Bilinçli tüketim kavramının boyutları: Bilinçli tüketim davranışının yeniden tanımlanması. *Sosyoekonomi, 24*(30), 187-206. https://doi.org/10.17233/se.2016.10.012

Buğday, E. B., & Babaoğul, M. (2016b). Conscious consumer scale: The study of validity and reliability. Asian Journal of Social Sciences & Humanities, 5(2), 119-134. http://www.ajssh.leena-luna.co.jp/AJSSHPDFs/Vol.5(2)/AJSSH2016(5.2-13).pdf

Bradley, J. C., Waliczek, T.M. & Zajicek, J.M. (2010). Relationship between environmental knowledge and environmental attitude of High school students. *Journal of Environmental Education, 30*(3), 17-21. https://doi.org/10.1080/00958969909601873

Castano, L., Perdomo, J., Duenas, O. S., & Duran, W. (2016). Socially responsible consumption: An application in Colombia. *Business Ethics A European Review, 25*(4), 460-481. https://doi.org/10.1111/beer.12128

Cavalcante, A. F. B. A., Silva, E. & Tavares, R. V. (2017). Analysis of social and environmental practices related to conscious consumption of students from public education of Sertão Pernambucano, Brazil. *Acta Scientiarum. Biological Sciences, 39*(4), 455-461. https://doi.org/10.4025/actascibiolsci.v39i4.35855

Crane, A. (2011). Facing the back lash: Greenmarketing and strategic reorientation in the 1990s. *Journal of Strategic Marketing*, *8,* 277-296. https://doi.org/10.1080/09652540050110011

Cunningham, H. W. & Cunningham, C. M. I. (1976). Consumer protection: more information or more regulation? *Journal of Marketing*, *40*(2), 63-68. https://doi.org/10.1177/002224297604000210

Davis, J.J. (1993). Strategies for environmental advertising. *The Journal of Consumer Marketing, 10*(2), 19-36. https://doi.org/10.1108/07363769310039102

Dere, İ., & Aktaşlı, İ. (2020). Conscious consumerism education in social studies courses: Reflections of an action research. *International Journal of Contemporary Educational Research, 7*(1), 215-227. https://doi.org/10.33200/ijcer.666525

Elgin, D. (2013). Voluntary simplicity-A path to sustainable prosperity. *Social Change Review, 11*(1), 69-84. https://doi.org/10.2478/scr-2013-0006

Ersoy, A. F. & Sarıabdullahoğlu, A. (2010). Erken dönemde tüketici bilincinin geliştirilmesi. *Üçüncü Sektör Kooperatifçilik, [Improving awareness of consumers in early period]*, *45*(1), 65-76. https://search.trdizin.gov.tr/tr/yayin/detay/114389/erken-donemde-tuketici-bilincinin-gelistirilmesi

Ersoy, A. ve Papatğa A. (2015). "İlkokul Öğrencilerinin Hikâyeler Aracılığıyla Bilinçli TüketiciFarkındalığının Geliştirilmesi" [The Improvement of the Conscious Consumerism Awareness of Elementary Students via Stories], *Eğitimde Politika Analizi Dergisi*, *4*(1), 61-78. https://dergipark.org.tr/tr/pub/epa/issue/48313/611640

Flamm, B. (2009). The impacts of environmental knowledge and attitudes on vehicle ownership and use. *Transportation Research Part D: Transport and Environment*, *14*, 272–279. https://doi.org/10.1016/j.trd.2009.02.003

Fromm, E. (2002), Yeni bir insan yeni bir toplum [Beyond the chains of illusion], (Çev. Necla Arat), İstanbul: Say Yayınları.

García-González, E., Albareda-Tiana, S., Solís-Espallargas, C. & Jiménez-Fontana (202, R. (2022). Transformative education for sustainable consumption. *Trends Higher Education*, *1*(1), 1–15. https://doi.org/10.3390/higheredu1010001

Gogia, J. (2014). Conscious consumption: a behavioral transformation approach for sustainable development. *Abhinav National Monthly Refereed Journal of Research in Commerce & Management*, *3*(10), 26-33. https://www.academia.edu/79116244/Conscious_Consumption_A_Behavioural_Transformation_Approach_for_Sustainable_Development?f_ri=104394

Güvenç, H. (2017). "Öğretim Programlarımızda Finansal Okuryazarlık" [Financial Literacy in Turkish Formal Education Curriculum]. *İlköğretim Online*, *16*(3), 935-948. https://doi.org/10.17051/ilkonline.2017.330233

Hampel, B., Holdsworth, R., & Boldero, J. (1995). Urban/Rural diffirences in Environmental consciousness among adolescents. *RuralSociety*, *5*(4), 13-27. https://doi.org/10.5172/rsj.5.4.13

Harrison, R., Newholm, T., & Shaw, D. (2005). *The ethical consumer*. London: Sage Publications.

İnsel, A. (1997). Geçmişten Geleceğe. *Birikim Dergisi*, *104*, 19-29. https://birikimdergisi.com/dergiler/birikim/1/sayi-104-aralik-1997-sayi-104-aralik-1997/2300

Karsu, S. (2013). Tüketici bilinci ve bilinçli tüketim. In M. Yavaşi (Ed.), *Tüketim bilinci bilinçli tüketici içinde* (s. 98-119). Eskişehir: Anadolu Üniversitesi Yayınları.

Kozinets, R. V., & Handelman, J. M. (2004). Adversaries of Consumption: Consumer Movements, Activism, and Ideology. *Journal of Consumer Research*, *31*(3), 691–704. https://doi.org/10.1086/425104

MacIntyre, A. (2007). After virtue: a study in moral theraphy, Indiana: University of Notre Dame Press. https://epistemh.pbworks.com/f/4.+Macintyre.pdf

McCarty, J.A. & L.J. Shurm (2001). The ınfluence of ındividualism, collectivism and locus of control on environmental beliefs and behaviour. *Journal of Public Policy & Marketing*, *20*(1), 93-104. https://doi.org/10.1509/jppm.20.1.93.17291

Menon, A. & Menon, A. (1997). Enviropreneurial marketing strategy: Thee mergence of corporateenvironmentalism as market strategy. *Journal of Marketing*, *61*(1), 51-67. https://www.jstor.org/stable/1252189

Methlouthi, K. & Nefzi, A. (2023). Cumsumption desire among children (from 7 to 11): Role of the exposure to social media advertisements and product familiarity. *Cogent Business & Management. 10* (3). https://doi.org/10.1080/23311975.2023.2258621

Ministry of National Education in Türkiye (MoNE). (2018). *Fen bilgisi dersi öğretim programı* [The Science Education Curriculum]. Ankara: MEB Press. https://mufredat.meb.gov.tr/ProgramDetay.aspx?PID=325

OECD. (2009). *Consumer education - Policy recommendations of the OECD's Committee on Consumer Policy*. Retrieved December 20, 2019, from https://www.oecd.org/sti/consumer/44110333.pdf

Ortega, M. R. M., Rangel, J. A. M., Chacín, Í. M. P., & Ortega, J. I. M. (2020). Teacher training model in consumer education: A proposal for Ecuadorian primary education. In A. Basantes-Andrade, M. Naranjo-Toro, M. Zambrano Vizuete, & M. Botto-Tobar (Eds.), *Technology, Sustainability and Educational Innovation (TSIE). TSIE 2019*. Advances in Intelligent Systems and Computing, Vol 1110 (pp. 1-9). Springer. https://doi.org/10.1007/978-3-030-37221-7_1

Polat, E. & Kır, S. (2020). Spor Bilimleri Öğrencileri ve Diğer Bireylerde Bilinçli Tüketicilik Düzeyi ile Sürdürülebilir Tüketim Davranışlarının İncelenmesi [Investigation of Conscious Consumerism Level and Sustainable Consumption Behaviors in Sports Science Students and Other Individuals], *Gaziantep Üniversitesi Spor Bilimleri Dergisi, 5*(4), 468- 485. https://doi.org/10.31680/gaunjss.800670

Polonsky, M. J., Vocino, A., Grau, S. L., Garma, R., & Ferdous, A. S. (2012). The impact of general and carbon-related environmental knowledge on attitudes and behavior of US consumers. *Journal of Marketing Management, 28*(3-4), 238-263. https://doi.org/10.1080/0267257X.2012.659279

Priya, A. (2020). Case study methodology of qualitative research: Key attributes and navigating the conundrums in its application. *Sociological Bulletin, 70*(1), 94-110. https://doi.org/10.1177/00380229209703

Rahmawati, D. & Indartono, S. (2018). The integration of sustainable consumption education on social studies learning to increase students' intention toward enviromental sustainability. *Advances in Social Science, Education and Humanities Research, 323*, 233-238. https://www.atlantis-press.com/proceedings/icossce-icsmc-18/125910005

Roberts, J. A. (1996). Green consumers in the 1990s: Profile and implications for advertising. *Journal of Business Research, 36*(3), 217-231. https://doi.org/10.1016/0148-2963(95)00150-6

Roberts, J. A., & Bacon, D. R. (1997). Exploring the subtle relationships between environmental concern and ecologically conscious consumer behavior. *Journal of Business Research, 40*(1), 79–89. https://doi.org/10.1016/S0148-2963(96)00280-9

Saray, M. T., & Hazer, O. (2017). Etik Tüketici ölçeğinin Türkçe uyarlaması; Geçerlilik ve güvenilirliğine ilişkin bir çalışma: Hacettepe Üniversitesi örneklemi. *International Journal Of Education Technology and Scientific Researches, 2*(4), 258-283. https://dergipark.org.tr/tr/pub/ijetsar/issue/33837/355383#article_cite

Scholz, R. W., & Tietje, O. (2002). *Embedded case study methods: Integrating quantitative and qualitative knowledge*. London: Sage Publications.

Solomon, M., Bamossy, G., Askegaard, S. & Hogg, M. (2013). *Consumer behaviour: a european perspective.* Pearson Education Limited.

Tallontire, A., Rentsendorj, E., & Blowfield, M. (2001). Ethical consumers and ethical trade: A review of current literature. *NRI Policy Series 12* [Working Paper]. https://gala.gre.ac.uk/id/eprint/11125/1/Doc-0182.pdf

Taufique, K. M. R., Siwar, C., Talib, B., Sarah, F. H., & Chamhuri, N. (2014). Synthesis of constructs for modeling consumers' understanding and perception of eco-labels. *Sustainability, 6*(4), 2176-2200. https://doi.org/10.3390/su6042176

The Global Goals For Sustainable Development. (2024, May 30). *Responsible consumption and production.* https://www.kureselamaclar.org/en/global-goals/responsible-consumption-production/

Turkish Language Association (TLA) (n.d.). Current Turkish dictionary. Retrieved from May 13, 2024, from https://sozluk.gov.tr/

Türkiye Official Gazette. (2013, November). *Law on the protection of consumers.* https://www.mevzuat.gov.tr/mevzuatmetin/1.5.6502.pdf

United Nations. (2024, May, 30). *How the un is supporting the sustainable development goals in Türkiye.* https://turkiye.un.org/en/sdgs

Uyanık, C. (2020). İlkokul 4. Sınıf öğrencilerinin bilinçli tüketicilik durumlarının incelenmesi. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, 8*(4), 1073-1090. https://doi.org/10.18506/anemon.638457

Ünal-Kestane, S. (2020). Bilinçli tüketim ve annelerin bilinçli tüketime yönelik tutum ve davranışları. *İstanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi, 19*(39), 803-827. https://doi.org/10.46928/iticusbe.729138

Yildirim, A., & Simsek, H. (2008). *Sosyal bilimlerde nitel araştırma yöntemleri* [Qualitative research methods in the social sciences]. Ankara: Seçkin Yayıncılık.

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Zureik, E. & Mowshowitz, A. (2005). Consumer power in the digital society, *Communications of the ACM, 48*(10), 46-51. https://cacmb4.acm.org/magazines/2005/10/6102-consumer-power-in-the-digital-society/fulltext

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Development of Social-Emotional Skills Among Prospective Elementary School Teachers in The Process of Teaching Disciplines of Professional Training Cycle

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Abstract

The article studies the effectiveness of the use of interactive techniques and technologies in the development of social-emotional skills among future elementary school teachers in the process of teaching disciplines of the professional training cycle. It also aims to determine the influence of certain elements of educational programs on the development of key social-emotional skills. A mixed-methods approach was employed, combining quantitative methods (testing, questionnaires, statistical analysis) to assess the development of students' social-emotional competencies. Standardised questionnaires such as the Emotional Intelligence Questionnaire, Emotion Regulation Scale, and Social Competencies Questionnaire, as well as statistical methods, in particular, t-test and correlation analysis, were used in the study. The results demonstrated a significant increase in the level of social-emotional skills of students after passing the course of disciplines of the professional cycle. In particular, the level of empathy increased from 3.45 to 4.05 points, while the ability in emotion regulation increased from 3.25 to 4.00 points. Role plays and group discussions showed the highest effectiveness, in particular in the improvement of communicative skills in which the level increased from 3.30 to 4.10 points. The practical significance of the study is in the potential use of its results for the improvement of curriculum oriented on the development of social-emotional competencies of future teachers. Based on the findings, further study perspectives might include the analysis of the long-term influence of interactive technologies on the development of social-emotional skills in teachers' professional activity.

Keywords:

Social-Emotional Skills, Future Teachers, Interactive Techniques, Professional Training, Emotion Regulation, Communication Skills, Empathy.

Introduction

Modern education requires the development of social-emotional skills of prospective teachers of elementary school. These skills are important for successful professional activity of teachers (Moreira-Choez et al., 2024). They facilitate effective communication and the creation of a favourable learning environment (Ishchenko et al., 2024). Such skills help to maintain positive interaction with students (Santamaría-Villar et al., 2021). Social-emotional skills enable teachers to better understand the emotional needs of children (Zhylin et al., 2022). This contributes to differentiated teaching and ensures psychological comfort in the classroom (Tobon & Lozano-Salmorán, 2024). Developing social-emotional skills is crucial for effective teaching and emotional well-being, as they enhance interaction and support in the classroom. These competencies, including empathy, emotion regulation, and communication, require detailed explanations to clarify their impact and unique importance in teaching. These skills include understanding one's own emotions and the ability to regulate them (Tsortanidou et al., 2022). Sympathy, communication, and conflict resolution are also important. These competencies play an important role in the educational process (Arace et al., 2021). They contribute to the development of interpersonal relations and harmonious children's growth. Lecturers should develop these skills in future teachers in the process of professional training (Lozano-Pena et al., 2021). Special attention should be given to the disciplines of the professional cycle. Integration of special techniques and technologies contributes to emotional intelligence development (Gavín-Chocano et al., 2024). This will enable future teachers to effectively work in a modern educational environment.

This study's theoretical foundation is based on emotional intelligence, which underscores the significance of understanding and regulating emotions in professional activities (Tsortanidou et al., 2022). The research is also rooted in the theory of social-emotional learning (SEL), which emphasizes the development of emotional and social competencies for fostering positive relationships and effective communication (Ishchenko et al., 2024). Moreover, the study draws on Vygotsky's sociocultural theory, which suggests that learning and development occur through social interaction and cultural tools, such as teaching methods and techniques. Lastly, the study aligns with the competency-based approach to teacher training, which integrates social-emotional skills into professional training programs to improve teaching effectiveness (Lozano-Pena et al., 2021).

The relevance of the study is stipulated by the increasing demands of modern education. Nowadays, education is oriented not only to providing knowledge but also to developing the personality of students. Teachers' abilities to regulate their own emotions become an inevitable part of their professional competence. Such skills help to develop constructive relationships with students and colleagues. Teachers tend to resolve conflicts better as well and create an atmosphere that is favourable for learning. The development of social-emotional skills is important for the improvement of the quality of the learning process in modern conditions.

