iejee

June 2021 Volume 13 Issue 5

www.iejee.com

international electronic journal of elementary education

KURA group Education & Publishing

INTERNATIONAL ELECTRONIC JOURNAL OF ELEMENTARY EDUCATION

ISSN: 1307-9298

www.iejee.com
iejee@iejee.com

KURA group
Education & Publishing

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5

Editorial

Dear IEEJE Readers,

We are delighted to presented Volume 13, issue 4 of International Electronic Journal of Elementary Education (IEJEE) for our readers. This issue contains a range of articles as always that are insightful, focused on various aspects of our profession and our relationship with, and between, theory and practice and inquired into innovative educational perspective.

Thirty seven researchers from eleven different countries address several important educational issues like reading prosody, sex education, social hierarchy among preschool aged girls, registers of semiotic representation, social and emotional learning, teaching evidence-based subject didactics, morpheme-based spelling intervention, formative and summative assessment, STEM in transition from primary school to middle school, multi-layered language policy and translanguaging space and early foreign language teaching

I hope you will find at least one of the papers relevant for your interest and/or field of research.

I would like to thank our Editor-in-Chief, Dr. Kamil Özerk, for giving me opportunity to introduce this issue. I would like to express my thanks to Dr. Gökhan Özsoy, Dr. Turan Temur and Dr. Murat Şahin Doğan for their editorial management and coordination of review process. I also would like to thank to Abdullah Kaldırım, IEJEE's technical staff and all the peer-reviewers. And last, but not least, I want to express my deep gratitude for the researchers that preferred IEJEE for their research publications.

Sincerely,

Dr. Hayriye Gül Kuruyer

Acting Editor-In-Chief, IEJEE

ISSN: 1307-9298

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5

Table of Contents

ISSN: 1307-9298

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 577-588

Outcomes of a Readers´ Theatre Program on Oral Reading Prosody: An Exploratory Study in Different Environments*

Natalia Ferrada Quezada[a]

Received : 16 January 2021
Revised : 17 April 2021
Accepted : 3 June 2021
DOI : 10.26822/iejee.2021.213

*This work is part of a Doctorate thesis supported by ANID through its Chile-Doctorate Scholarships Abroad.

[a] **Correspondance Details:** Natalia Ferrada Quezada, Facultad de Educación, Universidad de Las Américas, Santiago. Chile.
E-mail: nferrada@udla.cl
ORCID: https://orcid.org/0000-0002-9910-0217

Abstract

Readers' theatre is a teaching strategy that consists of the interpretative reading of theatrical texts in which readers use their voices to give life to the characters. This strategy promotes the development of various skills related to fluency, among which there is prosody. This research aimed to check the efficacy of a reader's theatre program on the prosody of oral reading. Eleven dyslexic students from the third and fourth grade of the primary school participated in this study, and who were distributed in two groups. To check the program effectiveness, a program evaluation method was used following the CIIP model and a pre-experimental pre-test post-test design. As a dependent variable, prosody and the prosodic characteristics were used and measured through the Prosody Assessment Scale. Findings showed a significant prosody improvement as well as the prosodic features. In addition, the results obtained by the program were similar in both groups of students. These findings suggest the readers' theatre is an effective strategy for improving the prosody of reading in schoolchildren of those ages and confirm that this strategy can be used as a part of an integral program for fluency development.

Keywords:

Dyslexia, Prosody, Repeated Reading, Readers' Theatre

Introduction

Reading fluency is often considered a synonym of reading speed (Young et al., 2020). However, this skill involves much more than the number of words a student can read. Reading fluency is defined as the ability to read a text without much effort, that is, read it without making mistakes, automatically and with the right expression (Kuhn et al., 2010; Paige et al., 2012). Accuracy, automaticity, and prosody are the crucial components that must be present so that the process of reading is fluent, and facilitates the understanding of the texts. One of the main reasons to give more importance to reading fluency is its link with understanding (Álvarez-Cañizo et al., 2015; Calet et al., 2015; Dowhower, 1991; Fuchs

et al., 2001; Klauda & Guthrie, 2008; Kuhn et al., 2010). Nevertheless, despite the importance that has been given to fluency in the last decade, even when talking about reading competence in general, prosody remains the most forgotten element of the skills that make up reading fluency.

Prosody is the part of phonology in charge of studying phonic or suprasegmental phenomena (Cortés, 2002). Prosody can be described as a linguistic term that refers to the rhythmic and tonal aspects of speech (Dowhower, 1991; Hudson et al., 2005) or oral language music (Kuhn et al., 2010). The prosodic features include volume, rhythm, intonation, phrasing and pausing when reading aloud.

Intonation is a linguistic and phonological phenomenon that the speakers of language used to communicate. Its main physical parameter is the tone, and its acoustic parameter is the fundamental frequency (F_0). The tone is the sensation produced by the F_0, and as children learn to read with good prosody, they exhibit an intonation tone that is more like adults', which has been associated with a good fluency level (Miller & Schwanenflugel, 2006, 2008; Schwanenflugel et al., 2004).

Pauses contribute to characterize rhythm and intonation patterns. Several studies have informed that the frequency of those pauses could be related to automaticity and comprehension (Benjamin & Schwanenflugel, 2010; Dowhower, 1987). It means, the less able readers tend to do more pauses in an inappropriate way than good readers, which may affect their reading comprehension (Dowhower, 1991). To readers with less experience, the number of incorrect pauses could be related to their capacity to decode (Miller & Schwanenflugel, 2008).

Another prosodical characteristic is phrasing or segmentation. These indicate the grouping of words into units or significant phrases. A phrase is appropriate when the group of words that makes it as such is syntactic and phonologically acceptable (Dowhower, 1991). Different studies (Benjamin & Schwanenflugel, 2010; Dowhower, 1987; Miller & Schwanenflugel, 2006) observed that appropriate phrasing could affect positively reading comprehension.

Volume depends on the pressure that the air makes from the lugs to the throat. When reading, the volume is related to the intention that the text receives, which means, if a reader is competent will be able to adjust the volume to the interpretation that makes of the text and the context where she or he does the reading.

Several authors also consider the rhythm as a reading expression feature (Cortés, 2002; Fountas y Pinnell, 2010; Rasinski & Padak, 2008). According to Cortés (2002), rhythm has as a function grouping the sounds into blocks or rhythmic groups to avoid monotony, contributing to maintaining the listener attention as facilitates the message comprehension. That way, a too slow or too fast reading may interfere with the text meaning comprehension.

Such elements contribute to expressiveness and they strengthen understanding (Dowhower, 1991), they suggest that the reader has segmented the text according to its main semantic and syntactic elements (Kuhn & Stahl, 2003). If a reader can integrate these elements when reading aloud, it is prosodic reading and its reading will resemble a conversation (Dowhower, 1991; Hudson et al., 2005).

Different studies have shown that prosody is related to the acquisition and development of various written language skills such as reading words (Whalley & Hansen, 2006), the reading of words and pseudowords (Calet et al., 2015), achieving fluent reading (Schwanenflugel et al., 2004) and reading comprehension (Calet et al., 2016; Kanik Uysal & Bilge, 2018; Miller & Schwanenflugel, 2006, 2008; Whalley & Hansen, 2006).

Fluency, Dyslexia and Prosody in the Spanish language

One of the characteristic deficits of dyslexic students is the inability to read fluently (Lyon et al., 2003), for whom the processes of learning to read and become skilled readers are arduous tasks. Studies show that no matter the language, dyslexics are more inaccurate and slower in reading single words, as in pseudowords and texts (Pae et al., 2017; Schaars et al., 2017; Suárez-Coalla & Cuetos, 2017; Ziegler et al., 2003). This seems to be related to the difficulty of acquiring and automating the alphabetic code and difficulty in developing orthographic representations of words (Suárez-Coalla & Cuetos, 2017), consequently, they fail to develop reading fluency.

Unlike the accuracy and speed of reading in dyslexics, suprasegmental phonology or prosody is the element of fluency that has received the least attention. This gap widens when comparing studies conducted in English (Calet et al., 2016) with studies conducted in transparent languages such as Spanish. Two studies carried out with Spanish dyslexic people inform that they have differences compared to typical readers regarding prosody performance (Suárez-Coalla et al., 2016; Jimenez-Fernandez et al., 2015). Suarez-Coalla et al. (2016) conducted two experiments, the former with children and the latter with adults. In the first experiment, the researchers found that there were differences in both the number and duration of breaks and in the intonation of the different types of sentences. In the case of the adults, they also observed differences with the control group, although to a lesser

extent. The data suggest that the development of prosody relies on other reading skills, such as decoding, speed and reading accuracy. Furthermore, Jiménez-Fernández et al. (2015) observed that Spanish dyslexics children also have a problem with stress awareness skill. The results of the study revealed that the group with dyslexia showed a significantly higher number of errors in the detection of the stressed syllable and, in addition, a longer response time. Likewise, the participants of the control group used different strategies of lexical knowledge, while the group with dyslexia tended to apply a single strategy to process words and pseudowords.

Readers Theatre to Improve Prosody

In researching about the teaching of reading fluency it is suggested that repeated oral reading is the most used and effective strategy for improving fluency (Lee & Yoon, 2017; Stevens et al., 2016; Wexler et al., 2008). Assisted repeated reading strategies seem to be more effective than repeated reading strategies without assistance since when the reading is previously modelled, a greater increase in fluency is obtained (Lee & Yoon, 2017; Rasinski, 2014).

Within the set of strategies that have been conceived to develop and improve reading, fluency is the reader's theatre. The readers' theatre is a strategy of assisted repeated reading that consists of performing a play with characters and narrator, as in the traditional theatre, but reading the text out loud. Unlike traditional theatre, the readers' theatre does not require memorization of texts, costumes, accessories and special stages, becoming an affordable and simple activity to implement. It also has the purpose of genuine communication that encourages the readers to re-read the text to share their interpretation with others (Rasinski, 2010; Young & Nageldinger, 2014). This characteristic to the readers' theatre allows students to maintain interest in the activity in time, without causing exhaustion or boredom, on the contrary to what happens when the reading of a text without an authentic intention is repeated.

Several studies have observed that the use of the readers' theatre in systematic programs carried out with primary school students brings benefits for prosody in reading (Garzón et al., 2008; Keehn, 2003; Mraz et al., 2013; Young & Rasinski, 2009, 2017). Young & Rasinski (2017) notes that this technique is one of the best to develop and improve the fluency of students. The improvement of this ability would not only be appreciated in the rehearsed scripts, but it would also transfer to previously unread texts (Keehn, 2003; Millin & Rinehart, 1999; Tyler & Chard, 2000).

The reader's theatre allows for the improvement of the reading interpretation so that the story becomes more real. The fact that the students must tell a story through their voices allows them to use the language exploring different ways to transmit it, as well as to intensify the correct pronunciation of the words and the tonal aspects of language. This is the main reason why the theatrical text works when developing expression (Rasinski, 2014) because it is a text that contains dialogues. For example, it allows the students to try out different tonalities that can be given to the voice to convey the character's emotions that appear in the story such as fear, joy or sadness are understood by their peers and by the audience (Young & Nageldinger, 2014).

Although the lack of reading fluency is recurrent in dyslexics students, there is a lack of studies focused on improving prosody in reading, especially in Spanish-speaking dyslexic students. Even more important is to consider the fact that the Chilean education system is highly segregating (Carrasco et al. 2014), in which many girls and boys are left behind because of the lack of learning opportunities. To diminish the gap, the purpose of this exploratory work has been to verify if this program is a good intervention proposal. The specific research questions were:

> Is the reader theatre intervention program effective to improve the prosody of dyslexic school children?
>
> Is the reader theatre intervention program effective for children with different socioeconomic status (SES) environments?
>
> Are reading prosody improvements of theatre texts generalized to descriptive texts?

Method

Research Design

To investigate the effects of a reader's theatre program on prosody, the program evaluation method was used (Rossi et al., 2004), following the Context, Input, Process, Product Evaluation Model (Stufflebeam & Shinkfield, 2007) and a pre-experimental pre-test post-test design (Campbell & Stanley, 1963). According to Rossi et al. (2004), it is a valid design to verify if an intervention program is suitable to reach an impact, and then continue using another kind of stronger design. That is why this design has a clear exploratory character.

Participants and Setting

The sample consisted of 11 dyslexic students (seven boys and four girls) that were studying in the third and fourth grade of Primary Education, aged between eight and ten years (M = 8.90; SD = .83). They were

students from two schools located in the urban area of a city in Chile, with a diverse SES. These children were previously identified as dyslexic in compliance with the principles for the diagnosis of dyslexia established in DSM-5 (American Psychiatric Association, 2014), and they were not having any kind of support for their reading problems in or out of school, so they were derived to the author of this study to receive specific assistance according to their difficulties. All the participants had manifested problems with written language since the beginning of the formal learning of it. Also, it should be noted that the average reading delay was one year and five months, that the intelligent quotient was between 95 and 117 and that they had no apparent reason to explain their difficulties with reading and writing.

They were distributed in two groups according to the school of origin: Public School Group (n = 5), belonging to a public school and a medium-low and low socioeconomic level, problems of school performance and desertion of the education system, and Private School Group (n = 6), belonging to a Catholic centre with a medium and medium-high socioeconomic level. Considering how complicated it was to coordinate their schedules, and with the consent of their parents, they were distributed separately.

Chilean school system context

There is evidence about the influence that SES has over the students' cognitive development and academic performance (Herbers et al., 2012). Children from socioeconomic disadvantage families have more possibilities to develop reading difficulties (Noble et al., 2006; Urquijo et al., 2015). There is evidence that the SES has a triggering role in the differences in the development of several reading precursors (Duncan & Seymour, 2000; Espinoza & Rosas, 2019). Those differences are especially relevant in Chile, where there is a high segregation level in the educational system (Carrasco et al. 2014), and it has been observed significant differences in the reading performance measured through a standardized test called Sistema de Medición de la Calidad de la Educación that is annually taken. According to the Agencia de la Calidad (2015), the socioeconomic group that the students belong to is an explanatory factor for the results of students from second, fourth and sixth grade in elementary school regarding reading comprehension.

Furthermore, there is evidence that, in general, the Chilean teachers do not feel prepared to assist children with special educational needs and mention they do not have the pedagogical tools or the knowledge to support diversity (Organisation for Economic Co-operation and Development, 2019). Considering those facts, it is necessary to carry out a study of how the specific programs focused on students with different SES impact them since those children with low SES could be less sensitive to those stimuli (Espinoza & Rosas, 2019).

Probes and Proceeding

An assessment of the prosody was carried out to establish the baseline and check the effectiveness of the intervention. The Adapted Prosody Appreciation Scale was designed, based on the work of Rasinski and Padak (2008) and Fountas and Pinell (2010). These types of instruments have been identified as valid and reliable for teachers to evaluate the prosodic reading of students (Kuhn et al., 2010; Miller & Schwanenflugel, 2006). The purpose of this scale was to assess the prosodic features of rhythm, volume, intonation, pauses and phrasing. In addition, it included a global score, called integration, which assessed the quality of reading at a general level. Each of these aspects was valued in a range of 1 to 4 points, with 1 being the lowest execution and 4 being the highest execution. With the sum of these scores, the global score of the prosody was obtained. In this way, overall scores obtained by children could fluctuate between 6 and 24 points.

To obtain the scores in prosody preintervention we used the reading of Theatrical Text (TT), in which each student had to read the full text following the instruction "read out loud the best you can." Generalization probes were collected consequently narrative texts Form A from the Pruebas de Dominio Lector (PDL) (Marchant, Recart, Cuadrado & Sanhueza, 2009), as appropriate to the school level of children and following the indications described in the manual of this instrument. For both texts, the time of reading out loud was one minute, according to the suggestions provided by some authors (Allington, 2009; Rasinski & Padak, 2008). These were evaluated individually in a classroom of their respective educational centres, within school hours and with the prior permission of their parents and teachers. Each evaluation lasted approximately 5 minutes and was recorded in audio. Once the program was completed, the corresponding post-test probes were collected. Children had to read a new TT with similar characteristics and, in the case of PDL, they read form B following the same pre-test instructions. Both, the pre-test and the post-test were carried out controlling the same conditions, norms, moments and times of application in the two groups of participants in the study.

Intervention

The program was carried out in groups, outside school hours and in a classroom of the education centre of both groups.

To the program design, it was considered an interactive reading difficulties perspective (Harmey, 2020) and few didactic principles have been taken into consideration according to the students' needs. The first one is students with severe difficulties in reading require an intensive and continuous intervention (Allington, 2009; Rasinski, 2014; Wexler et al., 2008) that allows determining the impact of the repeated reading on students' achievement. It had a total duration of 60 sessions of an hour for each group, distributed weekly throughout the first four months of the school year. Each play was worked on during five sessions. Another principle was to choose the texts carefully. In general, researchers agree to mention the importance of practising the reading of accessible texts (Allington et al., 2015; Rasinski, 2010). It means, that fits the students' reading level, nor too dense neither have an unfamiliar vocabulary, since fluency seems to develop faster (Mesmer, 2010; Rasinski & Padak, 2008). A total of twelve children's theatre plays was selected, adapted to make their readability easier according to Rasinski's instructions (2010). Some of them were to choose scripts between 2 and 5 pages, transcribed in letter-size sheets, Arial font, 12 font size and 1.5 spacing which representation were not longer than 15 minutes. The annotations were in bold to make the difference from the main text and the intonation pattern composed by phrases and affirmative, negative, exclamatory interrogative, passive and active sentences where complex words were changed emphasizing high-frequency words. Among the text topics, there were texts regarding cooperation, nature respect, the value of friendship, among others. Table 1 shows the design of the intervention.

Reliability

Since Prosody has a subjective character, blind judgements were made of the student's readings by two external judges without knowing if they had done it before or after the intervention. The inter-rater agreement was calculated by the Intraclass Correlation Coefficient. The values obtained in the pre-test were 0.56 (p = .001) for the reading of TT and 0.62 (p = .001) for the reading of PDL texts. Correspondingly, the post-test analysis of concordance between the judges was 0.65 (p = .001) and 0.78 (p = .001) for the reading of TT and the reading of texts of the PDL, respectively. In both cases, those values were considered acceptable to the judges' reliability.

Results

Initially, the Mann Whitney U test was used to check if there had been significant differences between the Public and Private groups before the intervention. The obtained results showed that both groups were equivalent before starting the program's implementation in the prosody variable (See Table 2). Secondly, a comparative analysis of initial and final performance in the variable prosody and its prosodic characteristics for each of the groups was performed, using the Wilcoxon signed-rank test. Table 3 summarizes the descriptive statistics and the results obtained in that analysis. In this table, it can be observed that the gains of the program are greater in the reading of TT than in the reading of PDL texts for both groups.

The performed analysis showed that both groups obtained a significant improvement in the post-test, both in the reading of TT (Public School Group, Z = - 2.04, p = .041; Private School Group, Z = - 2.23, p = .026) as in the reading of texts of the PDL (Public School Group, Z = - 2.06, p = .039; Private School Group, Z = - 2.21, p = .027), observing a large effect size (Public School Group, TT, d = 5.2 and PDL, d = 1.4; Private School Group, TT, d = 4.5 and PDL, d = 4.01).

The public group obtained an increase in the global prosody of 8.4 points in TT, being the prosody features with the biggest gains on rhythm (Z = - 2.041, p = .041), phrasing (Z = - 2.070, p = .038), intonation (Z = -2.236, p = .025) and pauses (Z = -2.121, p = .034). Regarding the volume, even though there were few improvements between the pre-test and the post-test, this was not significant enough (Z= - 1.890, p = .059). On this same group, but on the PDL text, the prosody increased 4.4 points compared to the first measure, but intonation (Z = -2.121, p = .034) and the pauses (Z = - 2.000, p = .046) had significant improvements, while the rhythm (Z = - 1.000, p = .31), the volume (Z = - 1.633, p = .102) and the phrasing did not (Z = - 1.732, p = .083).

Meanwhile, the Private School Group had an increase of 8.5 points in TT and 6.7 in the PDL text regarding the global measure of prosody. Although the students improved in all the prosodic characteristics in the reading of both texts, the highest progress was achieved with the TT, to be exact, the phrasing (Z = -2.232, p =.026), the volume (Z = -2.271, p =.023) and intonation (Z = -2.251, p =.024).

To check whether the reader's theatre program was equally effective for the two groups with different SES, the Mann Whitney U statistical test was used. The statistical analysis showed that there were no significant differences between the groups both in the TT reading and in the PDL reading. That is, the effects of the program seem to have been similar for both groups (see table 4).

The analysis carried out shows that in the reading of TT the Public School Group obtained a slightly higher score than the Private School Group in the global level of prosody. The prosodic feature that most

Table 1

Design of intervention

The general structure of the session of the intervention	Teacher's role	Student's role
Session 1		
Presentation of the play	Presents the play title and encourages the students to make predictions from it.	Comments by responding to the questions asked by the teacher.
Modeled reading	Reads aloud with appropriate expression and speed to transmit a fluent reading to students	Listens to the teacher's reading, while continuing to read the text in silence.
Comment of the text	Discusses the text with students.	Talks with the teacher and the classmates about the content of the story and answer the questions related to the narrative structure of the text and with common aspects to the theatre plays.
Joint reading	Asks students to read aloud and by taking turns.	Reads aloud as best he or she can, according to the teacher's instructions.
At home: reflective reading	Asks students to practice reading the text in the company of an adult, who will ask questions about the content text.	Reads the text aloud and answer the questions posed by the adult.
Session 2		
Guided joint reading	Asks students to read aloud and by taking turns. Corrects reading accuracy, expressiveness and posture while reading. Explain how to transmit moods and emotions through the voice.	Reads the text aloud and corrects the reading of his or her classmates.
Analysis of the characters	Asks questions to students to analyze the story characters	Identifies the character traits, emotions and feelings represented in the text
Assignment of the characters	Assigns characters to students according to their interests, personality and reading level, and asks them to highlight the assigned parts with fluorescent color.	Highlights the dialogue corresponding to the assigned character.
At home: repeated reading of content words	Asks students to read a list of content words of the text accompanied by an adult, who records the mistakes and speed.	Reads the list of words aloud
Session 3		
Guided joint reading	Asks students to read the assigned character aloud and by taking turns. Correct the reading	Reads aloud the text of their characters and correct his or her classmate's reading.
Guided reading in pairs or trios	Asks students to read aloud the assigned character to their classmates. Guides students with their characters	Reads aloud the text of the character and correct the classmate's reading.
Guided joint reading	Asks students to read aloud and by taking turns the assigned character. Correct the readings.	Reads aloud the text of the character and correct his or her classmate's reading.
At home: repeated reading of the assigned character's text	Asks students to practice the assigned character reading accompany by an adult, who records the mistakes and speed.	Reads aloud the text of the character.
Session 4		
Guided joint reading Guided reading in pairs or trios Guided joint reading	Repeats what was done in session 3.	Repeats what was done in session 3.
At home: repeated reading of the assigned character's text	Asks students to read a list of a functional word in the text in the company of an adult, who records the mistakes and the speed. .	Reads a list of words aloud.
Session 5		
Guided joint reading	Asks students to read the assigned character aloud and by taking turns. Corrects the reading.	Reads the text of the character aloud and corrects his or her classmate's reading.
Performance of the play	Organizes the final representation and records it in the video.	Performs the play reading along with his or her classmates.
Evaluation of the performance	Asks students to watch the video of the play and appreciate their performance.	Analyzes the video of the play along with his or her classmates and teacher.

Table 2

Differences between the Public School Group and Private School Group in reading Theatrical Text and "Pruebas de Dominio Lector" Text pre-test

	TT			PDL		
Variable	Public School Group	Private School Group	*p*	Public School Group	Private School Group	*p*
Prosody	11.0	10.33	.66	11.6	12.0	.42
	(1.87)	(2.06)		(2.88)	(1.09)	
Rhythm	1.60	.83	.54	2.00	2.00	1.00
	(.55)	(.41)		(.71)	(.00)	
Volume	2.60	2.00	.18	2.80	2.67	.79
	(.55)	(.63)		(.45)	(.52)	
Intonation	.80	1.67	.79	1.80	2.00	.66
	(.45)	(.52)		(.45)	(.63)	
Pauses	1.80	1.83	.93	1.80	2.17	.43
	(0.45)	(.41)		(.84)	(.41)	
Phrasing	1.40	1.33	.93	1,20	1.17	.93
	(.55)	(.52)		(.45)	(.41)	
Integration	1.80	1.67	.79	2.00	2.00	1.00
	(.45)	(.52)		(.71)	(.00)	

Note. TT= Theatrical Text; PDL= Pruebas de Dominio Lector Text.

Table 3

Descriptive statics and, pre-test and post-test results

	Public School Group					Private School Group				
	TT			PDL		TT			PDL	
Variable	Pre-test	Post-test	*p*	Pre-test	Post-test	Pre-test	Post-test	*p*	Post-test	*p*
Prosody	11.0	19.4	.04*	11.6	16.0	10.33	18.83	.03*	18.67	.03*
	(1.87)	(1.34)		(2.88)	(3.24)	(2.06)	(1.72)		(1.03)	
Rhythm	1.60	3.20	.04*	2.00	2.20	1.83	2.50	.04*	2.83	.02*
	(.54)	(.44)		(.70)	(.44)	(.40)	(.54)		(.40)	
Volume	2.60	3.60	.06	2.80	3.60	2.00	3.67	.02*	3.83	.02*
	(.54)	(.54)		(.44)	(.54)	(.63)	(.81)		(.40)	
Intonation	1.80	2.80	.03*	1.80	3.00	1.67	3.17	.02*	3.00	.03*
	(.44)	(.44)		(.44)	(.70)	(.51)	(.40)		(.00)	
Pauses	1.80	3.00	.03*	1.80	2.60	1.83	3.00	.02*	3.00	.02*
	(.44)	(.00)		(.83)	(1.14)	(.40)	(.00)		(.00)	
Phrasing	1.40	3.80	.04*	1.20	1.80	1.33	3.50	.03*	3.00	.02*
	(.54)	(.44)		(.44)	(.83)	(.51)	(.83)		(.63)	
Integration	1.80	3.00	.03*	2.00	2.80	1.67	3.00	.02*	3.00	.01*
	(.44)	(.00)		(.70)	(.44)	(.51)	(.00)		(.00)	

Note. TT= Theatrical Text; PDL= Pruebas de Dominio Lector Text.
**p < .05*

Table 4

Differences between the Public School Group and Private School Group in reading Theatrical Text and "Pruebas de Dominio Lector" Text post-test

	TT			PDL		
Variable	Public School Group	Private School Group	*p*	Public School Group	Private School Group	*p*
Prosody	19.4	18.83	.53	16	18.67	.13
	(1.34)	(1.72)		(3.24)	(1.03)	
Rhythm	3.20	2.50	.13	2.20	2.83	.08
	(.45)	(.55)		(.45)	(.41)	
Volume	3.60	3.67	.66	3.60	3.83	.54
	(.55)	(.82)		(.55)	(.41)	
Intonation	2.80	3.17	.43	3.00	3.00	1.00
	(.45)	(.41)		(.71)	(.00)	
Pauses	3.00	3.00	1.00	2.60	3.00	.66
	(.00)	(.00)		(1.14)	(.00)	
Phrasing	3.80	3.50	.66	1.80	3.00	.05*
	(.45)	(.84)		(.84)	(.63)	
Integration	3.00	3.00	1.00	2.80	3.00	.66
	(.00)	(.00)		(.45)	(.00)	

Note. TT= Theatrical Text; PDL= Pruebas de Dominio Lector Text.
**p < .05*

differentiates them is the rhythm (Z = -1.927, p = .126). Meanwhile, in the reading of descriptive texts, students of Private School Group are the ones who outscored their peers in both the global level of prosody (Z = -1,662, p = .126) as in all the measured prosodic features, except for intonation.

Discussion

This exploratory study aimed to determine the effectiveness of a reader's theatre program about prosody in the reading process of students with a specific reading learning difficulty. The results obtained in this study indicate that the program seems to produce significant improvements in this variable in both groups. These results match with the findings of previous studies (Garzón et al., 2008; Keehn, 2003; Mraz, et al., 2013; Young & Rasinski, 2009, 2017), that suggest that the use of the reader's theatre helps increase the level of prosody in oral reading of texts.

A consubstantial strategy to the readers' theatre is repeated reading (Tyler & Chard, 2000). Many studies have used repeated reading to increase the level of fluency (Lee & Yoon, 2017). Reading repeatedly allows readers to manage their attentional resources to other cognitive processes such as text comprehension or prosody and not so much to the decoding of the text. In this work, repeated reading became a prominent element of the program, as the students read their scripts several times aloud, to perfect their prosody.

The readers' theatre allowed students to work in prosodic, or suprasegmental features of reading fluency such as modulating voice tones to express emotions and feelings raised by the author, marking pauses at strategic places and emphasizing the words properly. At the end of the program, it was observed that both groups improved their general level of prosody and measured prosodic characteristics. So, we consider that students who are dyslexic can also benefit from repeated readings as shown in some studies (Lee & Yoon, 2017; Stevens, et al., 2016).

The second question of our study was to test whether the reader's theatre program was equally effective for two socioeconomic distinct groups. In the TT reading, the Public School Group was slightly higher than the Private School Group. As observed in the analysis performed, the differences found among the participants were not meaningful, except for intonation on PDL text. Therefore, the program seems to have been equally effective for both groups. Findings reinforce the idea that children with difficulties have scarce opportunities to move forward in their learning, but the opportunities to improve their performance and academic success increase when they are supported and have the specialized attention that matches their needs from an interactive perspective (Harmey, 2020). The replication of the same results in students with different socioeconomic status reinforces the internal validity of the program. Nevertheless, we are aware that, since we do not have control groups, variables such as history, maturation, instrumentation, etc., may have influenced the observed changes.

Regarding our third question, if reading prosody improvements of theater texts would be generalized to descriptive texts, it was found that both groups obtained better performance in the post-test compared to the pre-test. Though, the readers' theater could have a facilitating effect on learning, since it would benefit generalization, as suggested in other studies (Keehn, 2003; Tyler & Chard, 2000). However, the Private Group had better performance and obtained significant benefits in their prosody, while the Public Group did not obtain statistically significant differences in rhythm, volume and phrasing.

It is also observed that the benefits were less in the reading of descriptive texts. This fact could be due to several reasons. First, the lack of reading accuracy is a persistent difficulty in dyslexic subjects, becoming an elusive goal. Second, repeated reading of words or texts helps to visually recognize words and reinforce correspondences; but for children who have a specific difficulty with some letter, this kind of task is generally not enough. This fact makes us reflect on the need to dedicate complimentary hours in the intervention to work on the reading accuracy of those students with pronounced difficulty. But, even though they obtained fewer benefits in the descriptive reading texts, our results may indicate that students learnt to use and relate knowledge with a new reading experience. By changing a few aspects of the program, greater benefits may be reached in both groups of students, even more in those who present some contextual disadvantages (Espinoza & Rosas, 2019; Noble et al., 2006; Urquijo et al., 2015).

Although the program helped to improve the prosody in the reading of texts of the study participants, this work has some limitations. The main limitation was not having a control group that showed that the results obtained were due to the program itself and not to other variables. The investigations carried out on the readers' theatre as a strategy for the development of prosody are scarce, and even more, those that use an experimental design as part of their methodology. Making a study of this kind would give us a clearer vision of the effects of the program on the prosody of the participants. Another limitation is not having made a more exhaustive selection of the participants, as they were selected according to the type of errors of reading accuracy that they made since other variables involved in fluency such as accuracy and automation could have had implications for greater improvements in the prosody.

Much of the research that has been done, concerning programs to develop fluency, have not always put their attention on prosody (Rasinski, 2014; Young & Rasinski, 2017), but to reach the reader accuracy and automation. Furthermore, it is not easy for a teacher to find reading strategies that draw the attention of school children and by which they feel motivated. The program presented has also an impact on teachers or education professionals, since it is a useful tool that encourages reading, focuses on expressiveness, gives schoolchildren a real reading environment in which they can share and live reading, and allows for teamwork. It is for this reason that reader's theatre can be an effective strategy to develop prosody in the reading of school children with a specific difficulty in learning to read since it has not only allowed improving this ability, but it has also turned out to be highly motivating for children who, in most cases, manifest a rejection towards the tasks of reading.

The present study has provided preliminary evidence that a specialized intervention can benefit school children who have reading difficulties and come from different environments, but more rigorous research is needed.

References

Agencia de Calidad de la Educación. (2015). *Resultados Educativos 2015* [Educational results 2015]. http://archivos.agenciaeducacion.cl/Presentacion_Resultados_Educativos_2015.pdf

Allington, R. L., McCuiston, K., & Billen, M. (2015). What research says about text complexity and learning to read. *The Reading Teacher, 68*(7), 491-501. https://doi.org/10.1002/trtr.1280

Allington, R. L. (2009). *What really matters in fluency: Research-based practices across the curriculum.* Pearson.

Álvarez-Cañizo, M., Suárez-Coalla, P., & Cuetos, F. (2015). The role of reading fluency in children's text Comprehension. *Frontiers in Psychology, 6,* Article 1810. https://doi.org/10.3389/fpsyg.2015.01810

American Psychiatric Association (2014). *DSM-5. Manual diagnóstico y estadístico de los trastornos mentales* [DSM-5. Diagnostic and Statistical Manual of Mental Disorders] (5 ed.). Editorial Médica Panamericana.

Benjamin, R. G., & Schwanenflugel, P. J. (2010). Text complexity and oral reading prosody in young readers. *Reading Research Quarterly, 45*(4), 388-404. https://doi.org/10.1598/RRQ.45.4.2

Calet, N., Defior, S., & Gutiérrez-Palma, N. (2015). A cross-sectional study of fluency and reading comprehension in Spanish primary school children. *Journal of Research in Reading, 38*(3), 272–285. https://doi.org/10.1111/1467-9817.12019

Calet, N., Flores, M, Jiménez-Fernández, G., & Defior, S. (2016). Habilidades fonológicas suprasegmentales y desarrollo lector en niños de educación primaria [Phonological suprasegmental skills and reading development in primary school children]. *Anales de Psicología, 32*(1), 72-79. http://dx.doi.org/10.6018/analesps.32.1.216221

Calet, N., Gutiérrez-Palma, N., Simpson, I., González-Trujillo, M. C., & Defior, S. (2015). Suprasegmental phonology development and literacy acquisition: A longitudinal study. *Scientific Studies of Reading, 19*(1), 57-71. https://doi.org/10.1080/10888438.2014.976342

Campbell, D., & Stanley, J. (1963). *Expermental and quiasi-experimental designs for research.* Rand McNally & Company.

Carrasco, A., Contreras, D., Elacqua, G., Flores, C., Mizala, A., Santos, H., Torche, F., & Valenzuela, J. P. (2014). *Hacia un sistema escolar más inclusivo: Como reducir la segregación escolar en Chile* (Informe de políticas públicas 03) [Towards a more inclusive school system: How to reduce school segregation in Chile (Public policy report 3)]. https://www.espaciopublico.cl/wp-content/uploads/2016/05/25.pdf

Cortés, M. (2002). *Didáctica de la prosodia del español, la acentuación y la entonación* [Didactics of Spanish prosody, accentuation and intonation]. Edinumen.

Dowhower, S. L. (1987). Effects of repeated reading on second-grade transitional readers´fluency and comprehension. *Reading Research Quarterly, 22*(4), 389-406. https://doi.org/10.2307/747699

Dowhower, S. L. (1991). Speaking of prosody: fluency's unattended bedfellow. *Theory into Practice, 30*(3), 165-175. https://doi.org/10.1080/00405849109543497

Duncan, L., & Seymour, P. (2000). Socioeconomic differences in foundation-level literacy. *British Journal of Psychology, 91*(2), 145-166. https://doi.org/10.1348/000712600161736

Espinoza, V., & Rosas, R. (2019). Diferencias iniciales en el proceso de acceso al lenguaje escrito según nivel socieconómico [Initial differences in development of access to written language according to socioeconomic status]. *Perspectiva Educacional, 58*(3), 23-45. http://dx.doi.org/10.4151/07189729-vol.58-iss.3-art.955

Fountas, I. C., & Pinnell, G. S. (2010). *Benchmark assessment system 2* (2nd ed.). Heinemman.

Fuchs, L. S., Fuchs, D., Hosp, M. K., & Jenkins, J. R. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading, 5*(3), 239-256. https://doi.org/10.1207/S1532799XSSR0503_3

Garzón, M., Jiménez, M. E., & Seda, I. (2008). El teatro de lectores para mejorar la fluidez lectora en niños de segundo grado [Readers' theater to improve reading fluency in second graders]. *Lectura y Vida: Revista Latinoamericana de Lectura, 29*(1), 32-44. http://www.lecturayvida.fahce.unlp.edu.ar/numeros/a29n1/29_01_Garzon.pdf

Harmey, S. (2020). Perspectives on dealing with reading difficulties. *Education 3-13, 49*(1), 52-62. https://doi.org/10.1080/03004279.2020.1824702

Herbers, J. E., Cutuli, J. J., Supkoff, L. M., Heistad, D., Chan, C., Hinz, E., & Masten, A. S. (2012). Early reading skills and academic achievement trajectories of students facing poverty, homelessness, and residential mobility. *Educational Researcher, 41*(9), 366-374. https://doi.org/10.3102/0013189X12445320

Hudson, R. F., Lane, H. B., & Pullen, P. C. (2005). Reading fluency assessment and instruction: What, why, and how? *The Reading Teacher, 58*(8), 702-714. https://doi.org/10.1598/RT.58.8.1

Jiménez-Fernandez, G., Gutierrez-Palma, N., & Defior, S. (2015). Impaired stress awareness in Spanish children with developmental dyslexia. *Research in Developmental Disabilities, 37*, 152-161. https://doi.org/10.1016/j.ridd.2014.11.002

Kanık Uysal, P., & Bilge, H. (2018). An investigation on the relationship between reading fluency and level of reading comprehension according to the type of texts. *International Electronic Journal of Elementary Education, 11*(2), 161–172. https://iejee.com/index.php/IEJEE/article/view/645

Keehn, S. (2003). The effect of instruction and practice through readers theatre on young readers´ oral reading fluency. *Reading Research and Instruction, 42*(4), 40-61. https://doi.org/10.1080/19388070309558395

Klauda, S. L., & Guthrie, J. T. (2008). Relationships of three components of reading fluency to Reading comprehension. *Journal of Educational Psychology, 100*(2), 310–321. https://doi.org/10.1037/0022-0663.100.2.310

Kuhn, M. R., Schwanenflugel, P. J., & Meisinger, E. B. (2010). Aligning theory and assessment of reading fluency: Automaticity, prosody, and definitions of fluency. *Reading Research Quarterly, 45*(2), 230-251. http://www.jstor.org/stable/20697184

Kuhn, M. R., & Stahl, S. A. (2003). Fluency: A revision of the development and remedial practices. *Journal of Educational Psychology, 95*(1), 3-21. https://doi.org/10.1037/0022-0663.95.1.3

Lee, J., & Yoon, S. Y. (2017). The effects of repeated reading on reading fluency for students with reading disabilities: A meta-analysis. *Journal of Learning Disabilities, 50*(2), 213-224. https://doi.org/10.1177/0022219415605194

Lyon, G. R., Shaywitz, S. E., & Shaywitz, B. A. (2003). Defining dyslexia, comorbidity, teachers' knowledge of language and reading: A definition of dyslexia (Part I). *Annals of Dyslexia, 53*(1), 1-14. https://doi.org/10.1007/s11881-003-0001-9

Marchant, T., Recart, I., Cuadrado, B., & Sanhueza, J. (2009). *Pruebas de dominio lector Fundación Educacional Arauco para alumnos de enseñanza básica* [Fundación Educacional Arauco Reading Proficiency Tests for elementary school students] (4th ed.). Ediciones Universidad Católica de Chile.