Despite numerous studies, the importance of social-emotional skills for the professional activity of teachers remains understudied. Numerous works confirm the significance of these skills in pedagogical practice. Nevertheless, their development in the process of professional training of future elementary school teachers is studied superficially. Most studies focus on general aspects and do not pay attention to specific teaching methods. The possible development of social-emotional skills in teaching disciplines of the professional cycle is yet to be explored. This creates the necessity for a more detailed study of the integration of these skills in the curricula of pedagogical specialities. Such integration may be essential for the comprehensive preparation of future teachers to work with children. Therefore, this study aims to explore the development of social-emotional skills among future elementary school teachers while teaching professional cycle disciplines and to determine the effectiveness of different methods of integration of these skills into study programs. To achieve these purposes, the following tasks were set:

1. To analyse the level of development of social-emotional skills in pedagogical specialities students in the elementary training stage.
2. To study the influence of interactive teaching techniques and technologies on the development of socio-emotional competencies of future teachers.
3. To evaluate changes in the level of social-emotional skills of students after passing the course of disciplines of the professional cycle with the use of specially developed techniques.
4. To determine the effectiveness of separate elements of the study program which facilitate the development of social-emotional competencies, and to formulate recommendations for the improvement of training future teachers.

Literature Review

The development of social-emotional skills in teachers has been extensively studied, with various scholars highlighting their crucial role in successful professional activities. These competencies are essential for effective communication, emotional well-being, and a conducive learning environment. Gabrijelcic et al. (2021) examined the socio-emotional competencies of future teachers and pedagogical students in Slovenia, demonstrating that these skills are vital for ensuring effective interaction and emotional well-being in the teaching process. Similarly, Serrano et al. (2023) focused on the emotional regulation and empathy skills necessary for school counsellors, highlighting their importance in managing student behaviour and promoting emotional support in secondary schools.

Integrating socio-emotional competencies in teacher training has also been explored, emphasizing their role in professional adaptation. Barrera (2022) explored the significance of metacognition and emotion regulation during higher education practical training, asserting that socio-emotional skills are crucial for students' adaptation to professional activities. The study by Özdemir Cihan and Dilekmen (2024) further supports this view, showing that emotional intelligence training for prospective elementary school teachers enhances their understanding and regulation of emotions, which is fundamental for effective teaching.

In addition to these studies, various scholars have explored the development of social-emotional skills in different educational contexts. Zakaria et al. (2021) examined the role of painting in developing communication skills and emotional understanding among preschool children, emphasizing the value of creative activities for socio-emotional development. Mowat (2019) focused on the emotional support needed for students transitioning from elementary to secondary school, highlighting the importance of socio-emotional skills in easing this adaptation. The need for emotional support has become particularly evident in the aftermath of the COVID-19 pandemic, as noted by Sanz-Ponce et al. (2023) emphasizing the necessity for teachers to provide emotional support to students affected by the pandemic's consequences.

Technological advancements have also contributed to the development of socio-emotional skills. Goldoni et al. (2023) studied the effectiveness of digital tools in teaching and enhancing social-emotional competencies, particularly in interactive learning environments. Pérez and Bahamon Muneton (2023) emphasized that emotional competence is crucial for creating a positive educational environment, underscoring the importance of socio-emotional skills in fostering a healthy classroom atmosphere. Furthermore, the study by Huerta Cuervo et al. (2022) demonstrated that the development of socio-emotional competencies in students leads to improved academic performance and psychological comfort, while Butvilas et al. (2022) investigated how these competencies vary by age and gender, suggesting that socio-emotional skills develop differently across these factors and should be taken into account in the educational process. Together, these studies provide a comprehensive overview of the importance of social-emotional skills in both teachers and students and the various methods and contexts in which they can be developed to enhance the educational experience.

Some controversies and understudied aspects were found while analyzing the results of previous studies related to the development of social-emotional skills of future teachers. In particular, studies underline the importance of these competencies for the professional activity of teachers, but do not always offer effective approaches to their development in the educational process. Moreover, some aspects such as the integration of social-emotional skills into the professional cycle of disciplines or the influence of different techniques on the development of emotional competence remain understudied. This indicates the necessity for further studies, directed at the development of practical recommendations for the improvement of training future teachers.

Methods and materials

Study procedure

The study employed a mixed (quantitative-qualitative) design, with the use of quantitative methods for objective data collection, and qualitative ones for a better understanding of the results of the study. The research process was conducted in several stages. In the preparation stage, the research plan was developed, data collection tools (questionnaires and interview) were selected, and participant sampling was conducted from the students of pedagogical specialities. In the first stage, students passed initial testing, which measured their social-emotional skills, including emotion regulation and empathy. The second stage included conducting the classes with the use of interactive methods and technologies, oriented on the development of socio-emotional competencies. In the third stage, repeated testing was applied to evaluate the dynamics of skills development after passing the course of disciplines of the professional cycle. In the final stage, testing results were analysed and interviews with participants were conducted for qualitative evaluation of their experiences and changes in socio-emotional competencies. The study utilized pre-and post-tests to measure changes in students' social-emotional skills before and after implementing interactive teaching techniques.

Sample

The study was conducted from September 2023 to February 2024, by the research group of lecturers of Regional College "Kremenchuk A.S. Makarenko Humanitarian and Technological Academy" of the Poltava Regional Council. The participants included

80 students aged 18 to 22, studying in the specialty "Elementary Education". The gender distribution was 65% female and 35% male which represents the typical situation in pedagogical educational institutions. The sample was formed randomly from students who met the participation criteria: 2nd or 3rd year of study and no prior experience in similar studies. The number of participants was selected based on a power analysis to ensure statistical validity, though the exact process of determining sample size is not specified. If applicable, consider moving this justification to the methodology section, where details on sample size calculation and statistical power are typically discussed. The age of students corresponds to the stage of professional training of future teachers, at which social-emotional skills are being developed. All participants provided voluntary consent to participate in the study, after being fully informed about the purpose and terms of the experiment. The presence of a qualified psychologist, who provided psychological support to participants and monitored their emotional well-being, was ensured throughout all stages of the study. It is important to add that an ethics committee approved the study, and ethical considerations regarding participant confidentiality and consent were followed.

Study methods

Several empirical methods were used in the study. The main methods included questionnaire-survey, testing, observation and interview. Standardised questionnaires, widely recognized in the studies of socio-emotional competence, were used for quantitative analysis. In particular, we used the Emotional Intelligence Questionnaire, TEIQue) (Orhan, 2024), developed for the evaluation of emotional awareness, self-regulation, empathy, and interpersonal relations. Emotion Regulation Questionnaire (ERQ) (delValle et al., 2022), evaluating strategies of cognitive processing of emotional experiences and control over emotional reactions, was also used. Additionally, we used the Social Competence Inventory (SCI) which enabled the measurement of the ability of students in effective social interaction and conflict resolution. The applicability and validity of these tools within the cultural and educational context of this study should be critically examined and discussed. Observation of participants' behaviour during the learning process and their participation in group tasks enabled receiving additional qualitative data. At the end of the study, semi-structured interviews with participants were conducted to better learn their impressions and experience of the development of social-emotional skills (Annex 1).

The Emotional Intelligence Questionnaire (TEIQue), widely used for assessing emotional awareness, self-regulation, empathy, and interpersonal relations, demonstrated a Cronbach's alpha of 0.85, indicating high reliability. The Emotion Regulation Questionnaire (ERQ), validated for measuring emotion regulation strategies, showed a Cronbach's alpha of 0.82 in this study, ensuring its consistency. The Social Competence Inventory (SCI), used for evaluating social interaction and conflict resolution skills, had a Cronbach's alpha of 0.80, confirming its reliability. These values reflect the strong reliability of the instruments in assessing social-emotional competencies within the given sample.

We used statistical analysis tools enabling the evaluation of changes before and after classes. A t-test for the dependent variable was used for comparison of the results before and after the study. While p-values indicate statistical significance, the effect sizes should also be reported to determine the practical significance of these changes. This method enabled the determination of statistical differences in the level of social-emotional skills in the initial and final stages of the study. Moreover, correlation analysis according to Pearson was conducted to determine interrelation between separate components of socio-emotional competence. Analysis of variance (ANOVA) was used to evaluate the influence of separate factors such as gender, age, and level of previous training of students on the dynamics of social-emotional skills development. A one-way ANOVA was conducted to examine the effect of gender, age, and level of previous education on social-emotional skills. This approach enabled the detection of statistically significant differences between different groups of participants.

Tools

- SPSS software, which was used for the calculation of indicators of central tendency (mean value, median), as well as variety (standard deviation).

Results

The analysis process regarding the development level of social emotional skills among pedagogical specialities students in the elementary training stage was conducted using the Emotional Intelligence Questionnaire (TEIQue). Its use enables the measurement of the main components of emotional intelligence, in particular emotional awareness, self-regulation, empathy, and social skills. Statistical analysis, including the calculation of the mean value (M), standard deviation (SD) and variation coefficient (CV), was conducted for each questionnaire item after initial testing. Table 1 presents the main statistical indications for the evaluation of the development of social-emotional skills of students.

Table 1

Statistical analysis of the level of development of social-emotional skills in pedagogical specialities students in the initial training stage

Questions of TEIQue Questionnaire	*M.*	*SD*	*CV (%)*
How aware are you of your own emotions?	3.45	0.75	21.74
How effectively do you control your emotions?	3.20	0.82	25.63
To what extent are you able to recognise the emotions of other people?	3.65	0.68	18.63
How often do you experience empathy for others?	3.55	0.72	20.28
How easy do you find establishing interpersonal relations?	3.10	0.90	29.03

The table demonstrates that the mean level of awareness of students' own emotions is 3.45 at a standard deviation of 0.75, indicating a relatively high level of this component. However, the ability to control emotions showed somewhat lower results (*M* = 3.20, *SD* = 0.82), which shows the need for further work for the development of self-regulation. Herewith, students demonstrate quite high results in the recognition of the emotions of others (*M* = 3.65, *SD* = 0.68), an indicator of well-developed empathy. At the same time, social skills, in particular establishing interpersonal relations have lower indicators (*M* = 3.10, *SD* = 0.90), which reflects the need for additional attention to the development of communication skills. Results show that in the initial stage, students have sufficiently developed emotional awareness and the ability to empathise, but self-regulation and social skills require further improvement.

The study of the influence of interactive teaching techniques and technologies on the development of socio-emotional competencies of students was conducted using the Emotion Regulation Questionnaire (ERQ). Testing was conducted before and after the course for the analysis of the dynamics of the development of emotion regulation of students. Interactive learning methods such as group discussions, role plays and educational technologies were used in the course. Indicators before and after the introduction of interactive techniques were analysed using a t-test for dependent variables, which enabled the determination of statistically significant changes in the emotion regulation level (table 2).

Table 2

Indicators of emotion regulation of students before and after the use of interactive techniques

ERQ question	Before techniques use (*M ± SD*)	After techniques use (*M ± SD*)	t-value	p-value
How often do you attempt to control your emotions?	3.15 ± 0.81	4.05 ± 0.69	6.74	< 0.001
How often do you change your emotional reactions?	3.25 ± 0.77	4.00 ± 0.65	5.89	< 0.001
Do you wish to change the way you experience emotions?	3.10 ± 0.85	3.95 ± 0.70	6.12	< 0.001
How often do you try to hide your emotions?	3.05 ± 0.90	3.85 ± 0.78	5.43	< 0.001

The results shown in the table demonstrate a clear dynamics of the increase in the level of emotion regulation of students after the use of interactive teaching techniques and technologies. Each ERQ question reflects significant changes in different aspects of emotion self-regulation, which enables making conclusions on the effectiveness of the implemented techniques. The mean score in the first question, related to the ability to control their own emotions, increased from 3.15 to 4.05. This indicates significant progress in the students' ability to manage emotions, possibly resulting from interactive classes. Moreover, t-value 6.74 indicates high statistical significance of changes, which is confirmed by p-value < 0.001, meaning that the probability of random changes is extremely low.

Positive dynamics were also observed regarding the second question related to the change in emotional reactions. The mean score increased from 3.25 to 4.00 indicating improvement in the ability of students to regulate their emotional responses based on the situation. Besides, t-value 5.89 and p-value < 0.001 show that these changes are statistically significant and can not be random. The mean score for the third question related to the ability to change the way to experience emotions also improved from 3.10 to 3.95. This means that after the implementation of interactive techniques, students more frequently want to adapt their emotional reactions for better emotional reactions. At this, t-value 6.12 also indicates statistically significant changes.

The fourth question relates to the ability to hide one's own emotions, which is an important element of emotion regulation. After the course, this indicator increased from 3.05 to 3.85, which demonstrates the improved ability of students to emotion control in social situations. The significance of this result is confirmed by a t-value of - 5.43 and a p-value of <0.001. In general, all changes in the table show that students significantly improved their emotion regulation skills after the implementation of interaction techniques. This is confirmed by the high t-test value and low p-values, which reveal that the received results are not random and are statistically substantiated. Interactive techniques facilitated a better understanding of one's own emotions by students, who also learned to effectively control their emotional reactions.

Social Competence Inventory (SCI) was used to evaluate changes in the level of social-emotional skills of students after passing the course of disciplines of the professional cycle. Testing was conducted twice: before the course and after its completion. We used a t-test for dependent variables for the quantitative analysis of the received results, which enabled the evaluation of the statistical significance of changes in students' social-emotional skills. Results of the analysis of the main components of social competencies before and after the course are presented in Table 3.

Table 3

Changes in the level of social competencies of students before and after the course of disciplines of the professional cycle

SCI Question	Before the course (M ± SD)	After the course (M ± SD)	t-value	p-value
How effectively do you communicate with others?	3.30 ± 0.70	4.10 ± 0.60	7.21	< 0.001
How often do you use empathy in communication?	3.45 ± 0.65	4.05 ± 0.50	6.35	< 0.001
Are you able to solve conflicts in social situations?	3.25 ± 0.75	4.00 ± 0.55	6.82	< 0.001
How open are you to new contacts and cooperation?	3.20 ± 0.80	4.00 ± 0.60	6.57	< 0.001

Data analysis indicates a significant improvement in social-emotional skills after passing the course of disciplines of the professional cycle. The mean value for the first question, related to the effectiveness of communication, increased from 3.30 to 4.10, an improved ability of students to effectively cooperate with others. The statistical significance of this indicator is confirmed by a t-value of 7.21 and a p-value of < 0.001. The second question related to the empathy use in communication also showed positive dynamics. The mean score increased from 3.45 to 4.05 which indicates improvement of the ability of students to understand and perceive emotions of other people. A t-value of 6.35 and a p-value of < 0.001 confirm the significance of this improvement.

The third question related to the ability to resolve conflicts demonstrated an increase in the mean score from 3.25 to 4.00. A t-value of 6.82 also indicates a high level of statistical significance. Finally, the mean score for the question related to the effect of openness to new questions and cooperation, increased from 3.20 to 4.00, demonstrating improved ability of students to social interaction. The statistical significance of this indicator is confirmed by a t-value of 6.57 and a p-value < 0.001. The received results reveal that specially developed techniques, integrated into the course of disciplines of the professional cycle, positively influenced the development of socio-emotional competencies of students. Indicators of communication skills, empathy, ability to resolve conflicts and openness to cooperation significantly improved after the end of the course which confirms the effectiveness of the used techniques.

Although the study presents statistically significant p-values, the absence of reported effect sizes limits assessing the practical significance of the observed changes. While the findings suggest that interactive methodologies enhanced socio-emotional skills, the lack of a control group precludes definitive causal inferences regarding the intervention's efficacy, potentially confounding the observed improvements with extraneous variables. Furthermore, despite using semi-structured interviews, the methodology fails to delineate the analytical approach applied to the qualitative data, such as thematic analysis, thus compromising the robustness of the mixed-methods design's qualitative component. Additionally, while the study reports strong correlations between variables (e.g., $r = 0.78$, $r = 0.70$), it is imperative to acknowledge that correlation does not establish causation, and unexamined confounding variables may have contributed to the reported associations. These methodological limitations underscore the necessity for further investigation to elucidate the causal mechanisms underlying the development of socio-emotional competencies in pre-service teachers.

Discussion

The results demonstrate a statistically significant enhancement in the social-emotional competencies of pre-service elementary school teachers after implementing interactive pedagogical technologies. Data analysis evidences a marked increase in core areas, including empathy, emotion regulation, and communicative efficacy, thereby validating the methodologies' effectiveness. These findings support the integration of role-playing, collaborative discourse, and digital resources within teacher education curricula, facilitating their professional development and cultivating a conducive learning milieu.