Mesmer, H. A. E. (2010). Textual scaffolds for developing fluency in beginning Readers: Accuracy and reading rate in qualitatively leveled and decodable text. *Literacy Research and Instruction, 49*(1), 20–39. https://doi.org/10.1080/19388070802613450

Miller, J., & Schwanenflugel, P.J. (2006). Prosody of syntactically complex sentences in the oral reading of young children. *Journal of Educational Psychology, 98*(4), 839–853. https://doi.org/10.1037/0022-0663.98.4.839

Miller, J., & Schwanenflugel, P.J. (2008). A longitudinal study of the development of reading prosody as a dimension of oral reading fluency in early elementary school children. *Reading Research Quarterly, 43*(4), 336–354. https://doi.org/10.1598/RRQ.43.4.2

Millin, S. K., & Rinehart, S. D. (1999). Some of the benefits of readers theatre participation for second grade Title 1 students. *Reading Research and Instruction, 39*(1), 71-88. https://doi.org/10.1080/19388079909558312

Mraz, M., Nichols, W., Caldwell, S., Beisley, R., Sargent, S., & Rupley, W. (2013). Improving Oral Reading Fluency through Readers Theatre. *Reading Horizons, 52*(2), 163-180. https://scholarworks.wmich.edu/reading_horizons/vol52/iss2/5

Noble, K. G., Wolmetz, M. E., Ochs, L. S. Farah, M. J., & McCandliss, B. D. (2006). Brain–behavior relationships in reading acquisition are modulated by socioeconomic factors. *Developmental Science 9*(6), 642–654. https://doi.org/10.1111/j.1467-7687.2006.00542.x

Organisation for Economic Co-operation and Development. (2019). *TALIS - The OECD Teaching and Learning International Survey. Country notes.* http://www.oecd.org/education/talis/talis-2018-country-notes.htm

Pae, S., Shin, G., & Seol, A. (2017). Developmental characteristics of word decoding and text reading fluency among Korean children with developmental dyslexia. *Communication Sciences and Disorders, 22*(2), 271-283. https://doi.org/10.12963/csd.17385

Paige, D. D., Rasinski, T. V., & Magpuri-Lavell, T. (2012). Is fluent, expressive reading important for high school readers? *Journal of Adolescent & Adult Literacy, 56*(1), 67-76. https://doi.org/10.1002/JAAL.00103

Rasinski, T. V. (2010). *The fluent reader: Oral & silent reading strategies for building fluency, word recognition & comprehension* (2nd Rev. ed.). Scholastic.

Rasinski, T. V. (2014). Fluency Matters. *International Electronic Journal of Elementary Education, 7*(1), 3-12. https://www.iejee.com/index.php/IEJEE/article/view/60/58

Rasinski, T. V., & Padak, N. D. (2008). *From phonics to fluency: Effective teaching of decoding and reading fluency in the elementary school* (2nd ed.). Pearson.

Rossi, P. H., Lipsey, M. W., & Freeman, H. E. (2004). *Evaluation: a systematic approach* (7th ed.). SAGE.

Schaars, M., Segers, E., & Verhoeven, L. (2017). Word decoding development during phonics instruction in children at risk for dyslexia. *Dyslexia. An International Journal of Research and Practice, 23*(2), 141-160. https://doi.org/10.1002/dys.1556

Schwanenflugel, P. J., Hamilton, A. M., Wisenbaker, J. M., Kuhn, M. R., & Stahl, S. A. (2004). Becoming a fluent reader: Reading skill and prosodic features in the oral reading of young readers. *Journal of Educational Psychology, 96*(1), 119-129. https://doi.org/10.1037/0022-0663.96.1.119

Stevens, E. A., Walker, M. A., & Vaughn, S. (2016). The effects of reading fluency interventions on the reading fluency and reading comprehension performance of elementary students with learning disabilities: A synthesis of the research from 2001 to 2014. *Journal of Learning Disabilities, 50*(5), 1-15. https://doi.org/10.1177/0022219416638028

Stufflebeam, D. L., & Shinkfield, A. J. (2007). *Evaluation theory, models, and applications.* Jossey-Bass.

Suárez-Coalla, P., Álvarez-Cañizo, M., Martínez, C. & García, N., & Cuetos, F. (2016). Reading prosody in Spanish dyslexics. *Annals of Dislexia, 66*(3), 275-300. https://doi.org/10.1007/s11881-016-0123-5

Suárez-Coalla, P., & Cuetos, F. (2017). Formation of orthographic representations in Spanish dyslexic children: The role of syllable complexity and frequency. *Dyslexia. An International Journal of Research and Practice, 23*(1), 88-96. https://doi.org/10.1002/dys.1546

Tyler, B. J., & Chard, D. J. (2000). Focus on inclusion: Using readers theatre to foster fluency in struggling readers: A twist on the repeated reading strategy. *Reading & Writing Quarterly: Overcoming Learning Difficulties, 16*(2), 163-168. https://doi.org/10.1080/105735600278015

Urquijo, S., García Coni, A., & Fernandes, D. (2015). Relación entre aprendizaje de la lectura y nivel socioeconómico en niños argentinos [Relationship between reading and socioeconomic level in Argentinian children]. *Avances en Psicología Latinoamericana, 33*(2), 303-318. https://doi.org/10.12804/apl33.02.2015.09

Wexler, J., Vaughn, S., Edmonds, M., & Reutebuch, C. K. (2008). A synthesis of fluency interventions for secondary struggling readers. *Reading and Writing: An Interdisciplinary Journal, 21*(4), 317-347. https://doi.org/10.1007 / s11145-007-9085-7

Whalley, K, & Hansen, J. (2006). The role of prosodic sensitivity in children's reading development. *Journal of Research in Reading, 29*(3), 288-303. https://doi.org/10.1111/j.1467-9817.2006.00309.x

Young, Ch., & Nageldinger, J. (2014). Considering the context and texts for fluency: Performance, readers theater, and poetry. *International Electronic Journal of Elementary Education, 7*(1), 47-56. https://www.iejee.com/index.php/IEJEE/article/view/63/61

Young, C., & Rasinski, T. V. (2009). Implementing readers theatre as an approach to classroom fluency instruction. *The Reading Teacher, 63*(1), 4-13. https://doi.org/10.1598/RT.63.1.1

Young, C., & Rasinski, T. V. (2017). Readers Theatre: effects on word recognition automaticity and reading prosody. *Journal of Research in Reading, 41*(3), 1-11. https://doi.org/10.1111/1467-9817.12120

Young, C., Rasinski, T. V., Paige, D. D. & Rupley, W. H. (2020). Defining fluency. Finding the missing pieces for reading fluency. *Literacy Today, May/June,* 32-33.

Ziegler, J. C., Perry, C., Ma-Wyatt, A., Ladner, D., & Schulte- Körne, G. (2003). Developmental dyslexia in different languages: Language specific or universal? *Journal of Experimental Child Psychology, 86*(3),169-193. https://doi.org/10.1016/S0022-0965(03)00139-5

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 589-598

Elementary School Teachers and Sex Education in Mexico: The Case of Veracruz

Ana Lis Heredia Espinosa[*,a], Adriana Rodríguez Barraza[b]

Received : 12 February 2021
Revised : 13 May 2021
Accepted : 5 June 2021
DOI : 10.26822/iejee.2021.214

[*,a] **Corresponding Author:** Ana Lis Heredia Espinosa, Institute of Psychological Research Universidad Veracruzana, Xalapa, Veracruz, Mexico.
E-mail: aheredia@uv.mx
ORCID: http://orcid.org/0000-0002-3998-3003

[b]Adriana Rodríguez Barraza, Institute of Psychological Research Universidad Veracruzana, Mexico.
E-mail: adrirodriguez@uv.mx
ORCID: http://orcid.org/0000-0003-4833-9540

Abstract

Elementary school teaches children to read and write, develop math skills, live together, explore the world, understand that world at a basic level, and grow as people. The objectives of this article are to examine the beliefs of elementary school teachers regarding sex education, to gain a notion of the limits and scope of sex pedagogy in the approach to content, and to provide accurate information for decision-making and public policy. A descriptive study was conducted using a qualitative methodology. The data were collected between October and December 2019 in two public elementary schools in the City of Veracruz, State of Veracruz, Mexico. A non-probabilistic sampling method with a maximum variation was used in the study. In total, nine teachers of ages ranging from 22 to 64 years participated. The teachers reported that the students must have reached sexual maturity to talk about sexuality. Likewise, a discourse that emphasizes the biological aspects and the belief that abstinence is the best way to prevent unwanted pregnancy predominates. Finally, there were different opinions regarding the need for training teachers to teach sex education.

Keywords:

Beliefs, Elementary School, Sex Education, Teachers

Introduction

Primary Education

Primary education in Mexico is constitutionally compulsory, must be accessible, and by mandate is secular. According to the type of support, public schools can get either federal or state aid. Federal elementary schools are subsidized by the national government and administered by the Ministry of Public Education (known as the SEP in Mexico). In contrast, state elementary schools are subsidized by the Secretary of Education in each state.

There is a vast disparity in the number of men and women in the teaching profession. According to the National Institute of Statistics, Geography, and Informatics in Mexico (INEGI,

2020), at the primary level, most teachers are women: in preschool, the difference is drastic given that 94% are women and 6% are men; in elementary school, 67% of teachers are women and 33% are men; and in secondary school, 57% are women and 43% are men. Wood (2012) examined teacher perceptions of gender-based differences among elementary school teachers in the USA. She found that more than half of the participants believed that female teachers are more nurturing, and that male teachers are more commanding with students. We must also consider the organization in preschool and elementary school where a teacher is responsible for teaching all subjects to the group. From secondary school, given the breadth of subjects taught, there is a teacher for each type of academic course.

Preparation of Primary School Teachers

In Mexico, most of the primary-level teachers (preschool, elementary, and secondary) are trained in the so-called Normal Schools. The Normal Schools are educational centers dedicated specifically and exclusively to training teachers. The term "Normal" is related to the idea that these establishments should serve as a norm or model for the others in their class (Meneses, 1999).

The training approaches that circulate in this institution parallel the national educational policies, while the Mexican government, through the Ministry of Public Education (SEP), dictates the guidelines for the training of future teachers (Navarrete, 2015).

The Normal Schools educate the teachers responsible for shaping future citizens. The direct antecedent of creating these schools was the pedagogical model of Enrique Rébsamen, first applied in Veracruz. Rébsamen was a Swiss pedagogue who arrived in Mexico in 1883. In 1885, Governor Juan de la Luz Enríquez entrusted him with a short course for the education of teachers in the region. Enrique Laubscher was another European pedagogue; he was of German origin and he promoted the founding of the first Normal Schools, where the pedagogical doctrine and the scientific bases would regulate educational development, mainly in public schools. At the end of the 19th century and the beginning of the 20th century, primary education was considered essential to achieving the ideal consolidation of national unity.

The Normal Schools in Mexico today are part of a diverse set of establishments dedicated to teachers' preparation. Throughout history, they have been reducing their number in terms of school enrollment and budget. According to their educational level, Normal Schools are divided into preschool, elementary, and secondary. There are two other types of schools that prepare specialized teachers, one for children with disabilities, and another for physical education. Currently, future elementary school teachers trained in the Normal Schools study a series of subjects that mainly fall into three categories:

1) Theoretical-methodological bases for teaching, including pedagogical models, planning, evaluation, and legal and normative bases of primary education.

2) Training for teaching and learning, which includes three areas: (1) the development of reading skills, the production of written texts, literature, theater, language, and communication; (2) algebra, geometry, statistics, music, and physical education; and (3) the natural sciences, environment, geography, history, civics, and ethics.

3) Professional practice, which includes observing and analyzing educational training, teaching work strategies, and school improvement projects.

Elementary School Curriculum

Elementary school lasts for six years and provides basic knowledge of Spanish, mathematics, and the sciences, and it is held in the morning (8:00 a.m. to 12:30 p.m.) or the afternoon (2:00 p.m. to 6:30 p.m.).

The school curriculum is the instrument that can structure schooling, the operation of educational centers, and pedagogical practices since it provides, transmits, and imposes rules, norms, and a determining order for the way that students should work in classes (Gimeno, 2010). In other words, it is the backbone of teaching in the classroom.

The SEP determines the curriculum. All the country's elementary schools base their curriculum on the SEP through textbooks that have been distributed free of charge since 1959. Palencia and González (2015) point out the importance of school textbooks in the general population's education since, for the majority, they could be the only books they will read in their lives. It is worth mentioning that the contents are determined by the state following the educational policies of the moment. Speaking about sexuality issues, they have been in the natural science textbook since 1974.

Sex Education Curriculum

In Mexico, the selection of content on sexuality uses the definitions given by the World Health Organization (WHO) as guidelines. According to the WHO, sex

education aims to develop and strengthen children and young people's ability to make conscious, satisfying, healthy, and respectful choices regarding relationships, sexuality, and emotional and physical health. Sex education does not encourage children and young people to have sex.

Also, the WHO (2006) defines "sexuality" as a central aspect of being human throughout life that encompasses sex, gender identities and roles, sexual orientation, eroticism, pleasure, intimacy, and reproduction. Sexuality is experienced and expressed in thoughts, fantasies, desires, beliefs, attitudes, values, behaviors, practices, roles, and relationships. While sexuality can include all these dimensions, not all of them are always experienced or expressed. Sexuality is influenced by biological, psychological, social, economic, political, cultural, legal, historical, religious, and spiritual factors.

In this regard, Rangel (2018) claimed that in Mexico, discourses on sexuality in elementary schools are established in the curricular guidelines; however, teachers transfer them and reproduce them in interaction with the students. In this sense, it is interesting to cite a study conducted by Mar (2009) with Mexican children in the fifth and sixth grade; the author mentioned that the metaphors that children use to describe the human body depend on what they learn in school. Most children identify the body as a machine or an apparatus; this has to do with the predominance of biomedical discourse and anatomical view of sexuality in the curriculum. In addition, teachers speak of an ethic of sexuality based on a religious nature's conservative morality (Rangel, 2018). Likewise, other studies have addressed Mexico's issue from the testimony of fifth- and sixth-grade elementary school teachers about the contents of books and professional training on sexuality and gender in the Yucatán and in Quintana Roo (Rosales & Salinas, 2017). However, there are no investigations of this nature in Veracruz.

The preceding allows us to understand the current panorama regarding sexuality in educational centers, which is important because, due to their deficiencies, young people lack a solid base to face situations such as those mentioned below.

Social Problems Associated with the Lack of Sex Education

Some current social conditions make it necessary to investigate what happens in sex education classes. For example, 23% of adolescents start their sexual lives between the ages of 12 and 19. Likewise, according to data from the Organization for Economic Cooperation and Development, Mexico ranks first in cases of adolescent pregnancy internationally (OCDE, 2018). Also, figures from the National Institute of Statistics, Geography, and Informatics (INEGI, 2020), revealed that 16% of the births registered at the national level corresponded to adolescents between 15 and 19 years old. Along the same lines, according to official data published in the National Strategy for preventing pregnancy in adolescents in Mexico 2018 (INMUJERES, 2018), recently, pregnancies have been registered in girls between 10 and 14 years old.

For its part, the state of Veracruz, where this study was carried out, ranks second nationally in adolescent pregnancy, with more than 20,000 pregnancies per year (GIPEA, 2018), and each year that figure increases. Another alarming fact is about maternal mortality. According to the National Council of Medical Arbitration, in terms of maternal deaths in adolescents that occurred in the country from 2002 to 2017, Veracruz ranked third in the country, with a record of 200 deaths in children under 19 years of age (Sánchez & Montoya, 2019). Likewise, in 2019 Veracruz ranked first in the nation in AIDS infections, with a total of 119 new cases registered, according to data from the National Center for the Prevention and Control of HIV and AIDS.

Thus, we can note that the incorporation of sex education in elementary school will not solve the problems since at a structural, cultural, and personal level, multiple factors have influence, including beliefs. Hence, the importance of doing studies like this one to examine the tremendous impact they have on observing, studying, and teaching students.

Beliefs

In this sense, beliefs have been studied from various fields. For example, for the philosopher Ortega y Gasset (2000), beliefs shape people's lives because they are put ahead of their perceived reality. There is usually no express awareness of them, but they act latently. When someone truly believes in something, they do not need to be clear about it; their notions are simply incorporated.

Also, for psychologists Martin Fishbein and Icek Ajzen (1975), beliefs are subjective probability judgments of a person regarding some area of their world; they deal with the understanding that subjects have of themselves and their environment. Along the same lines, Díez (2016) declares that belief is a psychological notion that implies the tendency to act as if one's beliefs are true. That means it is a conviction, or something that people consider true.

Therefore, as mentioned, this article's objective is to determine the beliefs of primary school teachers

regarding sex education, to determine its limits and scope in the approach of the contents, and to gain information that may be useful for decision-making and public policy. Sex education is a complex issue around which various beliefs are part of widespread knowledge (Ramírez, 2013). These have such a vital value range that they constitute an ethic that justifies and issues value judgments. Likewise, they play a crucial role in configuring daily practices such as gender relations and violence and inequality (Ramírez et al., 2009).

Given Mexico and Veracruz's circumstances, this text is relevant because it addresses the challenges elementary school teachers have regarding sex education and how pedagogy is permeated by what they believe. We think it can provide data that help identify and analyze beliefs since teachers are an agent that can contribute to social transformation, well-being, and people's quality of life.