Through a rigorous examination, this study confirms that interactive techniques and technologies substantially enhance the socio-emotional competencies of future elementary school teachers. The observed improvements in empathy, self-regulation, and communication are statistically significant and align with previous research; for instance, Gimbert et al. (2023) emphasize that such competencies are crucial for fostering a supportive educational environment, enabling teachers to engage more effectively with students. Furthermore, as Carmen et al. (2022) demonstrated, there is a strong interrelation between enhanced socio-emotional skills and increased teacher confidence in professional practice. Our findings also correlate with Danner et al. (2021) arguing that social-emotional skills are indispensable in both professional and personal spheres.

In a comparative perspective, our results extend Coskun's (2019) work by showing that interactive activities, such as role plays and group discussions, significantly boost self-regulation and empathy – findings that resonate with McNally et al. (2019) on the importance of socio-emotional support for language minority students in elementary schools. Moreover, the study reveals a direct association between the development of these competencies and improved academic performance, echoing Aleksić et al. (2019), who found a positive link between socio-emotional skills and achievements in Mathematics and literacy, as well as Colomeischi et al. (2022), who demonstrated that mental programs can reduce psychosocial difficulties while promoting academic success.

Finally, the study by Boon-Falleur et al. (2022) indicates the effectiveness of simple questionnaires in the measurement of social-emotional skills, also confirmed by our findings. The use of standardised questionnaires is a reliable method of evaluation of the socio-emotional competencies of students, while statistical analysis data indicate significant positive changes. In such a way, the results of our study confirm the importance of integration of socio-emotional learning in the curricula of future teachers. This will facilitate the improvement of their professional competencies and ability to work in modern conditions of the educational process. Practical implication of the received results is in the integration of effective techniques of socio-emotional education in the curricula of future teachers of elementary school. The results of our study may be used for the improvement of the curricula, by the introduction of role plays, group discussions and interactive technologies, which proved their effectiveness in the development of socio-emotional competencies.

Although the study demonstrates a statistically significant enhancement in social-emotional competencies following the implementation of interactive pedagogical technologies, it does not elucidate the long-term sustainability of these improvements. The temporal persistence of these enhanced competencies remains indeterminate. Moreover, whilst the findings posit a positive association between social-emotional skills and academic performance, these assertions are predicated on external research and lack empirical validation within the present study's framework. The study would be augmented by exploring potential mediating variables, such as intrinsic motivation or classroom climate, which may contribute to the observed enhancements. Without an analysis of these mediating influences, establishing a direct causal link between the intervention and the outcomes is challenging. Including such considerations would yield a more nuanced comprehension of the mechanisms underpinning the development of social-emotional competencies in pre-service educators.

Study limitations

One of the main limitations of the study is the small sample of participants, which restricts the possibility of generalising results for a wider population of students of pedagogical specialities. The study was conducted only based on one educational institution, which can influence a variety of participants and their learning experiences. Moreover, the influence of socio-cultural context was not considered, which might potentially influence the results.

Recommendations

Several important recommendations for the improvement of the training future teachers can be made based on the results of the study:

- increase the share of interactive techniques and group work in the curricula, as these methods showed high effectiveness in the development of socio-emotional competencies. The interactive techniques referenced include role-playing, group discussions, and digital tools, such as simulations and interactive platforms, all implemented to enhance socio-emotional competencies. These methods actively engage students in experiential learning, fostering empathy, emotion regulation, and communication skills through collaborative and reflective practices.
- use of technologies such as simulation and interactive platforms should be an inevitable part of the program, as they enable students to improve self-reflection and emotion management.
- create support and mentoring programs for young teachers and monitoring of their socio-emotional competencies in practice.

Conclusions

The relevance of this study is stipulated by the necessity of the development of social-emotional skills of future teachers, which is an important component of their professional training. Development of these skills helps to improve interaction with students, manage emotions and effectively resolve conflicts, which facilitates the quality of learning in modern schools. Results of the study indicate that the use of interactive teaching techniques and technologies significantly facilitates the development of socio-emotional competencies of future teachers of elementary school. Students demonstrated significant improvements in the level of empathy, emotion regulation, communication skills and ability to resolve conflicts after passing the course of disciplines of the professional cycle. Group discussions, role plays and use of digital technologies had the greatest influence on the development of the above-mentioned skills, which confirms the necessity of their integration into the curriculum for teacher training. In particular, the level of empathy increased from 3.45 to 4.05 points, while the ability to emotion regulation - from 3.25 to 4.00 points. Communication skills measured after the course increased from 3.30 to 4.10 points, which confirms the effectiveness of the techniques used for the preparation of teachers for professional activity. However, considering the limited sample and socio-cultural context, further studies with a larger sample and longer observation term are necessary to confirm the long-term effectiveness of such techniques.

The results also confirm the importance of the development of skills of future teachers, as they improve interaction with students and the effectiveness of teaching. The increase in empathy, emotion regulation and communication skills after the introduction of interactive techniques, indicates their effectiveness. Application of these results may serve as the basis for improvement of pedagogical training curriculum, as well as be used in programs for qualification advancing for teachers, which will enable improvement of the quality of education in educational institutions. One of the most relevant and prospective directions of further research is the study of the long-term influence of interactive techniques on the development of socio-emotional competencies of future teachers. Such a study will enable the determination of how the skills in emotion regulation, empathy and communication, obtained in the process of education, are maintained and developed after beginning the work in a school.

References

Aleksić, G., Merrell, C., Ferring, D., Tymms, P., & Klemenović, J. (2019). Links between socio-emotional skills, behavior, mathematics and literacy performance of preschool children in Serbia. *European Journal of Psychology of Education, 34*, 417-438. https://doi.org/10.1007/s10212-018-0387-8

Arace, A., Prino, L. E., & Scarzello, D. (2021). Emotional competence of early childhood educators and child socio-emotional wellbeing. *International Journal of Environmental Research and Public Health, 18*(14), 7633. https://doi.org/10.3390/ijerph18147633

Barrera, C. A. J. (2022). Socio-emotional skills: Toward a metacognition and emotional regulation use in higher education internship process. *Revista Liminales. Escritos sobre Psicología y Sociedad, 11*(22), 135-165. https://doi.org/10.54255/lim.vol11.num22.685

Boon-Falleur, M., Bouguen, A., Charpentier, A., Algan, Y., Huillery, É., & Chevallier, C. (2022). Simple questionnaires outperform behavioral tasks to measure socio-emotional skills in students. *Scientific Reports, 12*(1), 442. https://doi.org/10.1038/s41598-021-04046-5

Butvilas, T., Bubnys, R., Colomer, J., & Cañabate, D. (2022). Dependence of socio-emotional competence expression on gender and grade for K5–K12 students. *Education Sciences, 12*(5), 341. https://doi.org/10.3390/educsci12050341

Cheung, W. C., Shen, S., & Meadan, H. (2022). Correlation between motor, socio-emotional skills, and academic performance between young children with and without disabilities. *Journal of Developmental and Physical Disabilities, 34*(2), 211-231. https://doi.org/10.1007/s10882-021-09796-8

Colomeischi, A. A., Duca, D. S., Bujor, L., Rusu, P. P., Grazzani, I., & Cavioni, V. (2022). Impact of a school mental health program on children's and adolescents' socio-emotional skills and psychosocial difficulties. *Children, 9*(11), 1661. https://doi.org/10.3390/children9111661

Coskun, K. (2019). Evaluation of the socio emotional learning (SEL) activities on self-regulation skills among primary school children. *Evaluation,* 4, 14-2019. https://doi.org/10.46743/2160-3715/2019.3064

Danner, D., Lechner, C. M., & Spengler, M. (2021). Do we need socio-emotional skills? *Frontiers in Psychology,* 12, 723470. https://doi.org/10.3389/fpsyg.2021.723470

Gabrijelcic, M. K., Antolin, U., & Istenic, A. (2021). Teacher's social and emotional competences: A study among student teachers and students in education science in Slovenia. *European Journal of Educational Research, 10*(4), 2033-2044. https://doi.org/10.12973/eu-jer.10.4.2033

Gavín-Chocano, Ó., Checa Domene, L., Valdivia-Casas, M., & García-Martínez, I. (2024). The impact of self-esteem, optimism and emotional intelligence on the professional development of future primary and pre-school teachers. *Teacher Development, 28*(5), 694-709. https://doi.org/10.1080/13664530.2024.2340651

Gimbert, B. G., Miller, D., Herman, E., Breedlove, M., & Molina, C. E. (2023). Social emotional learning in schools: The importance of educator competence. *Journal of Research on Leadership Education, 18*(1), 3-39. https://doi.org/10.1177/19427751211014920

Goldoni, D., Reis, H. M., Carrascoso, M. M., & Jaques, P. A. (2023). Computational tools to teach and develop socio-emotional skills: A systematic mapping. *International Journal of Learning Technology, 18*(2), 207-236. https://doi.org/10.1504/IJLT.2023.132758

Huerta Cuervo, R., Téllez, L. S., Luna Acevedo, V. H., Ramírez Solís, M. E., Vela Ibarra, C., & Ávila García, G. (2022). The socio-emotional competencies of high school and college students in the National Polytechnic Institute (Mexico). *Social Sciences, 11*(7), 278. https://doi.org/10.3390/socsci11070278

Ishchenko, Y., Rusnak, A., Artemov, V., Syniavskyi, P., & Soroka, I. (2024). Psychological and pedagogical aspects of adaptation of students who received temporary shelter to the educational environment of another country. *Journal of Higher Education Theory and Practice, 24*(1), 127-139. https://doi.org/10.33423/jhetp.v24i1.6766

Lozano-Pena, G., Saez-Delgado, F., Lopez-Angulo, Y., & Mella-Norambuena, J. (2021). Teachers' social–emotional competence: History, concept, models, instruments, and recommendations for educational quality. *Sustainability, 13*(21), 12142. https://doi.org/10.3390/su132112142

McNally, S., Darmody, M., & Quigley, J. (2019). The socio-emotional development of language-minority children entering primary school in Ireland. *Irish Educational Studies, 38*(4), 519-534. https://doi.org/10.1080/03323315.2019.1663550

Moreira-Choez, J. S., de Rodríguez, T. M. L., Lapo-Palacios, M. Á., Campuzano-Rodríguez, S. M., Guevara-Sandoya, J. A., & de Mavárez, A. A. (2024). Social impact of emotional education in the development of socio-emotional competences of university teachers. *Societal Impacts,* 4, 100080. https://doi.org/10.1016/j.socimp.2024.100080

Mowat, J. G. (2019). Supporting the socio-emotional aspects of the primary–secondary transition for pupils with social, emotional and behavioural needs: Affordances and constraints. *Improving Schools, 22*(1), 4-28. https://doi.org/10.1177/1542305018817850

Orhan, A. (2024). Trait emotional intelligence questionnaire short form (teique-sf): Reliability generalization meta-analysis. *Personality and Individual Differences*, 224, 112633. https://doi.org/10.1016/j.paid.2024.112633

Özdemir Cihan, M., & Dilekmen, M. (2024). Emotional intelligence training for pre-service primary school teachers: A mixed methods research. *Frontiers in Psychology,* 15, 1326082. https://doi.org/10.3389/fpsyg.2024.1326082

Pérez, B. R., & Bahamon Muneton, M. J. (2023). The socio-emotional dimension in education: A systematic review. *Issues in Educational Research, 33*(1), 307-326. https://search.informit.org/doi/10.3316/informit.173573406487575

Romero-García, C., Buzón-García, O., & Marcano, B. (2022). Socio-emotional competence and self-efficacy of future secondary school teachers. *Education Sciences, 12*(3), 161. https://doi.org/10.3390/educsci12030161

Salmela-Aro, K., & Upadyaya, K. (2020). School engagement and school burnout profiles during high school –The role of socio-emotional skills. *European Journal of Developmental Psychology, 17*(6), 943-964. https://doi.org/10.1080/17405629.2020.1785860

Santamaría-Villar, M. B., Gilar-Corbi, R., Pozo-Rico, T., & Castejón, J. L. (2021). Teaching socio-emotional competencies among primary school students: Improving conflict resolution and promoting democratic co-existence in schools. *Frontiers in Psychology,* 12, 659348. https://doi.org/10.3389/fpsyg.2021.659348

Sanz-Ponce, R., López-Luján, E., Serrano-Sarmiento, Á., & Giménez-Beut, J. A. (2023). Emotional competences of primary education teachers: A need in school post COVID-19. *European Journal of Investigation in Health, Psychology and Education, 13*(10), 1961-1985. https://doi.org/10.3390/ejihpe13100141

Serrano, Á., Sanz, R., Cabanillas, J. L., & López-Lujan, E. (2023). Socio-emotional competencies required by school counsellors to manage disruptive behaviors in secondary schools. *Children, 10*(2), 231. https://doi.org/10.3390/children10020231

Tobon, S., & Lozano-Salmorán, E. F. (2024). Socioformative pedagogical practices and academic performance in students: Mediation of socioemotional skills. *Heliyon, 10*(15), 34898. https://doi.org/10.1016/j.heliyon.2024.e34898

Tsortanidou, X., Daradoumis, T., & Barberá, E. (2022). Developing social-emotional skills through imaginative teaching methods in elementary education. *Early Child Development and Care, 192*(8), 1201-1216. https://doi.org/10.1080/03004430.2020.1854241

del Valle, M. V., Andres, M. L., Urquijo, S., Zamora, E. V., Mehta, A., & Gross, J. J. (2022). Argentinean adaptation and psychometric properties of the Emotion Regulation Questionnaire (ERQ). *Psychological Reports, 125*(5), 2733-2759. https://doi.org/10.1177/00332941211021343

Zakaria, M. Z., Yunus, F., & Mohamed, S. (2021). Drawing activities enhance preschoolers socio emotional development. *Southeast Asia Early Childhood Journal, 10*(1), 18-27. https://doi.org/10.37134/saecj.vol10.1.2.2021

Zhylin, M., Sikorskyi, P., Balla, E., Barchan, V., & Kuzma, O. (2022). The impact of students' social identity on psycho-social adaptation during the period of a difficult educational transition. *Journal of Intellectual Disability – Diagnosis and Treatment, 10*(6), 293–302. https://doi.org/10.6000/2292-2598.2022.10.06.3

Annex 1

Semi-structured interview

- How do you evaluate your level of social-emotional skills before the beginning of the course?
- Which emotional and social skills do you believe you have improved during the course?
- Did you experience difficulties in mastering techniques directed at the development of social-emotional skills? If yes, what were they?
- How did the use of interactive techniques (role plays, group discussions) affect your ability to interact with others?
- Have your approaches to conflict resolution changed since you passed the course? If yes, in which way?
- Have you developed an ability in emotion regulation? Could you provide some examples?
- What learning methods do you believe to be the most effective for the development of empathy and emotion regulation?
- What social-emotional skills, you obtained, do you believe to be helpful in future professional activity?
- In your opinion, did the program contain something that could be improved for the better development of socio-emotional competencies?
- How do you plan to use the obtained social-emotional skills in your profession in future?

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Unlocking Potential: The Impact of Structured Digital Lessons and Self-Assessment Strategies on Mathematics Achievement and Motivation among School Students in the UAE

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Abstract

This empirical study investigates the impact of structured digital lessons integrated with success criteria-based self-assessment strategies on sixth-grade students' achievement and motivation in mathematics. The study is situated within the context of the United Arab Emirates (UAE), aligning with the "We the UAE 2031" vision that emphasizes innovation, learner autonomy, and academic excellence. A quasi-experimental pre-test/post-test design was adopted, involving 120 students from AlKhair Public School in Al Ain. Two classes (n = 60) received instruction through structured digital lessons embedded with success criteria and self-assessment strategies, while the remaining two classes (n = 60) were taught using traditional instructional methods without targeted self-assessment components. All students completed mathematics achievement and motivation measures before and after the intervention. The findings indicate that students in the experimental group demonstrated notable improvements in both academic performance and motivational dimensions such as self-efficacy, intrinsic value, and task engagement, compared to their peers in the control group. The study concludes by highlighting the pedagogical significance of integrating success criteria-based self-assessment within digital instructional models and suggests practical implications for classroom practice and educational policy in the UAE. Directions for future research are discussed, including the expansion of this approach across different subjects and educational settings.

Keywords:

Structured Digital Lessons; Success Criteria; Self-Assessment; Mathematics Achievement; Student Motivation; We the UAE 2031 Vision; Self-Regulated Learning.

Introduction

The transformation of education in the digital age necessitates innovative and structured approaches that align with the evolving needs of students and educators (Aldhafeeri & Alotaibi, 2023). Academic progress, both at an individual and societal level, is intricately linked to the efficacy of the educational system (Sakız et al., 2021). As contemporary education shifts towards dynamic and interactive methodologies, the integration of structured digital lessons has emerged as a crucial component in fostering student engagement, self-regulation, and academic excellence (Moorhouse & Wong, 2022). Digital learning platforms, particularly Smart Learning Gateway LMS, have redefined traditional pedagogical approaches by incorporating structured lesson plans, real-time assessments, and interactive engagement tools that cater to diverse learning needs (Kong, 2021). These platforms align with the UAE's educational reform initiatives, particularly the "We the UAE 2031" vision, which aims to cultivate a knowledge-based economy driven by innovation and excellence (Matsumoto, 2019; Khaled & Alghfeli, 2024).

Self-assessment plays a pivotal role in this transformation, equipping students with the ability to critically analyze their progress and develop a proactive approach to learning (Yan, 2020). Panadero and Dochy (2014) defines self-assessment as an essential mechanism for measuring success criteria, particularly in mathematics education. The need for precise and adaptive assessment tools is more pronounced than ever, as educational systems strive to implement objective evaluation frameworks that support data-driven decision-making (Zeide, 2017). Through platforms like Smart Learning Gateway LMS, students gain access to tailored assessments, personalized feedback, and targeted learning pathways, ensuring that their academic journey is both structured and adaptable to their individual needs (Simić et al., 2016; Ikhsan et al., 2025). Research indicates that structured self-assessment strategies significantly enhance students' ability to monitor their own learning, a key predictor of academic success (Zimmerman & Schunk, 2013; Karaman, 2024).

The modern educational landscape underscores the importance of data-driven evaluation, necessitating a shift towards methodologies that enhance instructional quality and student outcomes (Rehan, 2023). The ability to monitor and adjust learning strategies in real-time enables students to develop metacognitive skills, fostering deeper engagement and academic resilience (Anthonysamy, 2021). Educational evaluation, when effectively integrated into digital platforms, serves as an indispensable tool in refining curriculum delivery and enhancing student motivation. As Almarode et al. (2020) argue, success criteria serve as a guiding framework that not only clarifies learning objectives but also enhances students' ability to navigate their academic journey with greater confidence and precision.

Moreover, motivation represents a crucial determinant of academic success, significantly influencing students' perseverance and overall performance (Howard et al., 2021). Recent studies highlight the interplay between digital learning environments, structured success criteria, and intrinsic motivation, demonstrating that students who engage in goal-oriented and self-directed learning exhibit enhanced academic performance (Scheel et al., 2022; Zhu et al., 2020). The implementation of Smart Learning Gateway LMS provides students with an immersive learning experience that reinforces self-efficacy, allowing them to track their progress, receive continuous feedback, and refine their learning strategies accordingly (Simić et al., 2016; Ikhsan et al., 2025). Research by Ryan et al. (2021) further supports this notion, emphasizing that motivation in education is driven by structured learning environments that encourage autonomy, competence, and relatedness.

The integration of success criteria into digital learning is instrumental in fostering self-regulated learning, a process that empowers students to take control of their academic development (Lai & Hwang, 2023). According to Zimmerman and Schunk (2013), self-regulated learning is a key predictor of student success, enabling learners to set goals, monitor their progress, and make necessary adjustments to their study habits. By embedding structured lessons within digital lessons, educators can provide a clear roadmap for students, ensuring that learning objectives are transparent and achievable. This structured approach, facilitated by platforms like Smart Learning Gateway LMS, not only enhances academic outcomes but also nurtures essential life skills such as problem-solving, critical thinking, and adaptability (Simić et al., 2016; Ikhsan et al., 2025).

Recent empirical studies further emphasize the effectiveness of self-regulated learning and interactive learning strategies in improving students' mathematical proficiency and motivation (Xu et al., 2023; Theobald, 2021; Ejubovic & Puška, 2019). Fostering independent and critical thinkers capable of addressing complex real-world challenges is a central pillar of the UAE's "We the UAE 2031" vision, which aims to empower learners with the skills and mindset needed for a rapidly evolving global landscape (Khaled & Alghfeli, 2024). The integration of digital learning tools, self-assessment, and success criteria aligns with this vision by preparing students with the analytical and cognitive skills required for the 21st-century knowledge economy (Khaled & Alghfeli, 2024). Moreover, the UAE's commitment to educational excellence is reflected in national assessments such as the Trends in International Mathematics and Science Study (TIMSS), which have demonstrated significant improvements in student achievement when innovative learning methodologies are employed (Wardat et al., 2022).

The need for research in this domain is evident, given the profound implications of structured digital learning on student achievement and motivation.

Understanding the interplay between digital learning environments, self-assessment, and success criteria is critical to optimizing pedagogical strategies and ensuring that students are well-equipped to navigate the complexities of modern education. This research aims to bridge the gap between traditional educational methodologies and contemporary digital learning solutions, offering insights into how structured digital lessons and self-assessment can be leveraged to enhance academic achievement and motivation. By aligning with modern educational initiatives and incorporating evidence-based practices, this study seeks to contribute to the ongoing evolution of education, ensuring that learning remains meaningful, engaging, and impactful in the digital era.

Problem Statement

Aligned with the "We the UAE 2031" vision for education, which prioritizes the development of students' skills and competencies through cutting-edge research and advanced educational methodologies, the United Arab Emirates continues to experience transformative advancements that are redefining the educational experience (Khaled & Alghfeli, 2024). The UAE has made remarkable progress in implementing ambitious reforms to align with its national vision, fostering an environment of innovation and excellence (Karabchuk et al., 2022).

As the educational sector undergoes rapid digital transformation, structured digital lessons and self-assessment strategies have emerged as crucial tools in fostering student autonomy, self-regulation, and academic excellence (Al Zarooni, 2023; Al Murshidi, 2019). Research in this domain, particularly regarding their integration in mathematics education, is essential for ensuring that UAE schools leverage digital advancements to enhance learning outcomes and student motivation (AlKhaza'leh et al., 2023).

Given that mathematics is regarded as the language of modern sciences and a fundamental pillar of a knowledge-based economy, the UAE has placed significant emphasis on enhancing mathematical proficiency. This is evident in the introduction of specialized curricula in analytical and innovative thinking. Furthermore, increased student participation in applied mathematical activities outside the classroom reflects the country's commitment to achieving its educational vision (Al Zarooni, 2023; Badawy, 2022; ElSayary, 2021).

Despite notable progress in mathematics education, national and international assessments continue to highlight challenges that need to be addressed. The TIMSS has reported a significant improvement in the performance of UAE students in mathematics and science between 2015 and 2023 (Wardat et al., 2022). However, there remains an urgent need to adopt contemporary learning strategies that incorporate self-regulated learning and interactive methodologies. These approaches can better equip students with the skills to tackle academic challenges with confidence and flexibility (Lai & Hwang, 2023).

In this regard, Her Excellency Sarah bint Yousif Al Amiri emphasized that these improvements are a direct result of investments in human capital and the creation of an enabling educational environment. Such an environment prepares students to become future leaders in thought and innovation (Robinson & Aldridge, 2022). Nonetheless, existing studies indicate that while structured digital lessons and self-assessment techniques have demonstrated effectiveness in fostering engagement and improving student outcomes globally, their integration within the UAE's educational system remains underexplored (Ejubovic & Puška, 2019).

Furthermore, research examining the relationship between self-assessment, success criteria, and structured digital learning in mathematics remains limited (Haddad et al., 2024). This presents an opportunity to investigate how these elements can optimize learning outcomes both nationally and globally. The urgency of this research is further underscored by findings from an exploratory pilot study conducted by the researchers, which revealed persistent challenges among middle school students in mathematics education.

The pilot study conducted by the researchers highlighted continued reliance on traditional teaching methods, limited application of self-directed learning strategies, and a general lack of engagement with interactive educational tools. Additionally, interviews with mathematics teachers and coordinators indicated widespread deficiencies in students' problem-solving skills, motivation levels, and perseverance when faced with cognitively demanding tasks.

A recurring theme in these interviews was the absence of structured self-assessment strategies and success criteria. These tools could provide students with a clearer understanding of their learning progress and encourage greater academic ownership. As the UAE continues to advance its educational system, research on structured digital learning and self-assessment is vital in cultivating an environment that nurtures skill development, encourages independent learning, and aligns with the "We the UAE 2031" vision (Khaled & Alghfeli, 2024; Haddad et al., 2024).

By enhancing research efforts in structured digital education, the UAE can ensure its educational system remains at the forefront of modern advancements. This would equip students with the necessary tools for future success (Al Zarooni, 2023; Badawy, 2022;

ElSayary, 2021). The integration of success criteria into structured digital lessons is instrumental in achieving the UAE's long-term educational goals, particularly under the "Excellent Education in U.A.E. 2071" vision.

Success criteria provide clear benchmarks for students, fostering self-directed learning and improving problem-solving and analytical skills. When integrated with formative assessment and digital tools, they support goal setting, progress tracking, and reflection (Moorhouse & Wong, 2022). Coupled with a growth mindset, this approach empowers students to embrace challenges and develop core skills like critical thinking and independence (Stohlmann & Yang, 2024).

These principles align with the UAE's broader educational framework, which prioritizes transparency, participatory learning, and globally competitive education (Matsumoto, 2019). By embedding structured success criteria within digital learning platforms, UAE schools can empower students with autonomy and resilience, promoting deeper engagement and higher academic achievement.

While success-based self-assessment strategies have been extensively studied in global contexts (Karaman, 2024; Yan, 2020; Vrieling et al., 2018), their direct impact on student achievement and motivation within the UAE's educational system remains insufficiently examined. This study aims to bridge this gap by investigating the role of structured digital lessons and success criteria as a self-assessment strategy in enhancing the academic achievement and motivation of sixth-grade mathematics students in UAE schools.

The findings will contribute to a deeper understanding of the relationship between success criteria and self-assessment practices, providing evidence-based insights into their impact on student achievement. Moreover, this research seeks to inform educational policies and instructional methodologies, ensuring alignment with the objectives of the "We the UAE 2031" vision. By addressing the gap in structured digital learning methodologies and self-assessment frameworks, this study will support UAE schools in fostering an innovative, adaptive, and student-centered educational system, ensuring sustained excellence and empowerment in mathematics education.

Objectives of the study

This study seeks to explore the role of structured digital lessons and self-assessment through success criteria in enhancing mathematics achievement and motivation among students at Al-Khair School, UAE. By integrating these pedagogical approaches, this research aims to provide empirical insights into their effectiveness in fostering student autonomy, improving academic performance, and sustaining long-term learning engagement. The study is guided by the following objectives:

1. To assess how structured digital lessons incorporating self-assessment through success criteria influence students' mathematics achievement in comparison to traditional learning approaches.

2. To examine the effect of structured digital lessons integrated with self-assessment through success criteria on students' motivation compared to traditional learning approaches.

Research Questions and Hypotheses

Research Questions

1. How do structured digital lessons incorporating self-assessment through success criteria impact students' mathematics achievement compared to traditional learning approaches?

2. How do structured digital lessons incorporating self-assessment through success criteria influence students' motivation compared to traditional learning approaches?

Hypotheses

H1: Students exposed to structured digital lessons integrated with self-assessment through success criteria will demonstrate significantly higher mathematics achievement compared to those receiving traditional instruction, as measured by pre-test and post-test scores.

H2: Students participating in structured digital lessons integrated with self-assessment through success criteria will exhibit significantly higher motivation levels compared to those in traditional learning environments, as measured by student motivation surveys and engagement metrics.

Literature Review

The modern educational systems places increasing emphasis on integrating technology-driven practices to elevate students' academic outcomes and personal growth, especially in subjects like mathematics where conceptual understanding and procedural fluency are crucial (Cullen et al., 2020). Several studies have demonstrated the positive impact of digital tools and platforms on learners' engagement and performance. For instance, Chao et al. (2016) found that interactive lesson modules significantly enhanced students' motivation and conceptual clarity, while Kaplar et al. (2022) reported that students using structured digital lessons in mathematics displayed better problem-solving skills and higher self-regulation levels compared to those in traditional settings. Similarly, Candel et al. (2020) highlighted the importance of immediate feedback within digital environments, indicating that timely corrections and guided instructional content helped learners overcome conceptual barriers more effectively.

Beyond academic achievement, a growing body of research underscores the role of technology-enhanced education in supporting metacognitive development, including self-reflection, goal setting, and self-monitoring (Yorganci, 2025; Duangnamol et al., 2018). Engeness (2021) demonstrated how structured digital lessons, when combined with opportunities for self-assessment, can promote deeper engagement and foster a sense of ownership over the learning process. This aligns with the findings of Schmid et al. (2021), who noted that technology-rich classrooms cultivate an environment where students actively track their progress and willingly adapt their strategies to meet specific learning targets. In mathematics education, these self-directed behaviors are especially significant, as learners often benefit from iterative cycles of practice, feedback, and reflection to reinforce understanding (Yıldızlı & Saban, 2016).

Within this evolving educational context, structured digital lessons have emerged as a foundational framework for implementing pedagogical practices that emphasize learner autonomy and sustained motivation (Scheel et al., 2022). In tandem with self-assessment and well-defined success criteria, such lessons enable students to pinpoint their strengths and areas for improvement, thereby channeling their efforts strategically. Several studies corroborate that explicitly stated success criteria and consistent self-evaluation enhance students' confidence and willingness to tackle challenging tasks (Lopez Carrillo et al., 2024; Aldosari & Alsager, 2023). This synergy between clarity of learning goals, technology-driven instruction, and reflective practice has been associated with notable gains in mathematics achievement, higher-order thinking skills, and positive attitudes toward learning (Cullen et al., 2020; Christopoulos et al., 2020).

In the United Arab Emirates, there is a pronounced emphasis on leveraging educational technology to realize the nation's broader vision of innovation and excellence, as articulated in "We the UAE 2031" vision (Efstratopoulou et al., 2024; Sakr & Abdalla, 2024). Across UAE schools, teachers and administrators have recognized that structured digital lessons, combined with self-assessment practices and clear success criteria, can address diverse learning needs and mitigate gaps in mathematics achievement (Khaled & Alghfeli, 2024). Through the systematic integration of these components in everyday instruction, students benefit from a well-defined roadmap for progress, ongoing feedback loops to guide development, and the motivation to persevere through challenging mathematical problems (Zhang et al., 2022; Hansen, 2021; Barana et al., 2018). AlKhair School exemplifies these strategies in action, demonstrating how embedding technology-driven approaches within the curriculum can yield tangible improvements in student outcomes.

Against this backdrop, the present theoretical framework starts by examining the role of structured digital lessons in shaping the learning experience, followed by an in-depth exploration of self-assessment as a cornerstone of learner autonomy, and finally a discussion on success criteria as a guiding pillar for both teaching and learning. The review concludes by illustrating how these interwoven elements synergistically enhance mathematics performance and foster sustained motivation within the UAE educational context.

Structured Digital Lessons

Structured digital lessons are carefully designed online or technology-augmented instructional modules that provide clear objectives, interactive learning activities, and immediate feedback to learners (Ikhsan et al., 2025). These lessons typically incorporate diverse digital resources—such as multimedia presentations, virtual simulations, interactive quizzes, and discussion forums—to address various learning styles and maintain student engagement (Singhal et al., 2021). Importantly, they often allow learners to proceed at their own pace, revisiting content as needed for deeper understanding (Sorgenfrei & Smolnik, 2016).

Research has consistently highlighted the advantages of integrating structured digital lessons into mathematics curricula. Students benefit from the immediate feedback loops these lessons offer, which foster metacognitive awareness and help correct misconceptions early in the learning process (Candel et al., 2020). For instance, interactive problem-solving platforms enable real-time tracking of student inputs and error patterns, allowing for timely instructional adjustments by both the learner and the teacher (Ikhsan et al., 2025). This immediacy of feedback can be especially powerful in mathematics, where conceptual misunderstandings, if left unaddressed, can impede mastery of advanced topics (Candel et al., 2020).