Method

This study is descriptive, with qualitative methodology and a comprehensive-interpretive approach. We used the qualitative research interview technique, which allows us to build knowledge through a conversation that has a structure and a specific purpose (Kvale, 2008). Therefore, we conducted semi-structured interviews to determine teachers' perspectives and obtain descriptions of their beliefs and experiences in the approach to sex education. According to Bernard (1995), this method consists of a guide used when there is only one occasion to interview someone. In this case, the teachers had limited time to answer the interview questions because they were at work.

Context

In Mexico, primary education comprises the first three school levels in the lives of the students:

1. Preschool consists of three grades, and the children attend when they are 3 to 6 years old.
2. Elementary school has six grades, and children enter at the age of 6 and remain until 12.
3. Secondary school has three grades and is generally attended between the ages of 12 and 15 years.

The State of Veracruz has 212 municipalities. We conducted this study in the City of Veracruz, which has problems including pregnancies in girls and adolescents, maternal deaths, and the profusion of sexually transmitted diseases. Research of this nature is pertinent. The data were collected in two of the largest elementary schools, with the highest number of students and teachers in Veracruz, from October to December 2019. As mentioned above, 67% of elementary school teachers in Mexico are women and 33% are men; however, in the two schools where we conducted the research, the teaching staff consisted only of women.

Participants

We used a non-probabilistic sampling method with a maximum variation (Hudelson, 1994), which means documenting unique or diverse variations over a wide range of ages and years of teaching experience. In total, nine teachers whose ages ranged from 22 to 64 years participated. All are graduates of the Bachelor of Primary Education in Normal Schools, and all are Catholic. Seven of them are married and the other two are single. Three teach fourth grade (children of 9 and 10 years), three fifth grade (children of 10 and 11 years), and three sixth grade (children of 11 and 12 years). Four of them work in a state elementary school, and five in a federal elementary school. We should note that during the interviews, we asked the teachers if at some point in their academic career they had received sex education, to which they all answered in the negative, agreeing with the statement above.

Procedure

Before proceeding to the fieldwork, the Ethics Committee at the Institute of Psychological Research of Universidad Veracruzana approved the research. The provisions of the Federal Data Protection Law were always complied with. We developed a semi-structured interview script based on the research objectives, which aim to examine teachers' beliefs regarding sex education in elementary school and have a notion of its limits and scope in the approach of the contents.

Before beginning each consultation, teachers read an informed consent letter. Each participant was asked to sign it, reiterating that we would record the audio

Table 1

Scope of the Questions in the Data Collection Tool

Research objective	Interview guide
To examine teachers' beliefs regarding sex education in elementary school	1. Could you tell me in which subjects sex education contents are covered? 2. What can you tell me about the content on sex education in the " natural sciences " textbook? 3. How do you think sex education should be done in the grade you teach? 4. In what ways have you addressed sexuality in your classes? 5. How has your experience been in dealing with sexuality issues with students? 6. How do you feel about the knowledge of sexuality topics in the curriculum? 7. Have you completed courses on sexuality? 8. Do you think teachers should receive training on sex education pedagogy?

but that it would be assigned a pseudonym not to be identified, guaranteeing people's and institutions' confidentiality. On average, the interviews lasted 40 minutes. Interviews were held in various schools' spaces: some in the classrooms and others in the courtyard. We transcribed the interviews verbatim, and we safeguarded the transcripts. We collected around 90 pages of data.

Once we finished the interviews, they were analyzed based on the guidelines established by Kvale (2008) that consist of transcribing, coding, condensing, and interpreting the information obtained until we achieved a definitive categorization. An analysis was performed by the two researchers.

First, we proceeded to encode by hand, that is, to assign keywords to a text segment to allow later identification. Hence, we clustered these codes into mutually exclusive categories. Categorization implies a broader and more systematic conceptualization (Kvale, 2008). Therefore, we reduced the grouped codes to only three categories, with two subcategories in each.

Table 2

Categorization

Category	Subcategories
Beliefs about a textbook	Relevance of the contents. Omitting content
Beliefs about the characteristics of students	Maturation Discipline
Beliefs about teacher training	Need for teacher training Indifference toward training

For the study to be valid, we did a triangulation of evaluators, an intersubjective verification through the contrast of the information we obtained (Denzin, 1979). Likewise, for the study to have internal reliability, we created descriptive categories with a low level of interference, making them as concrete and precise as possible (Le Compte & Goetz, 1982). In addition, data were collected by two researchers to guarantee a better balance of observations, analysis, and interpretation.

Findings

Once the transcripts of the interviews were analyzed, we identified three major categories that encompass the beliefs: the contents of the textbooks, the students' characteristics, and teacher training. From these categories, six subcategories emerge that we will explain below.

Beliefs about Textbook Content

This category includes the beliefs that primary school teachers have about the knowledge, skills, attitudes, and values proposed in the curriculum that teachers will transmit in an educational project (SEP, 2017). Two subcategories emerged. The first is called relevance of the contents, and it refers to beliefs about the importance of sex education content that teachers will transmit during the course. Some teachers do not agree with the curriculum because they believe that students are given too much information. In contrast, others believe that it is important to talk about sexuality because knowledge can prevent abuse.

The second subcategory is called omitting content, and it refers to the belief that it is preferable to avoid addressing issues because they are considered inconvenient for children.

Beliefs About the Characteristics of Students

Through the analysis of interviews, we discovered that several teachers affirm that, to talk about sexuality with students, specific conditions regarding both maturation and discipline must be present in the group. Therefore, the first subcategory, maturity, refers to the belief that the development of sexual characteristics in students should be taken as a criterion to decide whether to talk about sexuality. One of the requirements is that the girls have already begun menstruating. The second subcategory is discipline; that is, the teachers have the belief that to talk about sexuality with their students, the group must behave appropriately without making jokes; otherwise, the topic is not taught.

Beliefs about Teacher Training

This last category encompasses beliefs about preparation for teaching, which includes the development of knowledge related to the contents of sexuality and gender and the knowledge and skills required in these subjects. The first subcategory refers to the need for teacher training. This implies a belief in one's lack of updating information on sexuality and gender and improving classroom practice. The last subcategory is Indifference toward training, which refers to the belief that training and updating information on sexuality and gender are irrelevant. Therefore, each teacher can prepare on their own.

Discussion

Regarding the relevance of textbook contents, we found that teachers avoid topics like sexual relations and contraceptive methods, despite those subjects being marked in the official curriculum. The teachers believe that students are not yet ready to start their sexual lives, as seen in the following speech by a teacher:

> *What I have avoided, and that comes in sixth grade books, is that they mention contraceptives... I have not seen that with kids; I do not think it is convenient for the student to know, despite knowing the different types of contraceptives, which are seen not only in elementary school but also in secondary school. I have always used the guideline that the greatest contraceptive is to abstain because they are not yet ready to initiate sexual relations (Samantha).*

Iyer and Aggleton's research (2013) in Uganda found that some teachers focus exclusively on abstinence as a preventive method when they talk about sexual matters. Also, a Brazilian study by Da Silva (2012) showed that when students ask about sexuality issues, teachers tend to avoid giving any explanation. In addition, Marseille et al. (2018) and Mirzazadeh et al. (2018) analyzed the effectiveness of school-based teen pregnancy and sexually transmitted infection prevention programs in North America. The results of the studies question the usefulness of interventions carried out in schools to prevent unwanted pregnancies and the incidence of HIV and other sexually transmitted infections in adolescents in North America.

According to Preston (2013), teachers continue to perceive their responsibility as combating sexual risk while viewing young people as immature, even as adolescents express a preference for sex education with less emphasis on strictly adverse sexual outcomes and more focus on peer education. In this sense, another relevant finding is that teachers take the sexual maturity of students as a criterion to decide whether to delve into sexuality issues:

> *From the fifth grade, I see when we are going to deal with this issue if there are kids who pay attention, and I begin to ask girls if they are already menstruating. I say, "Menstruation... do you know what that is?", and there are girls who say yes, others no. I do a survey, and if I see that the girls still do not understand it well, I treat the topic in general. I talk to the mothers and ask them to explain them too before I start to address them more in-depth. I give my students the example of girls I know from a community where I taught classes who are already pregnant, and I tell them,*

Table 3

Category 1: Beliefs about Textbook Contents

Subcategories	Condensation
Relevance of the content	- There are many topics about which teachers disagree such as the argument that children are given so much information about sexuality that far from helping them, it arouses curiosity that leads them to seek erroneous information. - Children are exposed to abuse. Thus, it is very important that they know about sexuality.
Omitting content	- Talking about contraceptives is avoided, even though it is mentioned in the textbook. Teachers believe that it is not convenient for the students to know about contraception, and the guideline has been given that the best contraception is to abstain because they are not yet ready to initiate sexual relations.

Source: Self-made

Table 4

Category 2: Beliefs About the Characteristics of Students

Subcategories	Condensation
Maturity	- Being able to talk about sexuality issues depends on the level of student understanding. The more awake they are, the more laughter and the less seriousness the explanation. - It is necessary to determine whether the girls are already menstruating. I do a survey; if a respondent is not menstruating, I speak with her mother before approaching the subject.
Discipline	- Being able to teach sexuality issues depends on group discipline. If the group is undisciplined, I do not teach the topic. - You must carefully choose your words and the way things are explained. You must also analyze the children's questions properly. It is not a subject where you can talk without limits.

Source: Self-made

Table 5

Category 3: Beliefs About Teacher Training

Subcategories	Condensation
Need for teacher training	- We are asked to teach subjects about which we are not prepared. - In the Normal School, we should be taught how to plan and what strategies to use for sex education. - It would be good to update the curriculum because courses always focus on reading, Spanish, and mathematics, but not on sexuality. - There is ignorance as to how to approach sex education, or it is simply avoided.
Indifference toward training	- Sexual training depends on the person. - Each one, as the programs come out, must read them. In the new plans, there are many issues.

Source: Self-made

> *"How is it possible that when they are 14 or will be 15 years old instead of having a party, they have a baby in their arms?" And then that's where I tell them that there are things to avoid, pregnancy, and that the least they must do is have sex (Elena).*

As we can see, the teacher knows how pregnancy affects girls' lives by acquiring responsibilities for which neither they nor their parents are prepared; likewise, the speech denotes how the biological aspects of sexuality are more critical than the affective, relational, and sociocultural issues. In this sense, Da Silva (2012) and Rangel (2018) also reaffirm that sexual education in elementary and secondary schools in Mexico is marked by a biomedical discourse characterized by an emphasis on diseases, pregnancies, hygienic care, and biological changes in adolescence.

Another important finding is the lack of sexual education among the teachers themselves. For example, the following teacher talks about how they are asked to teach subjects on which they have not received adequate instruction:

> *They ask us about these issues, but they don't instruct us or tell us how. In other words, we must read and see how we explain things to kids, and we are not prepared. It should start when future teachers study at the Normal School. Those who will become teachers should take a course that will guide them on how to plan, how to do it, and what strategies to use. Sometimes I feel nervous, precisely because I don't know if a group will have doubts and I will not know how to explain things to them or I will not know everything about the subject (Laura).*

Da Silva (2012) has pointed out that teachers feel devoid of the knowledge and tools to address sexual education, leaving little space for them to find an answer to the questions that concern students.

Several teachers accepted that they need to receive training to be able to teach sex education. "Yes, it would be good to update because we always focus on reading, Spanish, mathematics ... But not on sexuality" (Karla). "Either there is ignorance on how to approach it, or it is simply avoided. I mean, two things happen here, but there must be sexual education in our professional training" (Veronica). This information is consistent with a study by Rosales and Salinas (2017), in which all participants agreed that they lack training in sex education. Iyer and Aggleton (2013) found that teachers revealed their lack of knowledge about sexual reproductive health issues and concluded that attitudes, beliefs, and superstitions related to young people's sexual activity inevitably affect the content and nature of sexuality education provided in school. In addition, a report made between 2016 and 2017 by the German Federal Centre for Health Education and the European Network of the International Planned Parenthood Federation presents a new assessment of sex education in Western Europe, Eastern Europe, and Central Asia. Although in 21 of the 25 countries, there is currently a law, policy, or strategy either requiring or supporting sexuality education curricula in formal school settings, in practice, only in three of the 25 countries were most teachers sufficiently trained to teach sex education (Ketting & Ivanova, 2018). Most teachers had not been trained in the remaining countries or had participated in only a short (one day) course.

According to Fazio et al. (2020), in Italy, elementary school teachers generally have low science teaching efficacy beliefs. Their poor science background is mainly shaped by years of traditional, teacher-centered didactic activities, where science teaching is based on the transmission of general concepts to students. However, they showed that after attending an inquiry-based workshop and organizing a science fair, teachers highlight a positive evolution of their science teaching efficacy beliefs and more faith in young pupils' capabilities to approach science subjects.

Conclusions

We consider it necessary to work with elementary school teachers on transforming their beliefs about teaching sex education. If they keep omitting this subject in schools, then they will contribute to the maintenance of risky sexual practices, unwanted pregnancies in girls and adolescents, and high rates of contagion of sexually transmitted diseases.

Also, it is crucial to address sexuality as an element of interpersonal relationships since sex education must improve people's quality of life and well-being. This must integrate aspects such as love, respect, inclusion, gender equality, responsibility, and commitment, just to name a few. It must go beyond what has traditionally been a starting point: the biomedical approach.

Regarding the conditions in which elementary school educators teach sexuality issues, we suggest stopping taking girls' sexual maturity as a reference point. We must remember that the development of sexual characteristics is a process that occurs differently in each human being, so it is not feasible to continue taking it as a criterion for deciding whether to explain a topic.

Another essential aspect is teacher training. We must be aware of how necessary it is to modify teaching practices. They are not sufficient to respond to current global demands. The lack of knowledge and didactic tools for handling content such as sexuality leads many teachers to choose to avoid the subject or approach it superficially. As it does not appear in their

professional training curriculum, they omit the issue even though the subject is indicated in elementary school programs when working with students.

In conclusion, we can say that at the primary level, teachers play a representative role with their students since, in some cases, they may be the only people from whom children learn about sexuality. Therefore, we think that proper sex education in elementary school would allow children to have accurate information to know more about their bodily functions and improve coexistence through respect for others' rights and through developing the skills, attitudes, and values to enjoy their sexuality.

References

Da Silva, D. (2012). La producción de lo normal y lo anormal: Un estudio sobre creencias de género y sexualidad entre docentes de escuelas municipales de Novo Hamburgo, Brasil [The production of normal and abnormal: A study on gender and sexuality beliefs among teachers of municipal schools in Novo Hamburgo, Brazil]. *Revista Subjetividad y Procesos Cognitivos, 16*(1), 178–199.

Denzin, N. (1979). *The research act in sociology.* Aldine.

Díez, A. (2016). Más sobre la interpretación (II). Ideas y creencias [More about interpretation (II). Ideas and beliefs]. *Revista de la Asociación Española de Neuropsiquiatría, 37*(131), 127–143. http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S0211-57352017000100008&lng=es&tlng=es

Fazio, C., Di Paola, B., & Battaglia, O. R. (2020). A study on science teaching efficacy beliefs during pre-service elementary training. *International Electronic Journal of Elementary Education, 13*(1), 89–105. https://www.iejee.com/index.php/IEJEE/article/view/1138

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research.* Adison-Wesley.

Gimeno, J. (2010). ¿Qué significa el currículum? (Adelanto) [What does the curriculum mean? (Advancement)]. *Sinéctica*, (34), 11–43. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1665-109X2010000100009&lng=es&tlng=es

Grupo Interistitucional para la Prevención del Embarazo en Adolescentes. (2018). *Estrategia nacional para la prevención del embarazo en adolescentes* [National strategy for the prevention of adolescent pregnancy]. (Executive report ENAPEA 2018). https://www.gob.mx/cms/uploads/attachment/file/417443/Informe_Ejecutivo_GIPEA_2018.pdf.

Hudelson, P. M. (1994). *Qualitative research for health programmes.* Division of mental health. World Health Organization.

Instituto Nacional de Estadística, Geografía e Informática. (2020). *Censo de población y vivienda 2020* [Population and Housing Census 2020]. http://cuentame.inegi.org.mx/poblacion/escolaridad.aspx?tema=B

Instituto Nacional de Estadística, Geografía e Informática. (2020/may/13th). *Estadísticas a propósito del día del maestro* [Press release]. https://www.inegi.org.mx/contenidos/saladeprensa/aproposito/2020/EAP_Maestro2020.pdf

Instituto Nacional de las Mujeres. (2018). *Estrategia nacional para la prevención del embarazo en adolescentes* [National strategy for the prevention of adolescent pregnancy]. https://www.gob.mx/cms/uploads/attachment/file/425939/Informe_Ejecutivo_GIPEA_2018.pdf

Iyer, P., & Aggleton, P. (2013). Sex education should be taught, fine... but we make sure they control themselves: teachers' beliefs and attitudes towards young people's sexual and reproductive health in a Ugandan secondary school. *Sex Education, 13*(1), 40–53.

Ketting, E., & Ivanova, O. (2018). *Sexuality education in Europe and Central Asia. State of the art and recent developments.* BZgA: Federal Center for Health Education. https://www.ippfen.org/sites/ippfen/files/2018-05/Comprehensive%20Country%20Report%20on%20CSE%20in%20Europe%20and%20Central%20Asia_0.pdf

Kvale, S. (2008). *Las entrevistas en investigación cualitativa* [Qualitative Research Interviews]. Morata.

Le Compte, M. D. & Goetz, J. P. (1982). Problems of reliability and validity of ethnographic research. *Review of Educational Research, 52*(1), 31–60.

Mar, P. (2009). El cuerpo como sí mismo [The body as itself]. En: N. Durán, & M. Jiménez (Eds.), *Cuerpo, sujeto e identidad* (pp. 139–167). Universidad Nacional Autónoma de México/Plaza y Valdés Editores.

Marseille, E., Mirzazadeh, A., Biggs, M. A., Miller, A. P., Horvath, H., Lightfoot, M., Kahn, J. G. (2018). Effectiveness of school-based teen pregnancy prevention programs in the USA: A systematic review and meta-analysis. *Prevention Science, 19*, 468–489.

Meneses, E. (1999). *Las enseñanzas de la historia de la educación en México* [The teachings of the history of education in Mexico]. Universidad Iberoamericana.

Mirzazadeh, A., Biggs, M. A., Viitanen, A., Horvath, H., Wang, L. Y., Dunville, R., Marseille, E. (2018). Do school-based programs prevent HIV and other sexually transmitted infections in adolescents? A systematic review and meta-analysis. *Prevention Science, 19*, 490–506.

Navarrete, Z. (2015). Formación de profesores en las escuelas normales de México [Teacher training in normal schools in Mexico]. Siglo XX. *Revista Historia de la Educación Latinoamericana, 17*(25). 17–34. https://doi.org/10.19053/01227238.3805

Organización para la Cooperación y el Desarrollo Económico. (2018). *La OCDE sostiene que es necesario redoblar los esfuerzos para mejorar la equidad en la educación* [The OECD states that it is necessary to redouble efforts to improve equity in education]. http://www.oecd.org/centrodemexico/medios/laocdesostieneequeesnecesarioredoblarlosesfuerzosparamejorarlaequidadenlaeducacion.htm

Ortega y Gasset, J. (2000). *Ideas y creencias y otros ensayos* [Ideas and beliefs and other essays]. Alianza Editorial.

Palencia, M., & González, R. (2015). Libros escolares y políticas públicas de género: Un estudio retrospectivo [School books and public gender policies: A retrospective study]. *Temas de educación, 21*(1), 31–46.

Preston, M. (2013). Very very risky: Sexuality education teachers' definition of sexuality and teaching and learning responsibilities. *American Journal of Sexuality Education, 8,* 18–35.

Ramírez, J. (2013). "Traer cortita a la mujer": Una creencia sobre las relaciones de género en jóvenes de Guadalajara [Keep an eye on the woman. A belief about gender relations in young people from Guadalajara]. *Relaciones. Estudios de historia y sociedad, 34*(133), 15–40. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0185-39292013000100002&lng=es&tlng=es

Ramírez, J., López, G., & Padilla, F. (2009). ¿Nuevas generaciones, nuevas creencias? Violencia de género y jóvenes [New generations, new beliefs? Gender violence and youth]. La ventana. *Revista de estudios de género, 3*(29), 110–145. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-94362009000100006&lng=es&tlng=es

Rangel, L. (2018). Producción de discursos sobre sexualidad en la escuela y heteronormatividad: El caso de un profesor de Biología [Production of discourses on sexuality at school and heteronormativity: The case of a Biology teacher]. *Revista de El Colegio de San Luis, 8*(15), 269–290.

Rosales, A., & Salinas, F. (2017). Educación sexual y género en primarias mexicanas ¿Qué dicen los libros de texto y el profesorado? [Sex education and gender in Mexican elementary schools What do the textbooks and teachers say?] *Revista Electrónica Educare, 21*(2), 1–21.

Sánchez, M., & Montoya, Y. (July/August 2019). Panorama del embarazo y mortalidad materna adolescente en México [Outlook of adolescent pregnancy and maternal mortality in Mexico]. *Boletín CONAMED, 25*(5), 53–64. http://www.conamed.gob.mx/gobmx/boletin/pdf/boletin25/numero_completo.pdf

Secretaría de Educación Pública. (2017). *Aprendizajes clave para la educación integral* [Key learnings for comprehensive education]. https://www.planyprogramasdestudio.sep.gob.mx/index-descargas.html

Wood, T. D. (2012). Teacher perceptions of gender-based differences among elementary school teachers. *International Electronic Journal of Elementary Education, 4*(2), 317–345. https://www.iejee.com/index.php/IEJEE/article/view/202

World Health Organization. (2006). *Defining sexual health: Report of a technical consultation on sexual health, 28–31 January 2002, Geneva.* https://www.who.int/reproductivehealth/publications/sexual_health/defining_sexual_health.pdf?ua=1

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 599-609

Sparkly Princess Shoes: A Case Study Examination of a Social Hierarchy Among Preschool Aged Girls

Jill M. Raisor[*,a], Ilfa Zhulamanova[b], Gina Berridge[c]

Received : 26 February 2021
Revised : 19 April 2021
Accepted : 7 June 2021
DOI : 10.26822/iejee.2021.215

[*,a] **Corresponding Author:** Jill M. Raisor.
Department of Teacher Education, Early Childhood
University of Southern Indiana, Evansville, USA.
E-mail: jmraisor@usi.edu
ORCID: http://orcid.org/0000-0003-3333-4237

[b]Ilfa Zhulamanova. Department of Teacher Education, Early Childhood, University of Southern Indiana, Evansville, USA.
E-mail: izhulamano@usi.edu
ORCID: http://orcid.org/0000-0002-3167-3289

[c]Gina Berridge. Department of Teacher Education
University of Southern Indiana, Evansville, USA.
E-mail: ggberridge@usi.edu
ORCID: http://orcid.org/0000-0003-2437-5942

Abstract

Young children are faced with the challenges of collaborating with others usually for the first time as they enter preschool. They must learn to think beyond their own needs and recognize the needs and wants of other children. Most educators soon realize that the naturally occurring interactions among the children tend to establish hierarchies. A qualitative case study completed over a span of five months examined a clique of five preschool aged girls who appeared to partially identify themselves by wearing what they titled, "sparkly princess shoes". Methods of data collection include interview and observation. Implications for practice and strategies for adults working with preschool aged children are provided.

Keywords:

Peer Relations, Hierarchies, Social Cliques, Socialization, Preschool

Introduction

Early childhood provides a time of critical growth in all developmental domains and it is well understood that play has an important role in both learning and development. Copple and Bredekamp (2009) reiterate the importance of the early learning years and the role of play by stating "the collaborative planning of roles and scenarios and the impulse control required to stay within the play's constraints develop children's self-regulation, symbolic thinking, memory, and language – capacities critical to later learning, social competence, and school success" (p. xiii). Clearly, the skills learned during early childhood provide a foundation for later competencies in many domains. Preschool is the first time that many children are exposed to large numbers of peers outside of their home (Fabes, Martin, & Hanish, 2009); thereby, creating an ideal time to observe the formation of social hierarchies and the dynamics of social interactions of young children. Peer groups can offer a unique opportunity for a young child to learn how to negotiate his or her space within the group while under the supervision of adults. Martin, Fabes, Hanish, and Hollenstein (2006) claim that the unstructured play-based activities often found in preschools offer a unique opportunity to

study children's social organization since preschool is often the first time that many young children have the opportunity to interact with same-aged peers on a daily basis.

In this study, children were observed in their natural setting and informally interviewed as situations occurred. The researcher sought to see how social hierarchies are displaced in early childhood classrooms and to what extent are the roles interchangeable or consistent. Also, important are the roles gender-oriented and how is power and/or authority established and maintained? The guiding research question was: How are social hierarchies displayed in early childhood classrooms? Additional research questions explored were: To what extent are the roles in the hierarchy interchangeable or consistent? In what ways, if at all, are the roles gender-oriented? And, how is power or authority established and maintained? The following manuscript details findings involving preschool aged girls which were part of a larger study (Raisor, 2010).

Theoretical Framework

Vygotsky's sociocultural theory emphasizes the importance of increased peer play interaction to enhance cognitive development. When children are involved in peer play the social environment influences cognition through its tools. Vygotsky (1978) believed children develop the tools (i.e. skills) and social rules which lead to cognitive advancement through a process referred to as internalization (Hartup, 2009). Vygotsky's emphasis was on the importance of shared experiences in the acquisition of mental processes, claiming that the social context is actually part of the developmental and learning processes (Bodrova & Leong, 2007). Bodrova and Leong (2007) agree on the important role that the social context plays in development, claiming that without the shared experience the child could not internalize or independently use higher mental processes.

Social hierarchies can be seen across species and cultures resulting in some individuals having more influence than their peers and better access to all kinds of resources including a mate (Fiske, 1991). As young children begin understanding the organization of their social world and develop in the context of peer relations, they use the information to navigate their social world in strategic ways (Thomsen, 2019). As social structures begin to form some of these peer relations lead to the formation of social hierarchies. "Children's social categories provide a window into the abstract theories they use to make sense of a highly complex social world" (Rhodes, 2012, p. 4). However, these social categories can also include stereotyping and prejudice attitudes in young children (Rutland, Killen, & Abrams, 2010). "Findings within developmental science show that children develop moral principles of fairness and equality from an early age, but they also develop implicit and explicit prejudice toward others from different social groups" (Rutland, Kellen, & Abrams, 2010, p. 288). In a seminal mixed methods study, Farver (1996) examined the relationship between preschoolers' aggressive behavior and their social groups and discovered that dominance hierarchies existed among children as young as four. The study found that preschool aged children tended to form reciprocated friendships with children that were similar to themselves in terms of aggression, behavioral style, and social competence. Farver suggested that toughness was often the determinant of social status among preschoolers and defined it as, "the ability to direct the behavior of others, leadership in play, and physical coercion" (p. 335). Farver suggested that teachers should be aware of existing dominance hierarchies in their classroom since lower status children tend to look at higher status children for leadership.

The development of social hierarchies among young children is emerging in educational research. Currently, there is demand for more research in understanding social cliques and a particularly pressing need for qualitative studies. There have been some interesting studies looking at the relationship of gender and group hierarchical behavior. There is a growing body of research that suggests that in terms of aggressive behaviors, males tend to be more physically aggressive and girls more relationally aggressive (Crick, Ostrov, Burr, Cullerton-Sen, Jansen-Yeh, and Ralston (2006); Ostrov and Keating (2004); Giles and Heyman (2005) and that children will be gender-specific when applying either (Giles and Heyman, 2005). In a 2009 longitudinal study, Murray-Close and Ostrov observed the forms (relational vs. physical) and functions of aggression (reactive or proactive) and found that the forms of aggression employed by young children are consistent, but the functions are situational.

Methodology

Due to limited language skills and concern over the validity and reliability of young children's responses, the qualitative method of observation is most commonly utilized (Ostrov & Crick, 2007). The research described in this study fills multiple gaps in the existing literature. First, it is a qualitative study where children were observed in their natural setting and informally interviewed as situations occurred. Qualitative research is critical because it allows observational and interview data to capture the actual interactions and conversations of the children while the incidents are occurring in the children's natural play setting. Qualitative research invites the children's perspective to be captured in an age appropriate manner. Second, the research questions investigated the form of social

structures, the frequency of social interactions, the relation of gender to the roles identified, and power among one set of preschool aged children.

The present case study (Stake, 1995) took place at an early childhood setting on the campus of a large research-intensive university. To maintain anonymity of the setting, the location is referred to as *The Center* and referenced with the generic citation **The Center.* It is located in a rural, Midwestern college town. This site was intentionally chosen because of its proximity to the university and openness to research. *The Center* provides developmentally appropriate child care for children ages six weeks through approximately five years of age (**The Center*).

The research was conducted in the preschool classroom, commonly referred to as pre-kindergarten or Pre-K. The pre-kindergarten classroom was selected because it is during the preschool years that increased peer interaction occurs (Power, 2000) and is usually the first time that young children are exposed to a large number of peers outside of the home (Fabes, R. A., Martin, C. L., & Hanish, L. D. (2009). They must learn to think beyond their individual needs and recognize the needs and wants of other children in cooperative play. Peer group interaction provides opportunities for young children to collaborate with others and learn imperative social skills such as cooperation and negotiation.

The children in this study could choose where to play as well as the peers with whom they chose to interact during long periods of play. This freedom contributed to the qualitative nature of the present study by encouraging choice and natural interactions among the children. *The Center* provided a desirable location for this research through its openness to research, physical arrangement, goals, philosophy, and child centered approach to early childhood education.

The participants in the present study included children ages 3½ half to 6 enrolled in the pre-kindergarten classroom at *The Center*. Parental consent was gained from the participant's guardians as well as assent from the children participants. At the beginning of the study, the morning session included 14 children with nine full time children and five children enrolled in half-time care, one of which is enrolled in half-time care on Tuesdays and Thursdays only. The afternoon session consisted of 13 children with nine children in full day care and four children in half-day care. Two new children joined the class in January and were asked to join the study as participants. The total number of children participants was 16; however, one child was not included in the reported data due to lack of attendance in the mornings. This child typically arrived just as first author was exiting *The Center.* Refer to Table 1 for demographic information on the children included in the study.

Table 1
Demographic Information on Children Participants

Pseudonym	*Age	Gender	Race and/or Ethnicity
Alisha	4.6	F	Caucasian
Angela	4.7	F	Caucasian
Anne	3.6	F	Caucasian
Andy	3.6	M	Caucasian
Austin	3.1	M	Caucasian
Jackson	4.6	M	African American
John	3.5	M	Asian/Caucasian
Julie	4.1	F	Chinese
Luke	4.1	M	Caucasian
Kian	5	M	Middle Eastern
Zavian	3.6	M	Middle Eastern
Sarah	4.1	F	Ethiopian
Stephanie	6	F	African American/Caucasian
Tracy	4.6	F	Caucasian
Brooke	3.9	F	Middle Eastern/ Caucasian
**N/A	4.10	F	Hispanic

The Center's core staff members only (i.e. Director, pre-kindergarten Master Teacher, and two Lead Teachers) were included as participants in the research. Assistants, student workers or student teachers were not included in this study or only identified by their role. Refer to Table 2 for demographic information on the core staff members. Some staff members change every eight to 16 weeks; therefore, only the staff that consistently worked with the children through the span of the study were selected for interview.

Table 2
Demographic Information on Core Staff Participants

Age	Gender	Race/Ethnicity
27	F	Caucasian
31	F	Caucasian
32	F	Caucasian
38	F	Caucasian

In order to protect the confidentiality of the participants, pseudonyms are used in all reported data. All core staff members are referred to as core staff for the purposes of this study. All student teachers are referred to as student teachers (ST) while all student workers and practicum students are referred to as student workers (SW).

Methods of data collection included interview with the children participants, observations, and interviews with the adult participants. Observational field notes were simultaneously collected and analyzed for emergent codes. After the observations had concluded, semi-structured

interviews were conducted with *The Center's* pre-kindergarten core staff members. The interviews were analyzed for contextual understanding, confirmation of the data, and additional adult perspectives of the children's social interactions.

Multiple methods of data collection were utilized including observations, and semi-structured interviews with the pre-kindergarten children and their teachers (Master and Lead) as well as the Director. As stated by Maxwell (2005), interviews and observations often complement each other's validity. "Interviews can provide additional information that was missed in observation, and can be used to check the accuracy of the observations....triangulation of observations and interviews can provide a more complete and accurate account than either could alone" (p. 94). In addition to field notes, the children were randomly assigned numbers (see Table 3) for use in the time samples.

Table 3
Assigned Pseudonym and Number

Pseudonym	Number
Jackson	1
Julie	2
Sarah	3
Andy	4
Anne	5
Stephanie	6
Tracy	7
Luke	8
John	9
Kian	10
Angela	11
*	12
Alisha	13
Brooke	14
Austin	15
Zavian	16

*Note: * Child who was a participant, but not included in the reported data due to lack of attendance.*

Observations

The time samples (refer to Figure 1) were calculated every 30 minutes. The numbers were used to identify where the children were located in the classroom and with whom, if anyone, they were interacting. The single numbers indicate that the child was engaged in solitary play. Two or more numbers together symbolize the group structure (i.e. dyadic, triadic, quad, or five or more children). The daily time samples (refer to Figure 1) were totaled each month to track the areas with the most social interaction as well as which children were playing together. Over the course of the study, 182 time samples were conducted. A spreadsheet of time samples totaling all five months of data was compiled to determine overall patterns in the children's choice(s) of play partners.

Figure 1
Time Sample

9:30AM	
Dramatic play area	4, 5
Dramatic play area on rug	13, 15
Block area	2, 7, 11 9, 10
Activity Table	16 (Mr. Potato Head) 14 (dog activity)
Library area	
Writing Center	
Art Center	
Sensory table	
Loft	
Outside	
Other:	1, 3, 6, 8 (walking around)

Due to the mobility of the children and *The Center's* open door policy, only the areas of interaction inside of the classroom were documented. Anytime the children were outside, they were noted with tally marks as outside and their individual interactions were not documented. In addition, the category of other refers to times when the child or children were casually walking around, engaged in project work outside of the classroom, using the restroom, or at an area not categorized for the study, such as on a walk

Interviews

Interviews are important methods of gaining an understanding of the interviewee's perspective. Not only are the interviewee's responses valuable, but also his or her body language, hesitations or pauses in responses, as well as tone and pacing all add value to data collection during an interview. Bodgan and Biklen (2007) claim "Good listening usually stimulates good talking" (p. 107). Interviews with the children were recorded through field notes and/or audio taping. All interviews, relevant to this study, with the children were transcribed. Quotes were captured and the children's actual language as much as possible in play scenarios and through the use of the audio recorder when allowed.

The interviews with the core staff members were conducted at the end of the observations for fear that the questions might change the interviewees' interactions in the classroom if they were to know in advance the preliminary findings. One Master and two Lead Teachers were interviewed as well as the Director of *The Center* the week immediately following the end of observational data collection.

Data analysis occurred in three distinct phases as outlined by Miles and Huberman (1994). The first phase of analysis consisted of uploading and then analyzing transcriptions from her field notes and interviews with the children to identify emergent codes into the computer software, Atlas.ti. The second phase included pattern coding which consisted of the codes being sorted into clusters and creating memos in an attempt to make sense of the data. During the third phase, contextual examples and quotable quotes were pulled from the transcriptions. The process of data analysis assisted in reducing the data to a manageable amount which then led to the emergent themes as well as answers to the research questions.

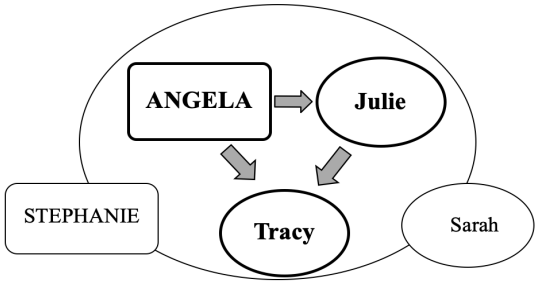
.

Results

The findings of this study identified one established social hierarchy within the preschool classroom. It consisted of three girls, all age four, reported using pseudonyms. The hierarchy is explained in Figure 2 and supporting documentation is detailed in the paragraphs below.

Figure 2

Small Scale Hierarchy



KEY:

▭	LEADER
◯	Member
Large Outer Circle	Enclosed Members
⇨	Relationship
↘	Secondary Relationship

Note. Based on data from the time samples, observations, interviews with the children and staff this illustrates a consensus of the established hierarchical formation displayed.

Established Hierarchy

Members: Julie, Tracy, and Angela. *ANGELA* and *Julie* displayed a strong dyadic relationship. *ANGELA*, *Julie*, and Tracy displayed the strongest triadic relationship observed. *ANGELA* was identified as being more directive, assertive, or a leader. All three of the girls shared in an exclusive friendship as illustrated by the large outer circle enclosing the members. *Stephanie (6)* is bi-racial, age 6, and was identified as a floater in and out of the hierarchy by the first author and three of the core staff members. Sarah (3) is Ethiopian, age 4.1, and is an occasional member in the hierarchy as identified by the first author and two of the core staff members. However, she also maintains relationships with children outside of the hierarchy.

Structure: Established Hierarchy

The strength of the triadic relationship between *Julie*, *Angela*, and *Tracy* was evident and the positioning of *Stephanie* and *Sarah* in the hierarchy was clearly displayed. In an example of a student worker attempting to their enter play, the power structure of the hierarchy was evident. The student worker joined the art center and started to join the girls in making cards, when Julie said, "You are not a card maker. You are supposed to ask *Angela*." The student worker then asked *Angela*, "Can I please make a Valentine card?" The student worker was granted temporary acceptance in the hierarchy based on the condition set forth by *Angela*, "Yes, only if you don't bother us." Another example came from the dramatic play area on the rug, when the children were playing babies. *Stephanie* was informally interviewed immediately after the play inquiring about her role. *Stephanie* stated, "I was the mom of Sarah." She was asked, "Who decided that?" *Stephanie* responded, "Them" as she pointed to the art center area. When probed for clarification, she responded, "Who is 'them'?" *Stephanie* replied, "Angela."