Furthermore, structured digital lessons can be adapted to accommodate various levels of difficulty, scaffolding the learner's journey from foundational skills to more complex tasks (Kang, 2018). By providing differentiated pathways based on performance data, these lessons support students who may need extra practice while simultaneously challenging those ready to move ahead (Rao et al., 2021). This adaptability is tied to heightened motivation; learners feel a sense of agency when they observe personalized progress trajectories, spurring them to persist in mastering difficult mathematical concepts (Chao et al., 2016).

Another critical feature of structured digital lessons is the capacity to integrate communication tools such as online discussion boards, collaborative problem-solving rooms, and peer-review systems (Moorhouse & Wong, 2022). These elements foster a communal learning atmosphere where students exchange ideas, challenge one another's thinking, and develop collective problem-solving strategies (Simić et al., 2016; Ikhsan et al., 2025). Alajarmeh and Rashed (2019) indicates that peer collaboration within digital environments can enrich understanding by exposing learners to diverse perspectives and solution methods. In short, structured digital lessons lay the groundwork for an engaging, student-centered milieu—one that aligns effectively with contemporary pedagogical goals of fostering independent, reflective, and motivated learners (Engeness, 2021).

Self-Assessment Strategy through Success Criteria

Self-assessment is a reflective practice in which learners critically evaluate their own work in light of established criteria (Almasraf, 2023). It involves judging the quality, completeness, and accuracy of their performance, thereby identifying strengths and areas needing improvement (Garshasbi et al., 2019). While self-assessment can be conducted in traditional classroom settings, its integration with structured digital lessons enhances both the immediacy and accuracy of the feedback loop (Zare et al., 2022). Digital platforms frequently embed mini-quizzes, polls, or interactive checkpoints that prompt students to gauge their understanding, compare their answers with model solutions, and adjust their study strategies as needed (Cullen et al., 2020).

One of the core benefits of self-assessment is the development of learner autonomy and responsibility (Sakr & Abdalla, 2024). As students actively monitor their progress, they become more aware of the cognitive strategies that contribute to effective learning. This metacognitive awareness fosters strategic thinking and planning: learners can set short-term goals, develop personalized study plans, and track their progress toward mastery (López Carrillo et al., 2024). Empirical studies suggest that students who engage in regular self-assessment exhibit better academic performance and a stronger sense of ownership over their learning processes (Almasraf, 2023; Khaled & Alghfeli, 2024).

Moreover, self-assessment plays a pivotal role in bolstering motivation (Howard et al., 2021). When learners can visually chart their progress or see improvements in real time—such as a rising score in an online practice environment—they experience heightened confidence and a willingness to tackle more challenging tasks (Van Wart et al., 2019). This cyclical pattern of challenge, feedback, and re-engagement cultivates resilience and adaptive learning behaviors, key elements of a growth mindset (Schunk, 2023). It is within this reflective process that success criteria serve as essential referents, guiding learners in their self-evaluation and helping them understand precisely how to move from current performance to targeted outcomes (Eagan, 2023).

Success criteria are explicit statements that define the quality of expected performance in a given task, often detailing the learning goals, the depth of understanding required, and the type of evidence that demonstrates mastery (Almarode et al., 2020). They are not merely checklists; rather, they represent a transparent framework that teachers and learners use to gauge growth (Garshasbi et al., 2019). By clarifying what successful work looks like, success criteria help students set realistic performance benchmarks and navigate the steps needed to improve (Eagan, 2023).

In mathematics education, success criteria may include mastery of procedural knowledge (e.g., accurate algebraic manipulation), conceptual understanding (e.g., explaining the rationale behind a given theorem), and application skills (e.g., solving real-world problems using learned concepts) (Khaled & Alghfeli, 2024). Research has shown that students' motivation increases when they understand the specific targets they must meet (Panadero et al., 2017). Clear success criteria allow them to measure progress concretely and to seek targeted assistance from teachers or peers whenever they detect a gap in knowledge or skills (López Carrillo et al., 2024).

The utility of success criteria is maximized when coupled with timely feedback. For instance, constructive feedback that highlights how closely a student's work aligns with the stated criteria bolsters self-efficacy and directs learners toward strategies for improvement (Khaled & Alghfeli, 2024). This synergy between clear goals, self-evaluation, and meaningful feedback is integral to nurturing self-regulated learners, as students internalize the benchmarks and continuously refine their work until it meets or exceeds those benchmarks (Cullen et al., 2020; Christopoulos et al., 2020).

Relationship between Structured Digital Lessons and Self-Assessment Through Success Criteria to Enhance Math Achievement

One of the core propositions in contemporary educational research is that structured digital lessons and self-assessment through success criteria are mutually reinforcing elements that promote math achievement. When students engage with well-designed digital content, they receive immediate, targeted feedback tied to predefined learning goals—feedback that can, in turn, guide their self-assessment processes (Christopoulos et al., 2020). This cyclical relationship plays a crucial role in mathematics instruction, given the cumulative nature of math concepts and the rapid identification of errors that immediate digital environments can offer (Zhang et al., 2022; Hansen, 2021; Barana et al., 2018). Students who routinely evaluate their progress against clear benchmarks not only detect gaps in their understanding promptly but also develop a stronger sense of ownership over their own learning (Eagan, 2023). As a result, self-assessment—a pivotal metacognitive skill—becomes more effective when learners have structured digital resources that reinforce transparency and goal-orientation.

A growing body of research indicates that structured digital lessons have a positive impact on students' mathematics achievement, largely due to their interactive components and potential for immediate feedback. In a frequently cited meta-analysis, Ran et al. (2021) found that the use of computer-based instructional tools significantly improved K–12 students' mathematics learning outcomes, highlighting the importance of technology integration for conceptual understanding.

Similarly, Zhang et al. (2015) examined a range of educational technology applications in mathematics and concluded that well-designed digital lessons can yield moderate to strong effects on students' test scores. They emphasized that ongoing feedback and interactivity are pivotal in sustaining student engagement and reinforcing newly acquired skills. A review by Higgins et al. (2019) further supported these findings, arguing that the successful use of digital technology in mathematics relies on both teacher preparedness and the strategic use of interactive software that keeps learners motivated. More recent work by Yeh et al. (2019) demonstrated how digital game-based learning in primary math classrooms contributed not only to higher achievement but also to increased enjoyment and lower math anxiety.

Alongside the rise of digital instructional tools, extensive research has underscored the effectiveness of self-assessment through success criteria in boosting mathematics performance. Panadero et al. (2017) noted that when learners are given explicit benchmarks to measure their own work, they develop stronger metacognitive skills—such as planning, monitoring, and regulating their learning strategies. Further evidence from Raaijmakers et al. (2019) suggests that learners who regularly compare their output to clear success criteria demonstrate increased accuracy in judging their mastery level, prompting timely adjustments in study habits and resulting in better test performance.

Relationship between Structured Digital Lessons and Self-Assessment Through Success Criteria to Enhance Motivation

A growing body of literature underscores the positive impact of structured digital lessons on learners' drive to succeed. In a systematic review, Schindler et al. (2017) reported that technology-rich environments encourage higher engagement levels by catering to diverse learning styles and providing individualized feedback. Similarly, Dinh and Phuong (2024) examined massive open online courses (MOOCs) and found that well-organized digital instruction can reduce demotivation by offering students flexible pacing and immediate evaluative information.

Alongside the integration of technology, extensive research has highlighted the role of self-assessment through success criteria in boosting motivation. Moorhouse and Wong (2022) explained that clear benchmarks and reflective prompts not only help students gauge their current standing but also cultivate self-efficacy, leading them to approach challenging tasks with more confidence. Li et al. (2021) echoed this perspective, showing that explicit success criteria in both science and math contexts led to greater persistence and curiosity among learners.

Reinforcing these insights, Puente-Díaz (2012) posited that when learners understand and internalize success criteria, they are more likely to set meaningful personal goals and embrace a growth mindset. In the same vein, Yan (2020) demonstrated that digital self-assessment tools—designed around well-defined criteria—help university students remain motivated over longer periods, as they can regularly see the direct impact of their efforts.

Collectively, these studies illustrate that weaving self-assessment through success criteria into structured digital lessons can significantly bolster learners' motivation. By offering precise indicators of progress and real-time feedback, digital platforms cater to students' need for autonomy, competence, and relatedness—fundamental ingredients for nurturing long-term motivation (Chiu, 2022).

While global research on structured digital lessons and self-assessment is expanding, studies in the UAE remain limited. Though some highlight the benefits of technology and reflective learning (Efstratopoulou et al., 2024), few examine their impact on motivation and math achievement in middle grades. Given the UAE's unique context, this study investigates how structured digital lessons and self-assessment using success criteria affect sixth-grade students' motivation and achievement, offering insights for local educational practice.

Methodology

The current study adopted a quasi-experimental pretest-posttest design to assess the impact of structured digital lessons and self-assessment using success criteria on students' mathematics achievement and motivation. Conducted at AlKhair School, UAE, this research integrates digital learning strategies with self-regulated assessment techniques to optimize student performance, aligning with the UAE's 2031 educational vision. The study examines how structured digital lessons embedded with self-assessment strategies empower students to take ownership of their learning process, enhancing both their mathematical proficiency and intrinsic motivation.

Given administrative constraints preventing full random selection, intact classes were assigned as study samples rather than randomly assigning students. The study was conducted during Term 1 of the 2023/2024 academic year, involving four sixth-grade classes. The selection of the experimental and control groups was determined through random assignment. The experimental group engaged in self-regulated assessment methods, incorporating detailed success criteria within structured digital lessons. In contrast, the control group followed traditional assessment methods without explicit structured digital lessons and success criteria.

To establish a baseline for student learning, a researcher-designed diagnostic pre-test, aligned with the national curriculum, was administered to both groups. The intervention's effectiveness was evaluated using post-test scores from the UAE Ministry of Education's national mathematics assessments. The Final Ministry Mathematics Exam served as the post-test for achievement, measuring concept mastery and procedural fluency. Additionally, students' Mathematical Motivation Questionnaire (MMQ) scores were analyzed to assess intrinsic and extrinsic motivation in relation to mathematics learning.

Beyond academic performance, the study highlights the role of interactive and self-reflective tasks in enhancing mathematical proficiency. It also explores how goal setting, feedback loops, and adaptive assessments contribute to increasing students' intrinsic motivation, fostering deeper engagement with the learning process, and promoting sustained academic growth

Participants

This study was conducted at AlKhair Public School in Al Ain, United Arab Emirates, during the academic year 2023/2024. The sample consisted of 120 sixth-grade female students from the general stream, all following the standardized curriculum prescribed by the UAE Ministry of Education. This ensured consistency in academic background and minimized the influence of external variables on study outcomes. Additionally, all students shared a common socio-cultural environment, further enhancing the homogeneity of the sample. The students were divided into two groups: an experimental group of 60 students, who were exposed to structured digital lessons incorporating self-assessment through success criteria to enhance mathematics achievement and motivation, and a control group of 60 students, who continued with traditional teacher-led instruction.

AlKhair Public School was selected for this study due to the researchers' professional affiliation with the institution and its pioneering implementation of innovative teaching and learning strategies among public schools in Al Ain. The school's administration actively supports cutting-edge educational strategies aimed at optimizing student performance, aligning with the UAE's 2031 educational vision. This proactive approach makes it an ideal setting for evaluating the effectiveness of new instructional methods.

To verify the initial equivalence between the experimental and control groups in terms of academic achievement, a diagnostic pre-test was administered prior to the implementation of the instructional intervention. This assessment aimed to ensure that both groups demonstrated similar levels of academic readiness at the outset of the study. An independent sample t-test was conducted to examine whether any statistically significant differences existed in the pre-test scores between the two groups. The results, presented in Table 1, confirm the absence of significant differences, thereby validating the comparability of the groups before the intervention.

Table 1

Independent sample t-test results for pre-achievement test scores by group

Group	*N*	Mean	*sd*	t-value	*df*	p-value
Control	60	40.92	14.22	0.576	118	0.566
Experimental	60	39.33	15.85			

Table 1 shows that the value of t is not statistically significant ($p > 0.05$), indicating no statistically significant differences between the mean scores of the experimental and control groups in prior achievement levels. This confirmation of equivalence ensures that any subsequent effects on academic achievement can be reliably attributed to the teaching strategies and intervention methods used in the study.

Moreover, to establish baseline equivalence in mathematical motivation between the experimental and control groups, the MMQ was administered as a pre-test. This instrument evaluates five core dimensions: intrinsic value, utility value, self-efficacy, self-regulation, and test anxiety (reverse-scored). Independent sample t-tests were conducted for each dimension to determine if any statistically significant differences existed prior to the instructional intervention. The results, detailed in Table 2, indicate no significant differences across any of the motivation dimensions, supporting the conclusion that the two groups were motivationally equivalent at the beginning of the study.

As shown in Table 2, none of the t-values were statistically significant ($p > 0.05$), indicating no significant differences between the experimental and control groups in any of the MMQ dimensions or in total motivation scores at the pre-test stage. This confirms that the groups were equivalent in terms of mathematical motivation prior to the intervention, ensuring that any post-test differences can be attributed to the instructional methods rather than pre-existing disparities.

Study Instruments and Procedure

Procedure

The instructional program implemented in Al-Khair School for sixth-grade mathematics, as part of the study integrates structured digital lessons with success criteria-based self-assessment. This model supports the development of academic achievement and motivation by combining the clarity and consistency of digital lesson design with the reflective practices encouraged by self-assessment. The program aligns with the "We the UAE 2031" vision by promoting innovation and educational excellence through technology-enhanced learning environments and formative assessment practices that empower students to understand learning objectives and evaluate their own progress.

The program was implemented over a period of 12 weeks during the first academic term, totaling 72 instructional sessions—6 sessions per week, with each session lasting 60 minutes. It was built around the official Grade 6 mathematics curriculum, covering four main units: ratios and rates, decimals and percentages, operations with multi-digit numbers, and integers, rational numbers, and the coordinate plane. While fully adhering to the national curriculum, the lessons were digitally structured to present clear learning goals and embedded success criteria at each stage. Self-assessment was systematically incorporated through color-coded indicators and reflection tools, allowing students to track their understanding in real time. This integration of structured digital instruction with continuous self-assessment aimed to foster clarity, confidence, and measurable improvement in both mathematical performance and student motivation.

At the core of this program lies the step-structured lesson design, a strategy that segments each lesson into defined, sequential learning stages. Each stage presents a clear objective aligned with success criteria displayed on the digital board and LMS interface (as seen in Figure 1). Lessons begin with a "To Do Now" prompt, followed by explicit learning targets and a visual progress tracker using the lesson step strip, which promotes planning, time management, and goal setting—key components of self-regulated learning.