As evidence of occasional acceptance into the established hierarchy, when discussing the seating arrangement at lunch, *Julie* stated, "She [Stephanie] always wants to sit by me...But, I do not know why." When asked "Well, do you let her sit by you?" And *Julie* responded, "Well, sometimes." The floater status of *Stephanie* was described in the field notes as "I noticed that *Angela* and *Julie* were playing on the rug. Stephanie was going back and forth between the dramatic play area on the rug and the dramatic play area." In first author's opinion, *Stephanie* was clearly split between the groups of children playing in different areas of the classroom.

Sarah was identified by first author and two core staff members as a child who floats in and out of the established hierarchy as well. She would occasionally engage in play with the girls inside the hierarchy, but would also maintain her friendships outside of the hierarchy. This balance was evident in an excerpt from the children's play with farm animals.

Sarah: Mommy, mommy I am back. I met a new friend, goat.
Angela: Hello, little goat.
Sarah: Look.

Julie: I don't want to be the momma.
Angela: I don't think that goat is in our family, what do you think?
Sarah: Oh, you don't like this goat. (O.C. She pretended to cry and move).
Angela: I think you can live in our family, if you want to.
Sarah: I want to be in your house.
Julie: Alright then, you can be in my house.

This is a clear example of *Sarah* attempting to gain entry into the hierarchy's exclusive circle through the use of animals in play. She was able to successfully gain entry and continue play with the girls.

Sarah: Look at me, Julie and Angela!
Core Staff: Julie and Angela, Sarah would like you to look at her.
Angela: We are not playing that.
Angela: Julie, are you playing this with Sarah?
Sarah: I want to play. What can I be?

Although the roles within the small scale hierarchy remained at primarily equal status, often anyone attempting to enter, as an equal, would be redirected by *Angela*, *Julie* or *Tracy* to parallel play, assigned a role of lower status, or rejected from playing. Of interest, children outside of the established hierarchy identified the girls as being friends and often perceived *Julie* and *Angela* as their own friends.

Core Staff Perspectives

A core staff member lent support to the notion of *Stephanie* as a floater by stating that she, "kind of floats between the grouping of *Julie*, *Tracy*, and *Angela*. Kind of floats in between there and *Sarah* and *Brooke*." Another core staff member described "a couple of girls that like to group together" as "... *Julie*, sometimes *Stephanie*, *Angela*, and *Tracy*..." Articulating *Stephanie's* floater status, another core staff member said, "*Stephanie*, I think, kind of just goes in and out of groups as she feels like it."

Two of the core staff members suggested that when *Stephanie* enters the hierarchy of *Angela*, *Julie*, and *Tracy* that *Angela* tends to back away from the leadership role. One core staff member stated, "When it is just *Julie*, *Tracy*, *Angela* playing together, *Angela* tends to be more of the assertive one except when *Stephanie* enters and she kinds of backs off that." To further first author's understanding of this dynamic, another core staff member explained, "If *Stephanie* was in any group she would want to be the boss of everyone. She is dominant. She is the oldest child in that room."

One core staff member identified *Angela*, *Julie*, and *Sarah* as children who tended to play together. When asked for confirmation of the triad, "You think that these three [*Angela*, *Julie*, and *Sarah*] females..." and the core staff member interjected "tend to stick together...especially those [*Angela* and *Julie*] two." This provided support of *Sarah's* status as a floater in the hierarchy. A second core staff member mentioned that Julie, *Angela*, *Sarah*, and *Tracy* play together frequently. Another core staff member stated that *Sarah*, "kind of goes with the flow with lots of different groups. You will see her with the boys, *Jackson* and *Luke* in particular. You will see her with the girls [*Julie*, *Angela*, *Tracy*, and sometimes *Stephanie*] who do a lot of literacy activities as well."

Conclusions

Two themes emerged from the data. The first theme, The Power of Exclusiveness, was documented in the functioning of the small scale hierarchy. Manners in which the members established their exclusive sisterhood are described. The second theme, The Power of Exclusion, was observed as the small scale hierarchy evolved into an established hierarchy and is detailed in the following paragraphs.

The Power of Exclusiveness

Each member within the small scale hierarchy of *Julie*, *Angela*, and *Tracy* had a unique way of establishing and maintaining power. Within the clique, each girl was held in primarily equal status whether it was through a primary or secondary relationship. Further, the girls continuously expressed concern about being fair with each other. An example of their concern over fairness was documented as the girls were engaged in cooperative play in the block area. The cohesiveness of the girls was dependent upon them being equal and fair with one another. So, when *Angela* chose a deer, in the excerpt below, it disrupted the notion of equality. *Julie* reacted by reinstating the concept of fairness by removing the deer figure and *Angela* did not display a reaction because she was aware of the *rules* to their group play. The following excerpt provides evidence of their concern for equality.

Angela: Okay, you guys are really not playing with me.
Julie: You have to come down here and play with us.
Tracy: I am the mom which one do you want to be?
(O.C. *Angela* chooses a deer figure.)
Julie: We all have one that is not fair.
(O.C. Julie grabs one of the deer out of *Angela's* hand and tosses it back into the pile of animal figures. *Angela* did not say or do anything).

Another example of the children's concern over fairness came when a student worker made two Valentine cards while at the art center. The student worker asked "Who wants one in their cubbie?" *Tracy* held up her hand and responded "I do!" *Angela* said, "Me! Me! Hey, *Julie* needs one too." The girls took each other's feelings into consideration and found ways to remain fair to each other.

Displays of Sisterhood

Each girl had a unique way of establishing power within the small scale hierarchy, but this did not necessarily result in authority over another member. Refer to Figure 2 to see an illustration of their small scale hierarchical relationship. For example, one might tend to play the mother role thereby establishing her own form of power, but also displaying a bond of sisterhood by engaging in roles that were consistently equal in status such as sisters, twins, or babies. Field notes provide multiple accounts of this. For example, *Julie* was documented as saying "Me and *Angela* are twins! We are the same person." This notion of sameness is consistent with Vygotsky's (1978) idea of how children make a concerted effort to display their relationship while in play. Vygotsky recalled two sisters playing imaginary sisters. *Suddenly*, the children are conscious of the emphasis of everything being the same to visibly display their relationship of sisterhood. They might dress alike, talk alike, or wear the same clothing to outwardly display their sisterhood. The actions of being sisters might be witnessed in everyday life, but the children bring the unspoken rules of sisterhood to life in their play. *Julie* and *Angela* made their bond of sisterhood very clear through their actions, words, and play behaviors.

Figure 3
Photo of Princess Sparkly Shoes

Princess Sparkly Shoes. Another manner in which the small scale hierarchy of girls displayed the exclusiveness of their sisterhood was evident by the members of the hierarchy wearing what they referred to as *princess sparkly shoes.* Three of the girls within the small scale hierarchy were able to identify the children in the class, *Julie*, *Angela*, *Tracy*, and *Sarah*, as the children who wear the shoes. The girls were also able to recall that *Julie* was the first one to get the shoes.

The shoes and what it meant to have a pair sparked particular interest, so *Julie* and *Angela* were asked what would happen if someone else in the classroom were to purchase a pair. The following conversation is documentation of *Julie* and *Angela's* responses.

First author: Does anybody else in this classroom have them?
Julie: No.
First author: What would you do if one of the other girls got them? Would that be okay or not okay?
(O.C. *Angela* and *Julie* both instantly shook their heads no without consulting each other first.)
Julie: Not okay.
First author: Why?
Julie: Because we just want our friends and *Stephanie* is not our friend.

This documentation provides evidence that, at least to the girls, the shoes exhibited a sense of cohesiveness among the members whom they refer to as friends. A core staff member was asked if she had ever heard the girls discussing the shoes. She commented that she had heard, "'I have the pink shoes you don't' or 'we all have the pink glittery princess shoes.'" Further she commented, "It has not gotten to the point where it has been upsetting for other children." However, the shoes were a clear indication of the exclusiveness of the girls, at least within the hierarchy. It is speculated that the girls had the shoes because they liked them and wanted to be similar to each other; however, they did not make a big deal of the shoes, maybe in order to keep it a sort of secret bond among them.

According to previous documentation from interviews with the core staff, *Stephanie* tended to float in and out of the established hierarchy. While in the hierarchy, she often tried to dominate the other children which tended to cause conflict. When *Stephanie* was asked about the shoes, she responded:

First author: Stephanie, do you know those pink shoes that some of the girls wear, they are pink and they are glittery? Do you know what I am talking about?
Stephanie: I don't know what you are talking about.
First author: You don't know which ones.
Stephanie: Which ones?
First author: Well, they are pink, slip on, and glittery.
Stephanie: Oh, they are *Julie's*.

*First author:*Does anyone else have them?
Stephanie: *Angela*.
*First author:*Anyone else?
(O.C. No response.)
*First author:*Do you have a pair?
Stephanie: Yeah. But I didn't want to wear them.
*First author:*Oh, do you ever wear them to school?
Stephanie: No.
*First author:*Why not?
Stephanie: Because they are too glittery. So everybody will see them.

Although *Stephanie* claimed not wear the princess sparkly shoes to school because "everybody will see them," two possible scenarios are suspected. The first is that *Stephanie* might not really own the shoes and is claiming she does in an attempt to be similar to the other girls. The second possibility is that by wearing the shoes it would associate *Stephanie* with a hierarchy of which she is not a full member. Therefore, she claims to be the same as the other girls, yet does not feel the need to outwardly display her sameness.

The Power of Exclusiveness was a powerful bond within the small scale hierarchy of girls. The cohesiveness among the girls also led to the second emergent theme, The Power of Exclusion, as a function of the established hierarchy and is detailed in the following paragraphs.

The Power of Exclusion

The triadic clique of girls, identified as a small scale hierarchy, was very exclusive in playing together and displayed great concern over being equal to one another; however, the notion of sameness as fairness was only applied to children within their clique. Vygotsky (1978) states while role playing sisters,

> *...'My sister and I act the same, we are treated the same, but others are treated differently.' ...the emphasis is on the sameness of everything that is connected with the child's concept of a sister; as a result of playing, the child comes to understand that sisters possess a different relationship to each other than to other people (p. 95).*

When a child from outside the hierarchy, attempted to enter the girls' play, they were reminded of the unspoken rules of sisterhood. This was typically displayed as relational aggression. Field notes documented one such account when "*Sarah* attempted to enter their [*Julie* and *Angela's*] play by getting on her knees [O.C. showing that she was willing to accept the role of a baby]. *Angela* said, 'Here is the baby.' *Julie* said, 'No, we are not playing that' and proceeded to leave the area. *Angela* followed." This example is consistent with the research of Ostrov and Keating (2004) suggesting that girls are more concerned with relationships; therefore, implementing relational aggression tactics to establish social acceptance or status diffusion is prominent.

Another example was documented when *Anne* tried to initiate play with the girls and *Angela* ignored her. Then, *Julie* arrived and *Angela* immediately left the area to greet *Julie*. She returned to her work and held one of the animals in the air saying "*Julie*, *Julie*." *Julie* came to the block area and the two started playing while *Anne* was then engaged in parallel play.

Anne: Guys, here is another sister.
Julie: We don't need one. That is no fair.
Anne: But I don't need some.
Julie: We need one more for *Angela*. No, I mean we don't need one. We are bigger.
(O.C. *Anne* returned to parallel play. *Angela* and *Julie* continued to play together with two animals (cows) on the blocks).
Julie: Can you [*Angela*] have the mom and I have the sister?
Angela: Yeah. That is fair isn't it?
Julie: Yeah. Really fair.
Angela: Hey, we are not playing with you.
(O.C. *Angela* looks at me after she says this, but I ignore her and contin ue to take notes).
Anne: But I am playing.
Angela: Play horses.
(O.C. *Angela* and *Julie* return to their play excluding *Anne*).

Of interest in the above documentation, is the fact that *Julie* and *Angela* were so concerned with being fair to each other yet lacked the ability to take into consideration *Anne's* feelings of being excluded. This confirms their sense of exclusiveness within their hierarchy while exemplifying the use of relational aggression to maintain their cohesiveness.

Another excerpt from the field notes, documents a clear example of how *Julie* and *Angela's* desire for sameness often overruled their ability to perceive fairness through the eyes of the other child. In this scenario, the children were playing in the dramatic play area and there was a vase of artificial Gerbera daisies on the kitchen table. There were three flowers in the vase, one of which had a broken stem yet appeared whole. *Angela* and *Julie* tried to grab the flowers off the table, but *Alisha* noticed. So, she grabbed a flower. Each girl had one flower; however, *Angela* had picked the broken one. Interestingly, *Julie*

threatened to leave the area if the play did not go as she and *Angela* wished.

Angela: We only want one, please.
Alisha: No, you can share that.
Angela: Julie needs one.
Julie: Or we won't play here anymore.
Angela: Let me have it. This one is perfect. (O.C. Angela had the broken flower and wanted the second flower that was not broken. This would have left Alisha with the broken flower).
Alisha: No. We can all have one that is fair.

Alisha did not want to be left with the broken flower, so she used assertive words and stood up for herself. She realized that everyone had one flower each which really was fair. However, through the eyes of *Julie* and *Angela* this was most likely not perceived as fair because they did not have the same flower. This example demonstrates both emergent themes, The Power of Exclusiveness through the eyes of the children in the hierarchy and The Power of Exclusion through the eyes of the child outside of their hierarchy.

Discussion

Early childhood provides an optimal time for young children to learn and practice social skills while in peer groups. It is imperative that adults support and encourage young children's social interactions with positive guidance. Children with a mentor, such as a teacher or coach, who support efforts through encouragement and belief, were identified as having higher resilience than those without mentors (Walsh, 2003 as cited in Keown, S., Carroll, R. and Raisor, J. M., 2020). Adults should be aware of the social dynamics in the classroom and be knowledgeable of positive guidance strategies which assist young children in negotiating and problem solving in peer groups. In the described study, the core staff members were aware of the existing social dynamics within the classroom, but not the complexity of the interactions; therefore, unable to fully assist the children in practicing negotiation skills. Rarely do staff members have the opportunity to step out of the teaching role and to observe the children's interactions. Active listening to the children's natural interactions during times when the children have a choice in what they are doing and with whom they are interacting is imperative to understanding the social dynamics within a classroom. Focus on the times when a child identified as a "leader" is absent. What happens to the social structure? Do other children step up to fulfil the role or does it remain vacant? Since not all the children in a classroom want to be leaders or are leaders of social groups, focus on their roles. Are they assigned or chosen? Is the child accepting of the role and fulfills it willing? If not, assist the child in learning how to approach the situation and negotiate a different space within the social structure. Future studies should focus on exploring these suggestions further. Additionally, this study should be replicated in a setting where the children do have a shared history. The skills learned in early childhood are truly the foundation for later competencies and interpersonal successes and most deserving of our time and attention.

Implications for Practice

This study authenticates the importance of teacher/staff interactions with children in peer groups. Teachers should be aware of the social dynamics occurring in his/her classroom as this becomes a rich context for teachers to learn about individual children's social skills, temperament, interests and the like. Gallagher et al. (2007) state teachers should be "aware of a variety of social factors including classroom peer groups, children's placement in the social structure, social dominance hierarchies, identification of children in key social roles..." (p. 35-36). In the present study, for example, one of the core staff members expressed concern over a group of girls in the classroom who always seemed to be together. She stated, "...there tends to be some cliques, some groups, especially with some of the girls and I was really trying hard not to break them up, but kind of get them to join other groups and work there..." Gallagher et al. (2007) emphasize the importance of a teacher being aware of social dynamics within his/her classroom in order to provide a safe environment for all children, while also allowing children the space to construct their own social rules in order to advance cognitive abilities and social skills.

Staff members must be tuned into the children's cliques in order to observe aggression that might occur. The staff should be knowledgeable of physical as well as relational aggression and how to appropriately address such situations. For this reason, areas of high social interaction, such as the dramatic play area and the block area, should have increased adult supervision. In addition, considering the limited verbal capabilities of young children, the staff should model appropriate language such as the use of assertive words for the children. Teacher training programs, therefore, should emphasize development of teachers' capacity to "read" children's play (Zhulamanova & Raisor, 2020).

The manner in which the staff was able to assist the children in directing the play of others as well as negotiating roles was highlighted throughout this study. This is a true exemplar of balance in the adult's skill to be able to intervene when necessary yet not dominate the children's play. The staff can serve as

an *invisible hand* (Cairns & Cairns, 1994; Farmer 2000 as cited in Gallagher et al., 2007) to scaffold and guide children's interactions (Gallagher et al., 2007). Gallagher et al. (2007) says, "Teachers can scaffold and guide children in new interactions and relationships in ways that unobtrusively foster productive relationships and social roles" (p. 18). The staff in the present study encouraged and modeled prosocial strategies such as problem solving, negotiation, and I-messages with the children and in doing so emphasized the importance of making individual choices and the children becoming more assertive with individual needs and wants. The staff should be aware of what the children are doing and be prepared with positive guidance strategies to implement when needed. With the guidance of an adult, children must learn how to take ownership of their actions by working through problems with their peers while in a safe classroom.

References

Bodrova, E. & Leong, D. J. (2007). *Tools of the mind: The Vygotskian approach to early childhood education.* Pearson Merrill Prentice Hall.

Bogdan, R. C. & Biklen, S. (2007). *Qualitative research for education: An introduction to theories and methods* (5th ed.). Boston, MA: Allyn and Bacon.

Cairns, R. B., & Cairns, B. D. (1994). *Lifelines and risks: Pathways of youth in our time.* Press Syndicate of the University of Cambridge.

Copple, C. & Bredekamp, S. (Eds.). (2009). *Developmentally appropriate practice in early childhood programs* (3rd ed.). National Association for the Education of Young Children.

Crick, N. R., Ostrov J. M., Burr, J. E., Cullerton-Sen, C., Jansen-Yeh, E., & Ralston, P. (2006). A longitudinal study of relational and physical aggression in preschool. *Applied Developmental Psychology, 27*, 254-268.

Fabes, R. A., Martin, C. L., & Hanish, L. D. (2009). Children's behaviors and interactions with peers. In K. H. Rubin, W. M. Bukowski, & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups* (pp. 45-62). The Guilford Press.

Farver, J. A. M. (1996). Aggressive behavior in preschoolers' social networks: Do birds of a feather flock together? *Early Childhood Research Quarterly, 11*, 333-350.

Fiske, S. T., & Taylor, S. E. (1991). *McGraw-Hill series in social psychology. Social cognition (2nd ed.).* Mcgraw-Hill Book Company.

Gallagher, K. C., Dadisman, K., Farmer, T. W., Huss, L., & Hutchins, B. C. (2007). Social dynamics of early childhood classrooms: Considerations and implications for teachers. In O. N. Saracho & B. Spodek (Eds.), *Contemporary perspectives in early childhood education* (pp.17-48). Information Age.

Giles, J. W. & Heyman, G. D. (2005). Young children's beliefs about the relationship between gender and aggressive behavior. *Child Development, 76*(5), 107-121.

Hartup, W. W. (2009). Critical issues and theoretical viewpoints. In K. H. Rubin, W. M. Bukowski, & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups* (pp. 3-19). The Guilford Press.