Table 2
Independent sample t-test results for MMQ pre-test scores by group

MMQ Dimension	Group	*N*	Mean	*sd*	t-value	*df*	p-value
Intrinsic Value	Control	60	2.95	0.64	0.412	118	0.681
	Experimental	60	3.02	0.61			
Utility Value	Control	60	3.15	0.58	0.395	118	0.694
	Experimental	60	3.20	0.60			
Self-Efficacy	Control	60	2.91	0.67	0.578	118	0.565
	Experimental	60	2.85	0.65			
Self-Regulation	Control	60	2.83	0.62	0.447	118	0.656
	Experimental	60	2.77	0.60			
Test Anxiety	Control	60	4.12	0.73	0.529	118	0.598
	Experimental	60	4.20	0.75			
Total Motivation	Control	60	3.19	0.47	0.361	118	0.719
	Experimental	60	3.24	0.49			

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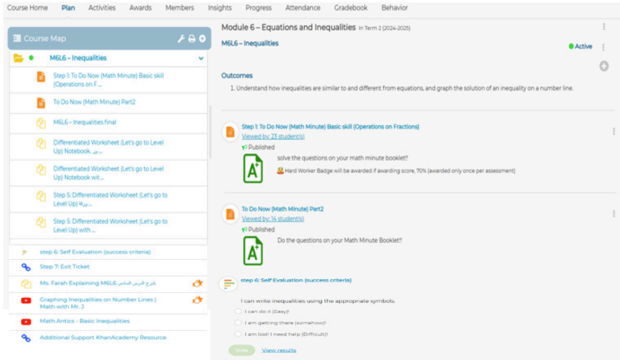
Figure 1

Step-Structured Lesson Design on LMS

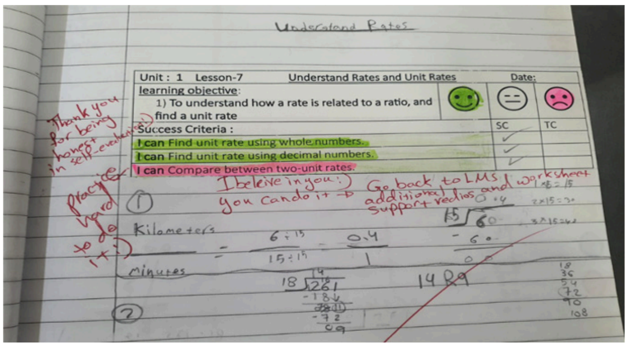


Students engage in daily short assessments known as "Math Minutes" during the opening of each class. These quick tests serve both as review and diagnostic tools, providing immediate feedback. Students chart their scores on personal graphs, fostering accountability and tracking growth over time. This process enhances metacognitive awareness, as students identify gaps and take ownership of their progress.

The self-assessment strategy is implemented after each lesson objective is taught and practiced. Using color-coded success criteria stickers (see Figure 2), students reflect on their mastery: red for "need improvement," yellow for "partial understanding," and green for "mastery." This visual, formative tool helps students monitor their learning in real time, while enabling the teacher to deliver targeted feedback.

Figure 2

Color-coded success criteria stickers used for student self-assessment and real-time feedback



Following the self-assessment strategy that was recommended by Khaled and Alghfeli (2024), students receive differentiated tasks tailored to their performance levels. Those who indicate red engage in remedial activities labeled "Let's Go" and "Continue," designed to reinforce foundational concepts. Students at the yellow level proceed to supportive activities such as "One Step to Go" and "Two Steps to Go," which help bridge learning gaps and prepare them for more advanced content. Meanwhile, green-level students explore enrichment activities labeled "Level Up" and "A+," which promote higher-order thinking skills in alignment with Bloom's Taxonomy (see Table 3). This differentiation ensures every student receives an appropriate level of challenge, directly supporting self-paced learning and maintaining high engagement.

Table 3

The designed level stickers and success criteria corresponding to Bloom's Taxonomy model (Khaled & Alghfeli, 2024)

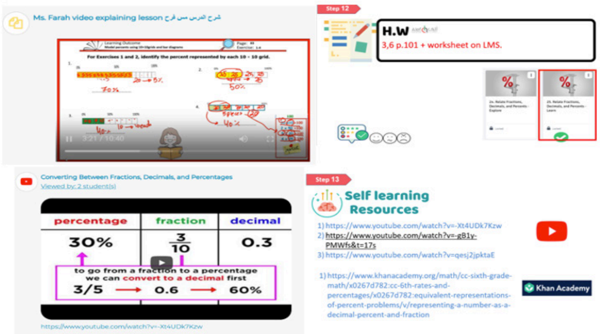
Stickers' levels for activities	Bloom's Taxonomy Levels	Success criteria
 	Remember: Recall basic math facts, terms, and concepts. Activities: listing formulas, identifying shapes, and retrieving definitions. Understand: Grasp the meaning of math concepts by interpreting and explaining them. Activities: summarizing procedures, explaining ideas, and comparing methods.	Mastery of 1 or none of success criteria.
 	Apply: Use learned math concepts in new situations. Activities: solving problems, applying formulas, and demonstrating procedures. Analyze: Break down math problems to understand their structure. Activities: comparing methods, identifying patterns, and organizing data.	Mastery of 2 of success criteria.
 	Evaluate: Make judgments about math solutions based on criteria. Activities: critiquing methods, assessing solutions, and justifying answers. Create: Generate new ideas and solutions in math. Activities: designing experiments, constructing models, and producing new problem-solving methods.	Mastery of 3 of success criteria or more.

The program also incorporates visual aids and motivational tools, including interactive success-tracking posters and level-based achievement badges, reinforcing a growth mindset. Throughout each session, students are encouraged to reflect, revise, and revisit their goals, which nurtures a cycle of self-regulation involving planning, monitoring, and evaluating.

Digital integration plays a vital role in amplifying the program's success. Lessons are hosted on an LMS platform, where interactive slides, embedded quizzes, polls, and discussion boards enable students to engage actively and independently. Teachers use the platform to embed additional resources like video tutorials, interactive worksheets, and Khan Academy links for extended practice, as referenced in Figure 3.

Figure 3

LMS platform interface featuring interactive lessons, quizzes, and supplementary digital resources



Finally, regular feedback sessions and peer discussion forums provide a safe space for reflection and collaborative learning. Teachers act as facilitators, shifting the responsibility of learning to the students, thereby reducing teacher talk to 20% and increasing student-led engagement to 80%.

This innovative framework supports a comprehensive self-regulated learning model, where structured digital instruction, continuous formative feedback, self-assessment, and differentiation converge to build academic confidence and independence. The program sets a clear path toward meeting the goals of "We the UAE 2031" vision by developing learners who are reflective, resilient, and ready to lead in a rapidly evolving world.

Study Instruments

To ensure the equivalence of the experimental and control groups before implementing the instructional intervention, a pre-test assessment was administered to measure academic achievement through a diagnostic test and evaluate students' motivation using the MMQ. An independent sample t-test was conducted to determine whether any statistically significant differences existed between the groups in their pre-test results. The analysis revealed no statistically significant differences between the two groups (p > 0.05), confirming their equivalence in academic readiness and motivation as presented in Table 1 and Table 2 previously.

The diagnostic test tool was utilized as a pre-test assessment, designed by the teacher in a format similar to the final ministerial exam. To ensure its validity, the test was reviewed by a panel of five experts in mathematics education, assessment, and psychometrics. The experts provided structured feedback on the clarity, alignment with curriculum objectives, and appropriateness of difficulty levels. Based on their recommendations, minor modifications were made to refine wording, eliminate ambiguous items, and improve content alignment with expected student competencies

Furthermore, an item analysis was conducted to evaluate the difficulty index and discrimination power of each question. The difficulty index ranged from 0.35 to 0.78, ensuring a balanced distribution of item complexity. The discrimination index, which measures an item's ability to differentiate between high- and low-performing students, ranged from 0.42 to 0.91, indicating strong validity.

The reliability of the diagnostic test was assessed using Cronbach's alpha coefficient, which reached 0.85, demonstrating a high level of internal consistency. The correlation coefficients of test items ranged from 0.65 to 0.91, further confirming the instrument's reliability. This test was employed to verify the equivalence of the two groups in prior mathematical achievement, ensuring that the final results accurately reflect the impacts of the implemented educational strategies.

The primary measure of achievement in this study was the Final Mathematics Exam, prepared by the UAE Ministry of Education. This post-test assessment is designed in accordance with national standards that encompass various cognitive domains, including recall, application, analysis, and evaluation. The exam consists of 15 multiple-choice questions administered electronically and 5 free-response questions presented in a paper-based format. These free-response questions aim to assess students' ability to apply mathematical concepts in structured problem-solving scenarios. Recognized as an official assessment tool by the Ministry, this exam ensures the integration of comprehensive evaluation criteria under the guidance of educational experts. Given that it is a standardized national measure implemented across UAE schools, its validity and reliability have already been established, eliminating the need for further psychometric testing in this study.

The study also employs the Mathematics Motivation Questionnaire (MMQ) designed and validated by Fiorella et al. (2021) to assess students' motivation towards learning mathematics. The MMQ was adapted from the Science Motivation Questionnaire (SMQ) originally developed by Glynn et al. (2011) to measure motivation in science education. The SMQ was based on well-established theories of academic motivation, including expectancy-value theory and self-determination theory. However, early applications of the SMQ revealed limitations in its internal structure, as some factors combined multiple constructs that were traditionally treated as distinct, such as self-efficacy and assessment anxiety (Fiorella et al., 2021).

To refine the instrument for mathematics education, Fiorella et al. (2021) modified the SMQ by replacing references to "science" with "math" and re-examining the theoretical alignment of the items. The resulting MMQ measures six distinct factors of mathematical motivation: intrinsic value (e.g., "I enjoy learning

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math"), attainment value (e.g., "Earning a good math grade is important to me"), self-regulation (e.g., "I use strategies to ensure I learn math well"), self-efficacy (e.g., "I am confident I will do well on math assignments and projects"), utility value (e.g., "The math I learn is relevant to my life"), and test anxiety (e.g., "I am nervous about how I will do on math tests"). The final version of the MMQ consists of 30 items, each rated on a five-point Likert scale ranging from "never" to "always."

The validation process for the MMQ involved assessing face and content validity to ensure that each item accurately reflected constructs from motivation and self-regulation theories in mathematics education. The refined structure of the MMQ allows for a more precise measurement of students' motivation, addressing previous ambiguities in factor definitions. Given its strong theoretical foundation and empirical validation, the MMQ serves as a reliable tool for evaluating the motivational dimensions influencing students' engagement and achievement in mathematics.

Data Analysis Method

To answer the research questions and test the hypotheses, all collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). The analysis aimed to evaluate the effectiveness of the structured digital lessons and self-assessment through success criteria in improving mathematics achievement and motivation among students in the experimental group, compared to the control group receiving traditional instruction.

Students' mathematical motivation was measured using the MMQ, which includes five-point Likert-type items categorized into key dimensions: intrinsic value, self-efficacy, utility value, self-regulation, and test anxiety. In interpreting MMQ results, student scores in each dimension were categorized using a three-level classification: low motivation (1.00–2.33), medium motivation (2.34–3.66), and high motivation (3.67–5.00). This classification was consistently applied across all motivation dimensions except for the Test Anxiety scale, for which reverse scoring was implemented. This reversal acknowledges that lower anxiety levels reflect higher motivation, thus allowing for an accurate reflection of students' overall motivational profiles.

To assess the effectiveness of the instructional intervention on students' motivation and academic achievement, One-Way Analysis of Covariance (ANCOVA) and Multivariate Analysis of Covariance (MANCOVA) were employed. The use of ANCOVA enabled control of pre-existing individual differences by statistically adjusting for pre-test scores, treating them as covariates. This allowed for more accurate estimations of the actual impact of the instructional program. Specifically, ANCOVA was applied to compare the two groups' post-test scores in academic achievement, using pre-test achievement scores as a covariate.

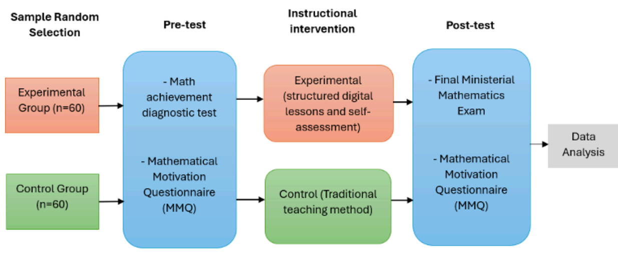
In evaluating the intervention's effect on students' motivation, MANCOVA was used to simultaneously assess the impact on all motivation dimensions, with pre-test scores in each dimension entered as covariates. Once a statistically significant multivariate effect was established, follow-up univariate ANCOVAs were conducted for each dimension separately, as well as for the overall motivation score.

All analyses were conducted at a significance level of $\alpha = 0.05$. In addition to statistical significance, the practical importance of results was assessed using effect size (η^2). According to Field's (2013) guidelines, η^2 values were interpreted as follows: small effect ($0.01 < \eta^2 < 0.06$), medium effect ($0.06 \le \eta^2 < 0.14$), and large effect ($\eta^2 \ge 0.14$). This dual approach—examining both statistical and practical significance—provided a more nuanced understanding of the educational intervention's effectiveness on enhancing students' motivation and academic achievement in mathematics. A p-value of less than 0.05 was considered statistically significant.

To visually represent the study's methodological framework, Figure 4 below outlines the full research design process, illustrating the timeline of instrument administration and the specific intervention procedures applied to both the experimental and control groups

Figure 4

The research design process illustrating the timeline of instrument administration and intervention procedures for both experimental and control groups



Results

To answer the first research question and test the related hypothesis, a one-way ANCOVA was conducted to examine differences in post-test math achievement between the experimental and control groups after controlling for pre-test scores. Descriptive statistics and adjusted means were calculated, and effect size (η^2) was used to assess the impact of the intervention integrating structured digital lessons and self-assessment through success criteria. Table 4 below displays the pre-test, and post-test means and standard deviations for both groups, as well as the adjusted means derived from the ANCOVA analysis.

Table 4

Descriptive statistics and adjusted post-test means for mathematics achievement scores before and after the intervention (ANCOVA)

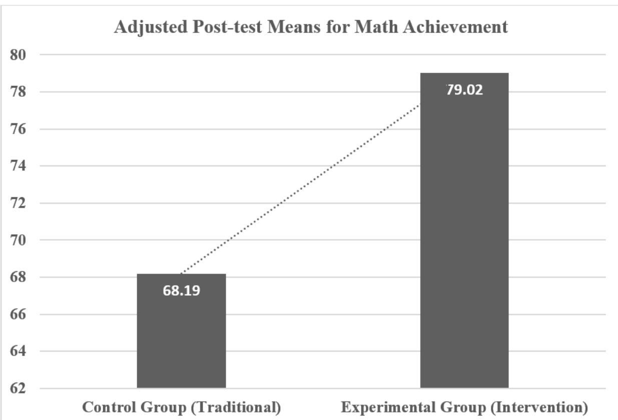
Group	*N*	Pre-test Mean	*sd*	Post-test Mean	*sd*	Adjusted Post-test Mean
Experimental (Intervention)	60	40.92	14.22	78.89	17.12	79.02
Control (Traditional)	60	39.33	15.85	68.32	22.18	68.19
Total	120	40.13	15.01	73.60	20.43	73.61

As shown in Table 4, there is a clear difference in mathematics achievement between the groups following the intervention. The experimental group, which received structured digital lessons incorporating self-assessment through success criteria, achieved a higher adjusted post-test mean (79.02) compared to the control group (68.19), suggesting that this instructional approach positively impacted students' mathematics performance. This finding supports the hypothesis that students exposed to structured digital lessons integrated with self-assessment through success criteria demonstrate significantly higher mathematics achievement than those receiving traditional instruction. It also aligns with the educational goals outlined in "We the UAE 2031" vision.

Moreover, Figure 5 below illustrates the adjusted mean scores of students in the experimental and control groups on the post-test of mathematics academic achievement after controlling for pre-test performance.

Figure 5

Comparison of adjusted post-test mean scores in mathematics achievement between the control group and the experimental group.



Accordingly, to determine whether the differences in adjusted post-test means were statistically significant, a one-way Analysis of Covariance (ANCOVA) was conducted. The results are presented in Table 5 below:

Table 5

One-way ANCOVA results for the effect of the instructional program on mathematics academic achievement

Source	Sum of Squares	*df*	Mean Square	*F*	p-value	η^2
Pre-test (Covariate)	744.243	1	744.243	1.911	0.169	0.016
Instructional intervention	3512.869	1	3512.869	9.021	*0.003	0.072
Error	45560.386	117	389.405			
Total Adjusted	49657.750	119				

*Significant at $p < 0.05$

As shown in Table 5, the ANCOVA revealed a statistically significant effect of the instructional program on students' mathematics achievement ($F = 9.021$, $p = 0.003$), after controlling for pre-test differences. The calculated effect size ($\eta^2 = 0.072$) indicates that approximately 7.2% of the variance in post-test achievement scores can be attributed to the instructional intervention. These results support the first hypothesis, confirming that structured digital lessons integrated with self-assessment through success criteria significantly enhance students' academic achievement compared to traditional instruction.