Keown, S., Carroll, R. and Raisor, J. M. (2020). Creating a community of caring within the school. *International Electronic Journal of Elementary Education 12*(4) 401-404.

Martin, C. L., Fabes, R. A., Hanish, L. D., & Hollenstein, T. (2006). Social dynamics in the preschool. *Developmental Review, 25,* 299-327.

Maxwell, J. A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Sage Publications.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook.* (2nd ed). Thousand Oaks, CA: Sage.

Murray-Close, D. & Ostrov, J. M. (2009). A longitudinal study of forms and functions of aggressive behavior in early childhood. *Child Development, 80*(3), 828-842.

Ostrov, J. M., & Crick, N. R. (2007). Forms and functions of aggression during early childhood: A short-term longitudinal study. *School Psychology Review, 36*(1), 22-43.

Ostrov, J. M., & Keating, C. F. (2004). Gender differences in preschool aggression during free play and structured interactions: An observational study. *Social Development, 13,* 255-277.

Power, T. G. (2000). *Play and exploration in children and animals.* Lawrence Erlbaum Associates.

Raisor, J. (2010). *A qualitative examination of social hierarchies among young children* [Doctoral thesis].

Rhodes, M. (2012). Two Intuitive Theories Shape the Development of Social Categorization. *Child Development Perspectives,* The Society for Research in Child Development DOI: 10.1111/cdep.12007.

Rutland, A., Killen, M., & Abrams, D. (2010). A new social-cognitive development perspective on prejudice: The interplay between morality and group identity. *Perspectives on Psychological Sciences, 5*, 279-291.

Stake, R. E. (1995). *The art of case study research. Thousand Oaks, CA: Sage. *The Center.* Retrieved July 12, 2009, from [removed to maintain confidentiality].

Thomsen, L. (2019). The developmental origins of social hierarchy: how infants and young children mentally represent and respond to power and status. *Current Opinion in Psychology, 33,* 1-8.

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

Walsh, F. (2003). Family resilience: A framework for clinical practice. *Family Process, 42*, 1-18. Wong, B. Y. L., (2003).

Zhulamanova, I. & Raisor, J. (2020). Early Childhood preservice teachers' perceptions on children's play. *International Online Journal of Primary Education, 9* (2).

This page is intentionally left blank.

www.iejee.com

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 611-624

Semiotic Representations in The Learning of Rational Numbers by 2nd Grade Portuguese Students

Floriano Viseu[*,a], Ana Luísa Pires[b], Luís Menezes[c], Ana Maria Costa[d]

Received : 5 February 2021
Revised : 29 May 2021
Accepted : 7 June 2021
DOI : 10.26822/iejee.2021.216

[*,a] **Corresponding Author:** Floriano Viseu, Department of Integrated Studies on Literacy, Didactics and Supervision, University of Minho, Braga, Portugal.
E-mail: fviseu@ie.uminho.pt
ORCID: https://orcid.org/0000-0002-8221-6870

[b]Ana Luisa Pires, University of Minho, Braga, Portugal.
E-mail: luisapires15@hotmail.com
ORCID: https://orcid.org/0000-0002-2472-2628

[c]Luís Menezes, Higher School of Education. Polytechnic of Viseu, Viseu, Portugal.
E-mail: menezes@esev.ipv.pt
ORCID: https://orcid.org/0000-0002-8978-8900

[d]Ana Maria Costa, Higher School of Education. Polytechnic of Viseu, Viseu, Portugal.
E-mail: anacostalopes@esev.ipv.pt
ORCID: https://orcid.org/0000-0002-8373-4223

Abstract

The use of different registers to represent mathematical concepts enhances understanding. For example, rational numbers can assume pictorial, symbolic and natural language representations and this kind of change improves learning. Based on these assumptions, a teaching experiment for the learning of rational numbers by 2nd grade students was conducted, so as to allow for an understanding of how semiotic representations contribute to the learning of rational numbers, particularly with concern to unit fractions. Using a qualitative methodology and a content analysis of the students' written productions, the study shows a greater use of the pictorial representation register compared to the other types. Students' main difficulties in learning rational numbers are related to the pictorial representation of unit fractions and to an understanding of the concept of fraction itself. Some of these difficulties result from errors such as the misrepresentation of unit fractions in the case of the pictorial register, the association of the concept "half" with multiple unit fractions, the absence of the fraction bar when it comes to the symbolic register, the use of everyday terms to represent fractions when students rely on the natural language register, and the misrepresentation of rational numbers when the graphic register is used.

Keywords:

Registers of Semiotic Representation; Mathematics; Learning Rational Numbers; Unit Fraction; Primary School.

Introduction

Mathematics is a human activity and one of the oldest sciences, occupying an important place in the school curriculum. This school subject is quite different from most other subjects that students have to learn in school because its object of study is of an abstract nature (Davis & Hersh, 2020; Ponte et al., 2007). Mathematics is also seen as a language that allows students to develop an understanding and representation of daily life and "a tool that provides ways to solve problems" (Ponte et al., 2007, p. 2). Given the nature of mathematical elements, being unique with regard to teaching and learning, it implies using good and multiple representations of mathematical ideas (Duval,

1995, 2003; Ponte et al., 2007; Ponte & Quaresma, 2012). Such a claim, which is widely accepted, is shown to be even more relevant for learning in the early years of schooling, since children's thinking, at this age, relies on the manipulation of concrete ideas (Canavarro & Pinto, 2012). An example of this is the teaching of rational numbers in the Portuguese early Primary school grades (1 to 4), which represents a great challenge for teachers, especially since the last curriculum changes determine that the learning of fractions, among other topics, should start earlier, in the earlier grades (Ministério da Educação e Ciência [MEC], 2013).

Lamon (2007) considers that fractions are, among all the topics that make up the curriculum and require more time for development and acquisition/ learning, the most difficult to teach, the most complex (mathematically speaking), but also the most challenging and essential for the learning process. This complexity is also highlighted by some other authors (Fernandes, 2013; Kieren, 1992; Silva et al., 2014). In an attempt to provide an explanation for this complexity, Silva et al. (2014) point out that rational numbers are "difficult for students to understand because of the multiplicity of representation registers and associated meanings" (p. 1487).

Written representations "of mathematical ideas are an essential part of mathematical learning and production" (National Council of Teachers of Mathematics [NCTM], 2007, p. 75). Students can use and connect the different representations of a given mathematical concept to externalise their thoughts. According to NCTM (2007), it is important to challenge students to represent their mathematical ideas in ways that really mean something to them, even if those representations are somewhat unconventional at first. By using instructional strategies that encourage associations between different types of representations, students develop their understanding of concepts, think and communicate with others using mathematical language (Duval, 1995, 2003, 2017; Guerreiro et al., 2015).

The theory of semiotic representations (Duval, 1993, 1995, 2003, 2017) includes different types of representations that facilitate student learning and allow them to choose how to represent their ideas. These representations give students the opportunity to record, reflect, and store the learnings they will need in the future (Woleck, 2001). The distinction between the different representations and mathematical objects becomes fundamental, but this distinction is also one of the main difficulties the learning process involves (Duval, 2017). Considering these difficulties, the teacher must adapt the tasks and materials (s)he proposes (Guerreiro et al., 2015).

The complexity of learning rational numbers at such an early age and the role that semiotic representations play in learning them is widely recognised, so in this study we intend to understand how semiotic representations are used to learn rational numbers, more specifically fractions, in a 2nd grade class of Portuguese students. To achieve this goal, we set the following research questions: Which semiotic representational registers do students use most when learning non-negative rational numbers? What difficulties do students perceive and what mistakes do they make when learning rational numbers? By answering these questions, we hope to contribute to the knowledge of semiotic representations in the topic of fractions by students in the early years of schooling.

Semiotic Representations

Representations play a fundamental role in the learning of mathematics and are essential for an understanding of mathematical concepts (Duval, 1995; NCTM, 2007). This additional importance of representations in Mathematics, from Duval's perspective (1995) occurs because "mathematical objects are not directly accessible to immediate perception or immediate intuitive experience like the so-called "real" or "physical" objects. Representative forms of meaning are therefore necessary (p. 268)".

Representations allow students to think mathematically, to express their ideas, and at the same time they are instruments that students use to communicate those thoughts to others (Duval, 1995; NCTM, 2007). Woleck (2001) points out that "representations are not static products. On the contrary, they allow us to capture the process of building a mathematical concept or mathematical relationships" (p. 215). Noting down and reflecting on representations tends to promote the recovery of the thought processes that students use in the activities they carry out, allowing them to "articulate, clarify, justify and communicate their reasoning to others" (Woleck, 2001, p. 215).

Goldin and Stheingol (2001) consider two distinct groups of representations: external and internal representations. According to these authors, an external representation may include a representational system of mathematical symbols, such as the base-ten number system or the formal algebraic notation, but also a representational system involving concrete manipulable materials. Internal representations "include constructs of personal symbolisation that are used to assign a given meaning to mathematical notations, the students' natural language, their visual images and, more importantly, their relationship to mathematics" (Goldin & Stheingol, 2001, p. 2).

Duval (1995) suggests four different groups of representations: external, internal, conscious, and non-conscious. From this author's perspective, external representations are "closely linked to a state of development and control of a semiotic system" (p. 25), and are produced to translate ideas or concepts, through tables, diagrams, graphs, models, and symbols. For Dreyfus (2002), these representations, written or spoken, are essential to make mathematical communication possible between people. Duval (1995) suggests that conscious representations are "those that have an intentional character and fulfil an objectivation purpose" (p. 24). For the author, objectivation corresponds to the subject's own discovery of what (s)he had not suspected until then, even if (s) he had already had access to such information." (p. 24). Semiotic representations are external and conscious, and "allow for a 'vision of the object' upon perception of different types of stimuli (points, lines, characters, sounds...) conducive to different sorts of significance" (Duval, 1995, p. 27). Figures, schematics, graphs, and symbolic expressions are examples of semiotic representations that can be used in mathematics.

The theory of registers of semiotic representation (TRSR) was developed by Duval in an attempt to understand how knowledge is acquired in mathematics through the specificities of representations. Semiotics is the study of signs that carry meaning and significance that can be identified by human beings. According to Duval (1995), "the notion of semiotic representation entails (...) the consideration of different semiotic systems and a cognitive operation that will be capable of converting representations from one semiotic system into another" (p. 17). According to this theory, mathematical objects can be displayed through semiotic representations, which are defined as "productions consisting of the use of signs that belong to a given system of representations, which has its own restrictions of meaning and operation" (Duval, 1993, p. 39). It follows that a semiotic system represents a chance to manifest and interpret signs, each one carrying its own meaning.

In mathematics, there is a wide variety of semiotic representation registers. Duval (2003) suggests the existence of four types: natural language, algebraic and numerical writing systems, geometric figures, and graphs. In mathematical activity, the same object can be represented through different registers of semiotic representation, which means that the object is different from its representation. Each representation provides different information about the object represented, hence the importance of using different representation registers. The diversity of registers is important in that it becomes "a necessary condition to prevent mathematical objects from being mistaken for their representations and to ensure that each one is recognizable" (Duval, 1993, p. 40). According to this author, a semiotic system can be a register of semiotic representation if it allows for the three fundamental cognitive activities linked to semiosis: the creation of an identifiable representation; treatment; and conversion. The treatment of a representation consists of a transformation carried out in the same register (Duval, 1995). The conversion of a representation is the transformation of a representation into a representation of another register, retaining all or part of the content of the initial representation. Unlike treatment, it mobilises different registers of representation and presents an external transformation of the source register. This activity "is a complex transformation, much more complex than the operation of treatment, because any change in register requires the recognition of the object shown in the two representations whose content is often very different" (Duval, 1995, p. 112). If students are unable to anticipate a conversion to be made, or to recognise an object in two distinct representations, it will be very hard for them to solve a given task suggested by the teacher.

Semiotic Representations Of Rational Numbers

Representations are the basis of mathematics, unlike other areas of knowledge where it is possible to observe facts without representing them (Canavarro & Pinto, 2012; Duval, 2017; Ponte et al., 2007). For example, representing a number allows "assigning a designation to that given number and students have to understand that a number can have several designations" (Ponte & Quaresma, 2012, p. 40). These designations are assigned through the different possible representations of the same number. In the case of rational numbers, they can be represented by a fraction, decimal number, percentage, diagram, among others, that must be considered in the classroom (Morais et al., 2014). A decimal number results from the fraction $\frac{a}{10^n}$, where a is an integer and n is a natural number.

If we follow the Portuguese curriculum for mathematics in Primary Education and assume that a and n are natural numbers, we obtain a set of positive decimal numbers (MEC, 2013). When students fully understand the different representations of rational numbers, they are able to develop their thinking skills (Canavarro & Pinto, 2012; Ponte & Quaresma, 2012), which reflects itself in the way they are able to "communicate their reasoning to others" (NCTM, 2007, p. 240).

Mathematics learning depends on several factors (e.g., cognitive, social, cultural, and contextual) and on the different actors involved in the educational process, among which the role of the teacher is

to be emphasized. Currently, recommendations for mathematics education indicate that students should be able to master the use of the different representations of rational numbers and not just memorize concepts (Barnett-Clarke et al., 2010; Canavarro & Pinto, 2012; Hodges et al., 2008; Kara & Incikabi, 2018; Özsoy, 2018; Scaptura et al., 2007). In order to enable familiarization with rational numbers, we need to represent them. Rational numbers can presume a symbolic representation, e.g., 2/5, a decimal representation, 0.4, or a percentage figure, 40%, or other kinds of possible registers of representations, such as an expression in natural language or a pictorial (also called iconic) representation (Canavarro & Pinto, 2012; Brandl et al., 2016; Özsoy, 2018).

Contact with fraction representation is very common and can lead to misunderstanding in the context of learning rational numbers, as students may believe that they are rational numbers and not a mere form of representation. Fractions are the first register of representation of rational numbers that students come into contact with and therefore can be defined as "two-sided symbols, a particular way of writing numbers: a/b. This particular meaning of the word fraction refers to a notational system, a symbol, two integers separated by a bar" (Lamon, 2007, p. 635). This is how the concept of fraction is understood, and there is evidence that it is not always properly explained to students and that they only remember the way fractions are written and not what they really stand for. In order to understand rational numbers, students need to understand that "all rational numbers can be written in the form of fractions; that there are numbers written in the form of fractions that are not rational numbers, like $\pi/2$ for instance; and that each fraction does not correspond to a different rational number, like 2/3, 6/9, for example" (Lamon, 2007, p. 635).

Students who are able to use different representations of rational numbers have mastered the concept of rational numbers and are aware that they are much more than just a simple way of representing rational numbers (Kara & Incikabi, 2018). Therefore, the teacher should encourage students to use rational number representations flexibly to promote the acquisition and development of knowledge (Lemonidis & Pilianidis, 2020).

Rational Numbers In Mathematics Curricula

In mathematics curricula, the development of the concept of number, its meaning and its operations and properties in a given number field is considered a central learning objective (MEC, 2013; Ponte et al., 2007). From preschool to the final term of high school, students develop their knowledge of numbers, namely their concept of numbers and how they are "represented by objects, digits, or straight lines; how they relate to each other; how they are (...) in systems with certain structures and properties; and how they should be used to solve problems" (NCTM, 2007, p. 34). In the first years of school, students learn about different types of numbers and become capable of distinguishing, for example, which numbers are even, odd, prime, connected or fractions (Brocardo & Carrillo, 2019; Canavarro & Pinto, 2012; Guerreiro et al., 2018).

In Portugal, the first numbers that students learn about in 1st grade are the natural numbers, as part of subtopics such as "correspondences one to one and comparison between the number of elements of two sets; counting up to twenty objects; the empty set and the number zero; counting natural numbers up to 100, and, counting on and back" (MEC, 2013, p. 7). Natural numbers, while addressed in preschool education through informal operations, require more systematic work to give meaning to these numbers so that students can competently solve computations and problems involving computations, for example.

In 2nd grade, the concept of numbers broadens with the introduction of non-negative rational numbers, among other new concepts, with subtopics like "fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{10}, \frac{1}{100}$ and $\frac{1}{1000}$ as measures of lengths and other quantities; and, representation of natural numbers and fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ and $\frac{1}{5}$ on a number line" (MEC, 2013, p. 9).

To introduce non-negative rational numbers, the current recommendations for the teaching of mathematics suggest that it should be done using everyday situations and common fractions that students use in their natural language (Guerreiro et al., 2018; Hunt et al., 2016). In 2nd grade, students should be able to understand when it is possible to divide a unit into equal parts, and this approach is more important than focusing on how fractions are represented (NCTM, 2007).

Students should also be able to identify parts of a unit divided into equal parts, such as three quarters of a sheet of paper folded into four equal parts and understand that 'quarters' means four equal parts of a unit (NCTM, 2007). The integer division is also introduced in 2nd grade so that students can understand that fractions are associated with division and associate the terms 'half', 'third part', 'fourth part' and 'fifth part' with the respective fractions (MEC, 2013).

In 3rd grade, the set of non-negative rational numbers includes three additional contents: non-negative rational numbers; adding and subtracting non-negative rational numbers represented by fractions; and decimal representation of non-negative rational numbers. The teaching of negative rational numbers includes the representation of several

fractions as a measure of length and other quantities, the representation of fractions on a number line, equivalent fractions, comparing and ordering fractions with the same numerator or the same denominator, among other subtopics, broadening the knowledge students had acquired in the previous year (MEC, 2013). Gradually, the concepts related to rational numbers interact with their procedural components as we introduce mathematical operations with non-negative rational numbers, namely addition and subtraction, and fractions with the same denominator. In 4th grade, the notion of non-negative rational numbers is further enlarged as students learn how to obtain equivalent fractions multiplying the top and bottom by the same factor and understand what it requires to simplify fractions (MEC, 2003). Operations get more complex as they learn how to multiply and divide non-negative rational numbers.

The way rational numbers are organised in school curricula allows for the existence of several different meanings, such as: part-whole/measurement, quotient, operator and ratios and rates (Oliveira, 2014). Part-whole/measurement refers to the division of a whole into equal parts or to the representation of a fraction as a single point on a number line. The quotient is based on the division of two natural numbers. It is like dividing 10 loaves of bread among two persons (10÷2).

The fraction can be used as an operator when there is a transformation, something that acts on something and modifies it, for example, by multiplying $\frac{2}{3}$ by something, we can first multiply by 2 and then divide by 3.

Ratio is used to compare two similar quantities, but "when a ratio represents the comparison of quantities of a different nature and can be conceived as the description of a phenomenon common to other situations, this comparison is considered a rate" (Oliveira, 2014, p. 70).

Rational numbers are introduced through fractions. This concept is not considered a priority in the pre-school to 2nd grade curriculum; however informal experiences at these levels will help lay down and develop mathematical bases that will be relevant to further learning (NCTM, 2007). Early contact with the unit fractions, like 'one half' and 'one third' for instance, allows students to better understand the meaning of the fractions, which will then make it easier for them to use fractions to solve tasks and problems. The development of the various meanings of the fractions, over the different school grades, provides students with a higher level of resources that will make their work much easier.