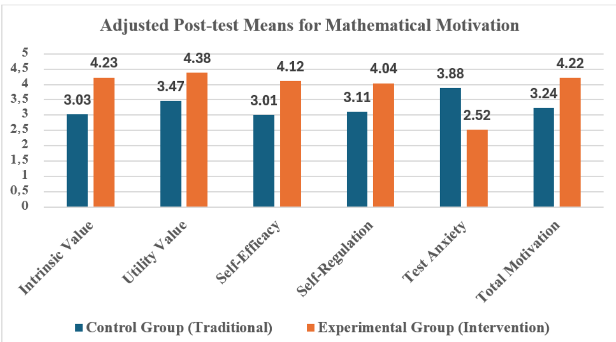
The significant improvement in students' mathematics achievement, as shown in Table 5, can be attributed to the clarity and structure provided by digital lessons integrated with self-assessment through success criteria. When students are aware of what success looks like, they are better able to monitor their progress, set specific learning goals, and engage in targeted practice (Almarode et al., 2020; López Carrillo et al., 2024). This process enhances metacognitive skills, such as self-regulation and critical thinking, enabling learners to identify gaps in their understanding and apply strategies to overcome them (Lai & Hwang, 2023; Vrieling et al., 2018). Moreover, the digital format facilitates immediate feedback and personalized support, fostering a more interactive and motivating learning environment that supports both academic growth and learner autonomy (Zare et al., 2022; Cullen et al., 2020).

To address the second research question and test the related hypothesis, a one-way MANCOVA was conducted to examine differences in mathematical motivation between the experimental and control groups across the five MMQ dimensions: intrinsic value, utility value, self-efficacy, self-regulation, and test anxiety, after controlling for pre-test scores. Descriptive statistics and adjusted means were calculated, and effect size (η^2) was used to assess the impact of the intervention integrating structured digital lessons and self-assessment through success criteria. Table 6 below presents the MANCOVA results, including the F-values, significance levels, and effect sizes for each MMQ dimension.

As shown in Table 6, the experimental group consistently outperformed the control group across all five MMQ dimensions and in total motivation. The most substantial differences appeared in self-efficacy and intrinsic value, with adjusted post-test means of 4.12 and 4.23 respectively, compared to 3.01 and 3.03 in the control group. Additionally, utility value and self-regulation also showed notable gains, with adjusted means of 4.38 and 4.04 in the experimental group, versus 3.47 and 3.11 in the control group. In contrast, test anxiety significantly decreased in the experimental group (adjusted mean = 2.52) compared to the control group (3.88), indicating a beneficial emotional outcome. These descriptive trends suggest a strong positive influence of structured digital lessons integrated with self-assessment through success criteria on students' motivational profiles in mathematics. Moreover, Figure 6 below illustrates the adjusted mean scores of students in the experimental and control groups across all MMQ dimensions as well as total motivation on the post-test of mathematical motivation, after controlling for pre-test performance.

Figure 6

Comparison of adjusted post-test mean scores in mathematical motivation dimensions between the control group and the experimental group.



To evaluate the statistical significance of the observed motivational differences, MANCOVA was conducted. Table 7 displays the MANCOVA results for the five MMQ dimensions, controlling for pre-test scores as covariates. The analysis assessed whether the intervention produced statistically significant effects on students' post-test scores in intrinsic value, utility value, self-efficacy, self-regulation, and test anxiety.

The multivariate test using Hotelling's Trace (138.211, p = 0.000) confirmed a statistically significant overall effect of the intervention across all five motivational dimensions. The univariate ANCOVA results further supported these findings, revealing statistically significant improvements in each dimension ($p < 0.05$), all favoring the experimental group. Notably, the largest effect sizes were observed for self-efficacy (η^2 = 0.165), test anxiety (η^2 = 0.157), and intrinsic value (η^2 = 0.146)—highlighting the intervention's strong influence on both cognitive and emotional components of motivation. These results underscore the effectiveness of structured digital instruction, when paired with self-assessment strategies, in fostering deeper and more sustained motivational engagement in mathematics learning.

To determine the overall impact of the intervention on students' total mathematical motivation, a one-way ANCOVA was conducted, controlling for pre-test scores. The results are presented in Table 8 below:

The ANCOVA results in Table 8 indicate a statistically significant effect of the intervention on students' total motivation (F = 377.915, p = 0.000), after accounting for baseline differences (F = 4.872, p = 0.030). The calculated effect size (η^2 = 0.764) indicates that approximately 76.4% of the variance in post-test motivation scores can be attributed to the intervention. This represents a remarkably large effect, demonstrating the substantial impact of structured digital lessons integrated with self-assessment through success criteria on enhancing students' overall motivation in mathematics. These findings provide strong empirical support for the second hypothesis and affirm the effectiveness of the intervention in fostering motivational growth.

The substantial increase in students' overall mathematical motivation, as shown in Table 8, can be attributed to the empowering effect of structured digital lessons combined with self-assessment through clear success criteria. This instructional model promotes learner autonomy, competence, and purpose—core components of intrinsic motivation (Howard et al., 2021; Almasraf, 2023). When students clearly understand expectations and are able to evaluate their progress using transparent benchmarks, they become more engaged and self-directed in their learning (Almarode et al., 2020; López Carrillo et al., 2024). Moreover, interactive digital tools provide timely, personalized feedback that boosts students' confidence, persistence, and motivation to overcome challenges (Zare et al., 2022; Cullen et al., 2020).

Table 6

Descriptive statistics and adjusted post-test means for MMQ dimensions before and after the intervention (ANCOVA)

MMQ Dimension	Group	*N*	Pre- test Mean	*sd*	Post-test Mean	*sd*	Adjusted Mean
Intrinsic Value	Experimental	60	3.02	0.61	4.25	0.48	4.23
	Control	60	2.95	0.64	3.01	0.50	3.03
Utility Value	Experimental	60	3.20	0.60	4.40	0.42	4.38
	Control	60	3.15	0.58	3.45	0.46	3.47
Self-Efficacy	Experimental	60	2.85	0.65	4.10	0.52	4.12
	Control	60	2.91	0.67	3.00	0.55	3.01
Self-Regulation	Experimental	60	2.77	0.60	4.05	0.48	4.04
	Control	60	2.83	0.62	3.10	0.51	3.11
Test Anxiety*	Experimental	60	4.20	0.75	2.50	0.59	2.52
	Control	60	4.12	0.73	3.90	0.62	3.88
Total Motivation	Experimental	60	3.24	0.49	4.21	0.38	4.22
	Control	60	3.19	0.47	3.25	0.42	3.24

Table 7

One-way MANCOVA results for the effect of the intervention on MMQ dimensions

Source	MMQ Dimension	Sum of Squares	*df*	Mean Square	*F*	p-value	η^2
Pre-test (Covariate)	Intrinsic Value	0.324	1	0.324	0.370	0.544	0.003
	Utility Value	0.218	1	0.218	0.256	0.614	0.002
	Self-Efficacy	0.189	1	0.189	0.206	0.651	0.002
	Self-Regulation	0.233	1	0.233	0.271	0.603	0.002
	Test Anxiety	0.341	1	0.341	0.384	0.537	0.003
Intervention Hotelling's Trace =138.211* *p = 0.000*	Intrinsic Value	17.341	1	17.341	19.803	0.000*	0.146
	Utility Value	14.118	1	14.118	16.129	0.000*	0.122
	Self-Efficacy	21.223	1	21.223	23.254	0.000*	0.165
	Self-Regulation	15.842	1	15.842	18.125	0.000*	0.134
	Test Anxiety	20.914	1	20.914	21.806	0.000*	0.157

*Significant at $p < 0.05$

Table 8

One-way ANCOVA results for total mathematical motivation post-test scores

Source	Sum of Squares	*df*	Mean Square	*F*	p-value	η^2
Pre-test	202.336	1	202.336	4.872	0.030	0.040
Intervention	15678.217	1	15678.217	377.915	0.000*	0.764
Error	4864.119	117	41.568			
Total Adjusted	20977.867	119				

*Significant at $p < 0.05$

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Discussion

The results of the current study revealed that students in the experimental group, who were engaged in structured digital lessons combined with self-assessment through success criteria, demonstrated significantly higher academic achievement and motivation compared to their peers in the control group who received traditional instruction. The mean score difference of 10.83 in adjusted post-test mathematics achievement (experimental: 79.02, control: 68.19) underscores the effectiveness of this intervention. These findings align with previous research emphasizing the role of self-assessment and success criteria in promoting deeper learning and improved academic performance (Almasraf, 2023). When students are provided with clear success indicators and opportunities to reflect on their progress, they develop a clearer understanding of expectations and are more likely to achieve higher outcomes.

Consistent with the work of Almarode et al. (2020), the integration of success criteria supports goal setting, enables targeted feedback, and encourages students to become active participants in their learning. The significant effect size (η^2 = 0.072) further suggests that structured, student-centered approaches can meaningfully impact achievement by fostering greater self-awareness and accountability. This aligns with López Carrillo et al. (2024), who emphasize that self-assessment not only promotes critical thinking but also strengthens students' ability to monitor their learning process, leading to measurable academic gains.

Beyond academic achievement, the intervention also produced a profound effect on students' mathematical motivation. The MANCOVA results showed statistically significant differences across all five MMQ dimensions, including intrinsic value, utility value, self-efficacy, self-regulation, and test anxiety, with large effect sizes—particularly in self-efficacy (η^2 = 0.165) and test anxiety (η^2 = 0.157). These outcomes confirm that the intervention did not only support cognitive outcomes but also positively shaped students' emotional and motivational engagement. According to Lai and Hwang (2023), self-assessment fosters metacognitive skills such as self-regulation and personal goal setting, enabling learners to identify strengths and address weaknesses more effectively. This is critical for building confidence and resilience in mathematics, a subject that often challenges students' self-perception and motivation.

The ANCOVA results for total mathematical motivation (F = 377.915, p = 0.000, η^2 = 0.764) further highlight the magnitude of this impact, indicating that 76.4% of the variance in motivation could be attributed to the instructional approach. Such a remarkably high effect aligns with the literature emphasizing that when students are equipped with tools for self-evaluation and reflection, they are more engaged, focused, and motivated to improve (Sakr & Abdalla, 2024). This confirms that self-assessment strategies can transform the learning experience by promoting ownership and sustained interest, particularly when coupled with clear, achievable success criteria.

Linking these findings to "We the UAE 2031" vision, the study supports the national emphasis on fostering critical thinking, problem-solving, self-regulation, and lifelong learning skills among students. Khaled and Alghfeli (2024) highlight the importance of aligning classroom practices with broader educational objectives to prepare students for a rapidly evolving knowledge economy. By implementing instructional models that encourage self-assessment and goal-oriented learning, educators can contribute meaningfully to national goals of excellence and innovation. This approach not only enhances student performance in mathematics but also equips learners with essential competencies needed for higher education and future career success.

In conclusion, the current study demonstrates that integrating structured digital lessons with self-assessment through success criteria offers a powerful strategy for improving both academic achievement and motivation in mathematics. These findings provide robust evidence in favor of pedagogical approaches that prioritize student autonomy, reflection, and personalized feedback—elements that are critical for advancing education in line with the UAE's long-term vision for development and innovation.

Conclusion

This study concludes that integrating structured digital lessons with self-assessment through success criteria significantly enhances mathematics achievement and motivation among sixth-grade students in the UAE. The findings affirm the powerful role of self-assessment as a success-based learning strategy, offering clear advantages over traditional instructional and evaluative methods. By enabling students to monitor their progress, set personal goals, and reflect on their learning, the intervention cultivated higher levels of self-efficacy, critical thinking, and intrinsic motivation—skills essential for academic success and lifelong learning.

Moreover, the results emphasize the importance of embedding clear success criteria within digital instructional design to foster student engagement, improve metacognitive awareness, and reduce test anxiety. These outcomes are especially relevant for mathematics education, where learners often face cognitive and emotional barriers. The approach presented in this study provides educators with a practical framework for implementing formative assessment and delivering targeted, personalized feedback.

Aligned with the educational priorities of "We the UAE 2031" vision, this research highlights the value of equipping students with 21st-century skills such as self-regulation, problem-solving, and independent learning. Teachers are encouraged to adopt success criteria-driven self-assessment practices to create student-centered environments that support academic excellence, emotional resilience, and ongoing personal development. As such, this study contributes a meaningful model for educational advancement and reform in mathematics instruction at the primary level.

Recommendations and Limitations

This study recommends the integration of structured digital lessons with self-assessment through success criteria as a core instructional strategy in mathematics education. Embedding clear success criteria within digital platforms empowers students to take ownership of their learning, enhances self-regulation, and boosts academic motivation. To ensure effective implementation, teachers should receive targeted training on designing and facilitating digital learning experiences that incorporate success criteria and foster reflective student engagement. Educational institutions and policymakers are encouraged to adopt policies that support digital self-assessment frameworks, aligning with "We the UAE 2031"'s goals of promoting innovative, student-centered learning environments and cultivating future-ready skills such as autonomy, critical thinking, and lifelong learning.

While the results affirm the effectiveness of integrating structured digital lessons with self-assessment, the study is limited by its focus on a single academic subject and educational stage—sixth-grade mathematics in the UAE. The findings may not fully represent outcomes in other disciplines, age groups, or instructional settings. Additionally, the short-term nature of the intervention restricts conclusions about its long-term impact on academic achievement and motivation. Future studies should consider longitudinal designs, expand to multiple educational contexts, and explore how various digital platforms and assessment tools affect student learning to build a more comprehensive understanding of this approach's scalability and sustainability.

References

Al Murshidi, G. (2019). Stem education in the United Arab Emirates: Challenges and possibilities. *International Journal of Learning, Teaching and Educational Research*, *18*(12), 316-332. https://doi.org/10.26803/ijlter.18.12.18

Al Zarooni, K. H. (2023). *The adoption of UAE's Vision 2021 and Vision 2071 into strategic plans of private schools in the Emirate of Abu Dhabi* (Doctoral dissertation). University of Gloucestershire, Cheltenham, United Kingdom.

Alajarmeh, N., & Rashed, A. (2019). Learner in the role of instructor: promoting student peer-collaboration in learning management systems. *International Journal of Technology Enhanced Learning*, *11*(2), 121-135. https://doi.org/10.1504/ijtel.2019.098791

Aldhafeeri, F. M., & Alotaibi, A. A. (2023). Reimagining education for successful and sustainable digital shifting. *Sage Open*, *13*(1). https://doi.org/10.1177/21582440231154474

Aldosari, M. S., & Alsager, H. N. (2023). A step toward autonomy in education: probing into the effects of practicing self-assessment, resilience, and creativity in task supported language learning. *BMC psychology*, *11*(1), 434. https://doi.org/10.1186/s40359-023-01478-8.

AlKhaza'leh, M. S., Obeidat, B. F., Abdel-Hadi, S., & Al-Qaruty, R. (2023). A Future Vision for Child Education in the UAE. *Migration Letters*, *20*(7), 88-96. https://doi.org/10.59670/ml.v20i7.4261

Almarode, J., Fisher, D., Thunder, K., & Frey, N. (2020). *The success criteria playbook: A hands- on guide to making learning visible and measurable*. Thousand Oaks, CA: Corwin.

Almasraf, A. (2023). The Effectiveness of Self-assessment in Promoting Growth Mindset in EFL Students. *International Journal of Educational Researchers, 14*(4), 25-36. https://doi.org/10.29329/ijer.2023.604.3

Anthonysamy, L. (2021). The use of metacognitive strategies for undisrupted online learning: Preparing university students in the age of pandemic. *Education and Information Technologies*, 26(6), 6881-6899. https://doi.org/10.1007/s10639-021-10518-y

Badawy, H. R. (2022). *Investigating teachers' and lead teachers' perspectives on the impact of STREAM on enhancing teaching, learning, and professionalism in the Emirates Schools Establishment* (Master's thesis, United Arab Emirates University). Al Ain, United Arab Emirates: United Arab Emirates University.

Barana, A., Marchisio, M., & Sacchet, M. (2018). Advantages of Using Automatic Formative Assessment for Learning Mathematics. *Communications in Computer and Information Science*, *1*(1),180-198. https://doi.org/10.1007/978-3-030-25264-9_12

Candel, C., Vidal-Abarca, E., Cerdán, R., Lippmann, M., & Narciss, S. (2020). Effects of timing of formative feedback in computer-assisted learning environments. *Journal of Computer Assisted Learning*, *36*(5), 718-728. https://doi.org/10.1111/jcal.12439

Chao, T., Chen, J., Star, J. R., & Dede, C. (2016). Using digital resources for motivation and engagement in learning mathematics: Reflections from teachers and students. *Digital Experiences in Mathematics Education*, *2*(3), 253-277. https://doi.org/10.1007/s40751-016-0024-6

Chiu, T. K. (2022). Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic. *Journal of research on Technology in Education*, *54*(1), 14-30. https://doi.org/10.1080/15391523.2021.1891998

Christopoulos, A., Kajasilta, H., Salakoski, T., & Laakso, M. J. (2020). Limits and virtues of educational technology in elementary school mathematics. *Journal of Educational Technology Systems*, *49*(1), 59-81. https://doi.org/10.1177/0047239520908838

Cullen, C. J., Hertel, J. T., & Nickels, M. (2020, April). The Roles of Technology in Mathematics Education. *The Educational Forum*, 84(2), 166-178. https://doi.org/10.1080/00131725.2020.1698683

Dinh, C. T., & Phuong, H. Y. (2024). MOOC learners' perspectives of the effects of self-regulated learning strategy intervention on their self-regulation and speaking performance. *Cogent Education*, *11*(1), 1-24. https://doi.org/10.1080/2331186X.2024.2378497

Duangnamol, T., Supnithi, T., Srijuntongsiri, G., & Ikeda, M. (2018). Computer-Supported Meta-reflective Learning Model via mathematical word problem learning for training metacognition. *Research and Practice in Technology Enhanced Learning*, *13*(1), 1-29. https://doi.org/10.1186/s41039-018-0080-1

Eagan, T. (2023). Unlocking Student Success: The Power of Success Criteria, Relationships, and Clarity. *NECTFL Review*, *90*(1), 95-102. https://eric.ed.gov/?id=EJ1382629

Efstratopoulou, M., Opoku, M. P., Shomotova, A., Davison, C., Jaffarul, A., & Mesmar, A. (2024). In their own voices: a nationwide study of students' attitudes towards the implementation of smart learning environments in UAE schools. *Smart Learning Environments*, *11*(4), 1-22. https://doi.org/10.1186/s40561-024-00291-z

Ejubovic, A., & Puška, A. (2019). Impact of self-regulated learning on academic performance and satisfaction of students in the online environment. *Knowledge Management & E-Learning*, *11*(3), 345-363. https://doi.10.34105/j.kmel.2019.11.018

ElSayary, A. (2021). Teaching and assessing creativity in STEAM education. Journal of Systemics, Cybernetics and Informatics, 19(2), 1-7. https://doaj.org/article/1f836cf0510f412d9206aa7588c6a516

Engeness, I. (2021). Developing teachers' digital identity: towards the pedagogic design principles of digital environments to enhance students' learning in the 21st century. *European Journal of Teacher Education*, *44*(1), 96-114. https://doi.org/10.1080/02619768.2020.1849129

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4th Edition). London: Sage Publications.

Fiorella, L., Yoon, S. Y., Atit, K., Power, J. R., Panther, G., Sorby, S., ... & Veurink, N. (2021). Validation of the Mathematics Motivation Questionnaire (MMQ) for secondary school students. *International Journal of STEM Education*, *8*(52),1-14. https://doi.org/10.1186/s40594-021-00307-x

Garshasbi, A., Fathi Vajargah, K., & Arefi, M. (2019). The effect of Cooprative Learning and Self-evaluation on self motivation of students with the approach of jigsaw. *Journal of New Approaches in Educational Administration*, *10*(37), 45-68. https://doi.org/20.1001.1.20086369.1398.10.37.3.7

Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science motivation questionnaire II: Validation with science majors and nonscience majors. *Journal of research in science teaching*, *48*(10), 1159-1176. https://doi.org/10.1002/tea.20442.

Haddad, M. Z., Heong, Y. M., Razzaq, A. R. B. A., & Kiong, T. T. (2024). The UAE education reform: opportunities and challenges. *International Journal of Economics and Business Research*, *28*(3-4), 304-313. https://doi.org/10.1504/IJEBR.2024.141502

Hansen, R. (2021). The use of learning goals in mathematics education. *Scandinavian Journal of Educational Research*, *65*(3), 510-522. https://doi.org/10.1080/00313831.2020.1739125

Higgins, K., Huscroft-D'Angelo, J., & Crawford, L. (2019). Effects of technology in mathematics on achievement, motivation, and attitude: A meta-analysis. *Journal of Educational Computing Research*, *57*(2), 283-319. https://doi.org/10.1177/0735633117748416

Howard, J. L., Bureau, J. S., Guay, F., Chong, J. X., & Ryan, R. M. (2021). Student motivation and associated outcomes: A meta-analysis from self-determination theory. *Perspectives on Psychological Science*, *16*(6), 1300-1323. https://doi.org/10.1177/1745691620966789

Ikhsan, I., Hartanti, K., & Lopo, F. L. (2025). Strategies for Implementing AI in LMS to Improve the Effectiveness and Personalization of Digital Learning. *The Journal of Academic Science*, *2*(3), 944-953. https://doi.org/10.59613/qp3e7d30

Kang, G. Y. (2018). Playing with digital tools with explicit scaffolding. *The Reading Teacher*, *71*(6), 735-741. https://doi.org/10.1002/trtr.1672

Kaplar, M., Radović, S., Veljković, K., Simić-Muller, K., & Marić, M. (2022). The influence of interactive learning materials on solving tasks that require different types of mathematical reasoning. *International Journal of Science and Mathematics Education, 20*(2), 411-433. https://doi.org/10.1007/s10763-021-10151-8

Karabchuk, T., Shomotova, A., & Chmel, K. (2022). Paradox of research productivity of higher education institutions in Arab Gulf countries: The case of the UAE. *Higher Education Quarterly*, *76*(4), 759-785. https://doi.org/10.1111/hequ.12347

Karaman, P. (2024). Effects of using rubrics in self-assessment with instructor feedback on pre-service teachers' academic performance, self-regulated learning and perceptions of self-assessment. *European Journal of Psychology of Education*, *39*(3), 2551-2574. https://doi.org/10.1007/s10212-024-00867-w

Khaled, F. J. , & Alghfeli, A. S. (2024). Unlocking Potential: The Impact of Success Criteria as a Self-Assessment Strategy on Elevating Mathematics Achievement among Alkhair School Students in UAE. *Educational Administration: Theory and Practice*, *30*(8), 71-83. https://doi.org/10.53555/kuey.v30i8.7042

Kong, S. C. (2021). Delivery and evaluation of an e-Learning framework through computer-aided analysis of learners' reflection text in a teacher development course. *Research and Practice in Technology Enhanced Learning*, *16*(1), 28. https://doi.org/10.1186/s41039-021-00172-w

Lai, C. L., & Hwang, G. J. (2023). Strategies for enhancing self-regulation in e-learning: a review of selected journal publications from 2010 to 2020. *Interactive learning environments*, *31*(6), 3757-3779. https://doi.org/10.1080/10494820.2021.1943455

Li, K., Johnsen, J., & Canelas, D. A. (2021). Persistence, performance, and goal setting in massive open online courses. *British Journal of Educational Technology*, *52*(3), 1215-1229. https://doi.org/10.1111/bjet.13068

López Carrillo, M. D., Calonge García, A., & Lebrón Moreno, J. A. (2024). Self-Regulation of Student Learning in a STEAM Project. *Education Sciences*, *14*(6), 1-11. https://doi.org/10.3390/educsci14060579

Matsumoto, A. (2019). Literature review on education reform in the UAE. *International Journal of Educational Reform*, *28*(1), 4-23. https://doi.org/10.1177/1056787918824188

Moorhouse, B. L., & Wong, K. M. (2022). Blending asynchronous and synchronous digital technologies and instructional approaches to facilitate remote learning. *Journal of Computers in Education*, *9*(1), 51-70. https://doi.org/10.1007/s40692-021-00195-8

Panadero, E., & Dochy , F. (2014). Student self-assessment: assessment, learning and empowerment. *Assessment & Evaluation in Higher Education*, 39(7), 895-897. https://doi.org/10.1080/02602938.2013.871412

Panadero, E., Jonsson, A., & Botella, J. (2017). Effects of self-assessment on self-regulated learning and self-efficacy: Four meta-analyses. *Educational research review*, *22*(1), 74-98. https://doi.org/10.1016/j.edurev.2017.08.004

Puente-Díaz, R. (2012). The effect of achievement goals on enjoyment, effort, satisfaction and performance. *International Journal of Psychology*, *47*(2), 102-110. https://doi.org/10.1080/00207594.2011.585159

Raaijmakers, S. F., Baars, M., Paas, F., Van Merrienboer, J. J., & Van Gog, T. (2019). Effects of self-assessment feedback on self-assessment and task-selection accuracy. *Metacognition and Learning*, 14(1), 21-42. https://doi.org/10.1007/s11409-019-09189-5

Ran, H., Kasli, M., & Secada, W. G. (2021). A meta-analysis on computer technology intervention effects on mathematics achievement for low-performing students in K-12 classrooms. *Journal of Educational Computing Research*, *59*(1), 119-153. https://doi.org/10.1177/0735633120952063

Rao, K., Torres, C., & Smith, S. J. (2021). Digital tools and UDL-based instructional strategies to support students with disabilities online. *Journal of Special Education Technology*, *36*(2), 105-112. https://doi.org/10.1177/0162643421998327

Rehan, H. (2023). Shaping the Future of Education with Cloud and AI Technologies: Enhancing Personalized Learning and Securing Data Integrity in the Evolving EdTech Landscape. *Australian Journal of Machine Learning Research & Applications*, *3*(1), 359-395.

Robinson, J. M., & Aldridge, J. M. (2022). Environment–attitude relationships: girls in inquiry-based mathematics classrooms in the United Arab Emirates. *Learning Environments Research*, *25*(3), 619-640. https://doi.org/10.1007/s10984-022-09409-x

Ryan, R. M., Deci, E. L., Vansteenkiste, M., & Soenens, B. (2021). Building a science of motivated persons: Self-determination theory's empirical approach to human experience and the regulation of behavior. *Motivation science*, *7*(2), 97-110. https://doi.org/10.1037/mot0000194

Sakız, H., Özdaş, F., Göksu, İ., & Ekinci, A. (2021). A longitudinal analysis of academic achievement and its correlates in higher education. *Sage Open*, *11*(1). https://doi.org/10.1177/21582440211003085

Sakr, A., & Abdalla, A. M. (2024). Students' Self-Evaluation: an Empirical Study on Umm Al Quwain University Students. *Kurdish Studies*, *12*(2), 4866-4880. https://kurdishstudies.net/menu-script/index.php/KS/article/view/2613

Scheel, L., Vladova, G., & Ullrich, A. (2022). The influence of digital competences, self-organization, and independent learning abilities on students' acceptance of digital learning. *International journal of educational technology in higher education*, *19*(44), 1-33. https://doi.org/10.1186/s41239-022-00350-w

Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: a critical review of the literature. *International journal of educational technology in higher education*, *14*(1), 1-28. https://doi.org/10.1186/s41239-017-0063-0

Schmid, R., Pauli, C., & Petko, D. (2023). Examining the use of digital technology in schools with a school-wide approach to personalized learning. *Educational technology research and development*, *71*(2), 367-390. https://doi.org/10.1007/s11423-022-10167-z

Schunk, D. H. (2023). Self-regulation of self-efficacy and attributions in academic settings. In *Self-regulation of learning and performance* (pp. 75-99). New York, NY: Routledge. https://doi.org/10.4324/9780203763353-4

Simić, K., Despotović-Zrakić, M., Bojović, Ž., Jovanić, B., & Knežević, Đ. (2016). A platform for a smart learning environment. *Facta universitatis-series: Electronics and Energetics*, *29*(3), 407-417. https://doi.org/10.2298/FUEE1603407S

Singhal, R., Kumar, A., Singh, H., Fuller, S., & Gill, S. S. (2021). Digital device-based active learning approach using virtual community classroom during the COVID-19 pandemic. *Computer Applications in Engineering Education*, *29*(5), 1007-1033. https://doi.org/10.1002/cae.22355

Sorgenfrei, C., & Smolnik, S. (2016). The effectiveness of e-learning systems: A review of the empirical literature on learner control. *Decision Sciences Journal of Innovative Education*, *14*(2), 154-184. https://doi.org/10.1111/dsji.12095

Theobald, M. (2021). Self-regulated learning training programs enhance university students' academic performance, self-regulated learning strategies, and motivation: A meta-analysis. *Contemporary Educational Psychology, 66*, 101976. https://doi.org/10.1016/j.cedpsych.2021.101976

Van Wart, M., Ni, A., Rose, L., McWeeney, T., & Worrell, R. (2019). A literature review and model of online teaching effectiveness integrating concerns for learning achievement, student satisfaction, faculty satisfaction, and institutional results. *Pan-Pacific Journal of Business Research*, *10*(1), 1-22.

Wardat, Y., Belbase, S., Tairab, H., Takriti, R. A., Efstratopoulou, M., & Dodeen, H. (2022). The influence of school factors on students' mathematics achievements in trends in international mathematics and science study (TIMSS) in Abu Dhabi Emirate schools. *Education Sciences*, *12*(7), 424-447. https://doi.org/10.3390/educsci12070424

Xu, Z., Zhao, Y., Zhang, B., Liew, J., & Kogut, A. (2023). A meta-analysis of the efficacy of self-regulated learning interventions on academic achievement in online and blended environments in K-12 and higher education. *Behaviour & Information Technology*, *42*(16), 2911-2931. https://doi.org/10.1080/0144929X.2022.2151935

Yan, Z. (2020). Self-assessment in the process of self-regulated learning and its relationship with academic achievement. *Assessment & Evaluation in Higher Education*, 45(2), 224-238. https://doi.org/10.1080/02602938.2019.1629390

Yeh, C. Y., Cheng, H. N., Chen, Z. H., Liao, C. C., & Chan, T. W. (2019). Enhancing achievement and interest in mathematics learning through Math-Island. *Research and Practice in Technology Enhanced Learning*, *14*(1),1-19. https://doi.org/10.1186/s41039-019-0100-9

Yıldızlı, H., & Saban, A. (2016). The effect of self-regulated learning on sixth-grade Turkish students' mathematics achievements and motivational beliefs. *Cogent Education*, *3*(1), 1-17. https://doi.org/10.1080/2331186x.2016.1212456

Yorganci, S. (2025). The impact of synchronous online discussions and online flipped learning on student engagement and self-regulation among preliminary undergraduates in a basic math course. *Educational technology research and development*,*1*(1) 1-32. https://doi.org/10.1007/s11423-025-10459-0

Zare, A., Heidari, H., Davoodi, H., & Moeini Kia, M. (2022). Modeling self-assessment impact on math achievement with mediated by self-regulation and self-efficacy of high school students. *Journal of School Psychology and Institutions*, *11*(2), 62-70. https://doi.org/10.22098/jsp.2022.1717

Zeide, E. (2017). The structural consequences of big data-driven education. *Big Data*, *5*(2), 164-172. https://doi.org/10.1089/big.2016.0061

Zhang, L., Jackson, H. A., Hunt, T. L., Carter Jr, R. A., Yang, S., & Emerling, C. R. (2022). Maximizing learning management systems to support mathematical problem solving in online learning. *Teaching Exceptional Children*, *54*(3), 192-201. https://doi.org/10.1177/0040059921996730.

Zhang, M., Trussell, R. P., Gallegos, B., & Asam, R. R. (2015). Using math apps for improving student learning: An exploratory study in an inclusive fourth grade classroom. *TechTrends*, *59*(2), 32-39. https://doi.org/10.1007/s11528-015-0837-y

Zhu, M., Bonk, C. J., & Doo, M. Y. (2020). Self-directed learning in MOOCs: Exploring the relationships among motivation, self-monitoring, and self-management. *Educational Technology Research and Development*, *68*(1), 2073-2093. https://doi.org/10.1007/s11423-020-09747-8.

Zimmerman, B. J., & Schunk, D. H. (2013). *Self-regulated learning and academic achievement: Theoretical perspectives*. New York, NY :Routledge. https://doi.org/10.4324/9781410601032