Method

This study aims to understand the contribution of semiotic representations to the learning of rational numbers, and specifically of unit fractions in the 2nd grade. Bearing in mind this particular objective, one of the authors carried out, during the last year of his master's degree, a teaching experience based on the use of mathematical tasks that called for the use of different semiotic representations of topics such as 'Introduction to unit fractions', 'Unit fractions: Part-whole', 'Dividing the unit: Number line', 'Unit fractions: Part-whole on a number line and using figures'. This teaching experience took place over four lessons (those that are curricularly defined) and included nine mathematical tasks, three of which are analysed in this paper. The different steps followed to solve each of the tasks include: the introduction, whose aim was to clarify the content of the task and to make sure that the students had understood what was expected; the exploration of the task that focuses on the students' resolutions; and the discussion of those resolutions.

The class in which this teaching experience was carried out consisted of 26 Portuguese students, 14 boys and 12 girls, aged between 7 and 8, each with a different learning pace. Although some students showed difficulties, most of them seemed to like mathematics.

Given the nature of the goal outlined, a qualitative and interpretative approach was adopted in order to understand the mathematical tools students resorted to, for solving the proposed classroom tasks (Bogdan & Biklen, 1994; Erickson, 1986). For that purpose, a wide range of data was collected, using various resources. For this paper, the data collected from the documental analysis reflects student performance in the proposed tasks.

Data analysis focused on the analysis of the content of student responses, and was translated, in a first moment, by the frequency distribution of the types of correct answers, partially correct answers, incorrect answers and of no answer situations. Subsequently, this analysis of the answers given by the students to each of the tasks focuses on the types of register of semiotic representation they used: RLN: register of natural language; RP: pictorial register; RS: symbolic register; RG: graphical register.

Results

When we introduced the topic 'Unit Fractions', students explored the division of the unit into equal parts, a topic already studied with natural numbers, and provided a representation of the situations covered in the tasks selected for the study of this topic. The first task the students had to perform, in pairs, was the following:

Task 1

In a 2nd grade math class, João learned some geometric shapes and, when he got home, he decided to make those shapes using cardboard sheets of different colors. In the meantime, his friend Rui arrived and ended up destroying the geometric figures, cutting them into tiny pieces. João was very upset and threw the figures to the ground and scattered them all over the floor. Rui told him that he had divided the figures into equal parts to show him what he had learned at school.

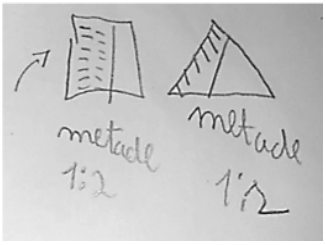
1. Once they put the geometric figures back together, Rui said "I divided the triangle and the square into two equal parts". How can we represent each of these parts?

2. Rui explained what he did with the triangle and the square. He also explained to his friend that he divided the rectangle into three equal parts, the circle into four equal parts and the pentagon into five equal parts to show him the numbers he had learned in his math class. What kind of numbers are these?

The division of the triangle and of the square into two geometrically equal parts highlighted the symbolic representation of this activity. During the discussion involving this representation, the students found that the results obtained are not always exact and, in such cases, the division can be represented by a fraction. Of all the parts of the figures the students encountered, halves were those they understood better, eventually because they remind students of common everyday situations. The clarification of the notion of half/halves of a geometric figure was seen as an occasion for focusing on its representation in the different registers. The representation of each part of the figures (square and triangle) was done correctly by four pairs of students. These representations are expressed in pictorial registers, symbolic registers and registers of natural language, as can be observed in the answer provided by pair P8 (Figure 1).

Figure 1

Correct answer provided by pair P8 to question 1 of task 1 (means half)

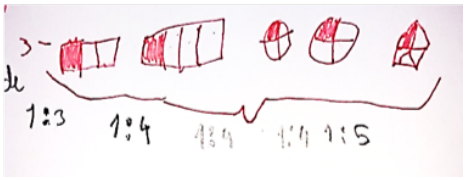


The other four pairs of students did not answer Question 1, which shows that they did not understand what they were supposed to do.

Question 2 of Task 1 proved to be fundamental in ascertaining if the students understood the concept of unit fraction. Two pairs of students answered correctly and were able to identify the numbers that represent the equal parts of a rectangle, a circle, or of a pentagon, using symbolic register and pictorial register, as shown in the resolution of pair P5 (Figure 2).

Figure 2

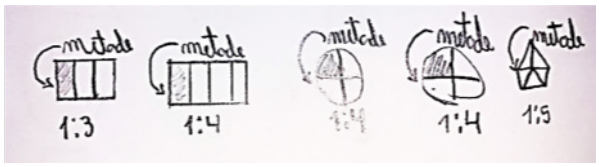
Correct answer provided by pair P5 to Question 2 of Task1



As for the answers that were considered partially correct, two pairs of students correctly performed the pictorial and symbolic representation of each of the situations considered but did not establish the right connection between these representations and the register of natural language they would need to describe the numbers they had identified, as shown by the resolution of pair P1 (Figure 3).

Figure 3

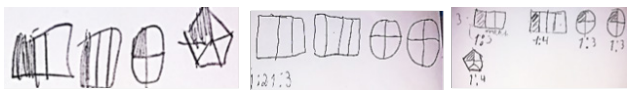
Partially correct answer given by pair P1 to Question 2 of Task1



The other three pairs of students whose answer was partially correct provided the correct division of the figures, but one of the pairs did not symbolically represent any of the numbers that explain the division; the other pair only displayed part of these numbers (1/2 and 1/3) and did not represent the pentagon divided into five geometrically equal parts; and the third pair did not symbolically represent the division of some of the figures (Figure 4).

Figure 4

Partially correct answers provided, respectively, by pairs P4, P3 and P7 to Question 2 of Task 1



In the incorrect answer given to Question 3, the pair P8 incorrectly represented the division of the figures and did not indicate the numbers corresponding to this division (Figure 5).

Figure 5

Incorrect answer provided by pair P8 to Question 2 of Task 1

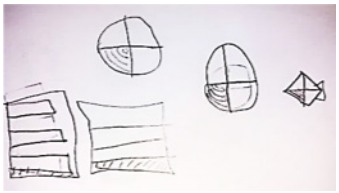


Table 1
Frequency of the types of register used by the students in Task 1

	Types of answers											
	C				PC				I			
Question	RG	RS	RLN	RP	RG	RS	RLN	RP	RG	RS	RLN	RP
1.	0	4	4	4	0	0	0	0	0	0	0	0
2.	0	2	0	2	0	4	0	5	0	0	0	1
Total	0	6	8	12	0	4	2	7	0	0	0	1

Note: RG: Graphical register; RS: symbolic register; RLN: register of natural language; RP: pictorial register.

The division of geometric figures, in this grade, does not usually demand that their construction be entirely thorough, especially when it involves figures with several sides like the pentagon. Therefore, students, when challenged to divide geometric figures, often end up by putting at risk the meaning assigned to each of the parts of the unity.

In addition to analysing the students' answers to the questions from Task 1, it is important to identify the type of registers they have used in each of these questions (Table 1).

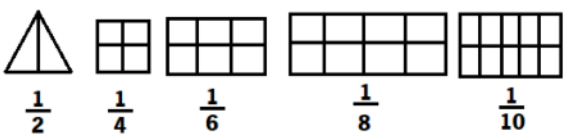
It appears that the pictorial record was the most commonly used for solving the questions in Task 1. It was used 12 times by the pairs of students who answered correctly, 7 times by the pairs of students who provided partially correct answers and once by a pair of students whose answer was incorrect. These results show that students find it easier to express their ideas using drawings than through other registers. This situation is quite natural since this ability is greatly developed in young students as soon as they enter pre-school.

Then, students solved Task 2 to deepen previous learning.

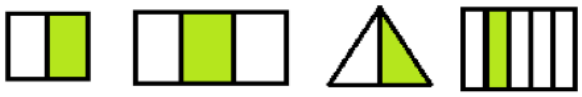
Task 2

1. Write down the fractions that correspond to the colored part in each of the situations.

2. Color the figures according to the fractions suggested.



3. Indicate, in each situation, the colored part using two different representations.



Students completed this task individually so that we could understand whether they had understood the topic 'Unit Fractions'. The results are shown in Table 2.

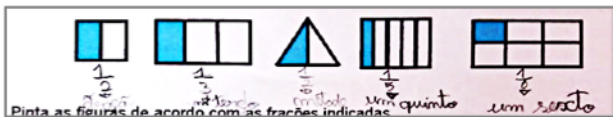
Table 2
Frequency of the type of answers provided for the questions of Task 2

	Types of answers			
Question	C	PC	I	NR
1.	7	3	2	4
2.	8	7	0	1
3.	6	3	3	4

Note: C: correct; PC: partially correct; I: incorrect; NR: no answer provided.

In the first question, seven students (43.75%) indicated the correct fraction that corresponds to the coloured part of each of the figures using symbolic register. However, one of these students answered using two types of representation register: symbolic register and register of natural language, as we can see in the answer provided by student A20 (Figure 6).

Figure 6
Correct answer provided by Student A20 to Question 1 of Task 2



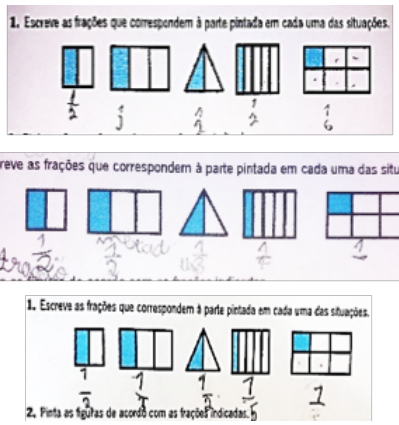
The use of both registers reveals that the student has not only understood what he was taught about unit fractions, but also that he feels confident enough to use different registers, showing that the same mathematical "object" can be represented in various ways. As he converts the symbolic register into natural language, the student uses, in the first figure, the term "fraction" referring to $\frac{1}{2}$, but in the third figure he writes the correct term to describe that same fraction, which shows a certain lack of critical thinking.

The answers given by three of the students (18.75%) are only partially correct because student A8 does not indicate all the corresponding fractions; student A26 answers correctly only to three of the five fractions, forgetting to place the fraction bar between the numerator and the denominator; and student A11 uses

symbolic representations and natural language to represent the coloured parts of the figures using fractions that do not correspond to the figure (Figure 7).

Figure 7

Partially correct answers given, respectively, by students A8, A26 and A11 to Question1 of Task2

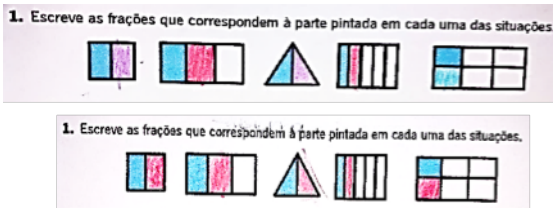


The analysis of student A26's partially correct answer shows that he correctly represents the fraction in the first figure but omits the fraction bar that separates the numerator from the denominator in the other figures. The way student A11 presents his fractions tells us that he or she did not understand the topic addressed, since the only correct answer is the fraction that he or she uses for the first figure. The representation of the fraction $\frac{1}{2}$ in natural language is only correct in the second figure, in which the student states that the corresponding fraction is $\frac{1}{2}$, which in the register of natural language is represented by 'half'.

The answers given by two of the students (12.5%) are incorrect because the students did not mention the corresponding fraction - the students coloured one of the parts on the figures instead of using the symbolic representation of the corresponding fraction. This indicates that they did not understand what they were asked to do (Figure 8).

Figure 8

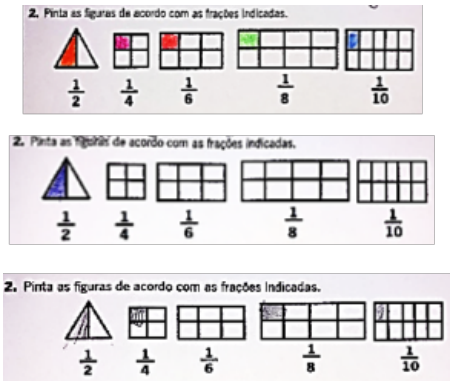
Incorrect answers given, respectively, by students A25 and A16 to Question 1 of Task2



In Question 2, eight students (50%) answered correctly, painting only one part of each figure, as registered by student A18 (Figure 12). However, seven students (43.75%) provided answers that were only partially correct. They did not provide a full answer to the question, since they only coloured correctly a part of some of the figures, as can be seen in the answers given by students A10 and A3 (Figure 9).

Figure 9

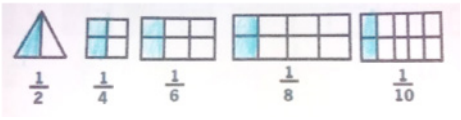
Correct answer given by student A18 and partially correct answers given, respectively, by students A10 and A3 to Question 2 of Task 2



The remaining five students whose answer was partially correct coloured two parts of each figure, only the first having been done correctly (Figure 10).

Figure 10

Partially correct answer given by student A20 to Question 2 of Task 2



Analysing the partially correct answer provided by student A20, it seems that he or she was able to establish a direct correspondence between the part coloured in the first figure and the others. The student did not consider the numerator of each fraction presented, though. The students who provided such an answer revealed that they did not understand what each unit fraction represents, failing to successfully carry out the conversion from the symbolic register into the pictorial register for each of the fractions.

Six students (37.5%) answered correctly to Question 3 of Task 2, but only one of them used two distinct registers of representation, the symbolic register, and the register of natural language. The latter was used by only one of the six students and the former was used by four of the six students, as expressed in the answers given by students A8, A4 and A11 (Figure 11).

The partially correct answers were given by three students (18.75%), who only provided a correct representation of two fractions, as shown by the answer given by student A5 (Figure 12).

The incorrect answers given by three students (18.75%) show once again that the students did not understand what they had to do, as shown by the answer given by student A16 (Figure 13).

Figure 11
Correct answers provided, respectively, by students A18, A4 and A11 to Question 3 of Task 2

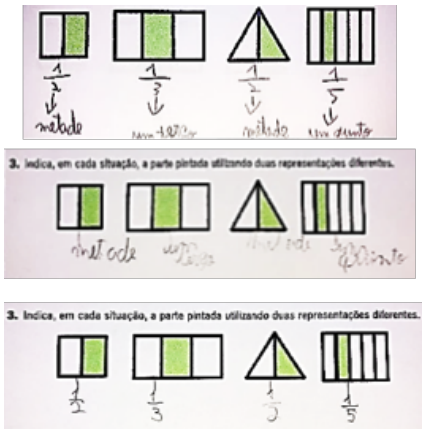


Figure 12
Partially correct answer given by student A5 to Question 3 of Task 2

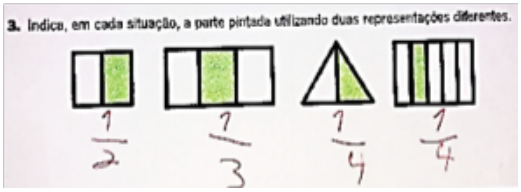


Figure 13
Incorrect answer given by student A16 to Question 3 of Task 2

As for the type of register that students use in the answers given to the questions of Task 2, symbolic register is the most widely used by students who provided correct answers, while pictorial register is the most commonly used in the partially correct and incorrect answers (Table 3).

The symbolic register used in most of the correct answers made it possible for students to acquire competences regarding the use of rational numbers and, more specifically, unit fractions. Through the symbolic representation of the operation of division, most students showed that they had understood what each fraction represented in the various situations. Using this type of register, the students were able to provide correct answers.

The pictorial register used by the students to answer Question 1 led to incorrect answers. They failed to perform what they were asked to do - which was to write down the fractions that corresponded to the coloured part of each figure – and failed to understand the instructions they were given. This type of register was more widely used to answer Question 2 and made it possible for students to obtain partially correct answers by answering correctly to a part of the situations presented.

The representation registers used in the questions that are part of the tasks can influence student responses, denying them the possibility of using different representations, as was the case in the aforementioned task. To understand this relationship, students were asked to solve Task 3 whose instructions used only the register of natural language. The students could use the representation register they wished to reply to what was required in the task.

Task 3

> The math teacher gave the students a rectangular chocolate bar and asked them to divide it into as many parts as they wanted. Maria decided to divide the chocolate into two parts, João into three parts, Rita into four parts and Rui into five parts. If each one of them eats one part of his/her chocolate bar, who will eat the greater amount of chocolate? Explain how you reached that answer.

The analysis of the students' answers to this task, which they solved individually, showed that half of the class did not provide any kind of answer, whereas six students from the other half (37.5%) provided a correct answer, one of the students (6.25%) gave a partially correct answer and another student (6.25%) an incorrect answer (Table 4).

Table 3
Frequency of the types of register used by the students in Task 2

	Types of answers											
	C				PC				I			
Question	RG	RS	RLN	RP	RG	RS	RLN	RP	RG	RS	RLN	RP
1.	0	7	1	0	0	3	1	0	0	0	0	2
2.	0	0	0	8	0	0	0	7	0	0	0	0
3.	0	5	2	0	0	3	0	0	0	0	0	3
Total	0	12	3	8	0	6	1	7	0	0	0	5

Note: RG: graphical register; RS: symbolic register; RLN: register of natural language; RP: pictorial register.

Table 4

Frequency of the types of answers provided to Task 3

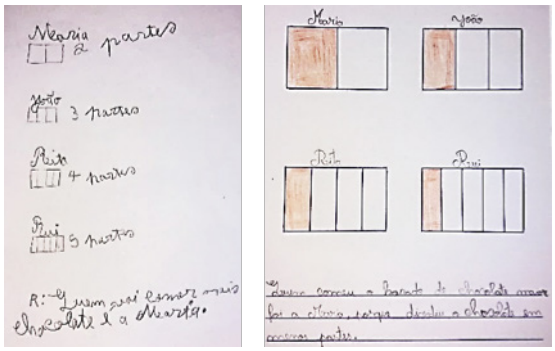
	Types of answers			
	C	PC	I	NR
Task 3	6	1	1	8

Note: C: correct; PC: partially correct; I: incorrect; NR: no answer provided.

In their responses, six students (37.5%) used a pictorial register to share their line of reasoning and answered that Maria was the one who ate the greater amount of chocolate, which was the correct answer. The register of natural language was used by four of these students to justify their answers, showing what they thought was the answer to this task, as shown by the answer given by students A5 and A20 (Figure 14).

Figure 14

Correct answers given, respectively, by students A5 and A20 to Task 3



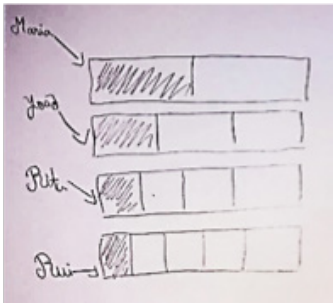
The pictorial register of the division of each chocolate bar allowed the students to realize how much each person would eat, making it easier for them to solve the task. The register of natural language completed the pictorial register and confirmed the identity of the person who had eaten more chocolate.

In the partially correct answer, one of the students (6.25%) pictorially represented the situation described in the problem but did not use the register of natural language to answer the question (Figure 15).

Student A7 answered the question using a pictorial register and this allowed him to see how much each person would eat. The final answer was not given though, which indicates that, in the student's understanding, the final answer is implicit in the pictorial representation he provided.

Figure 15

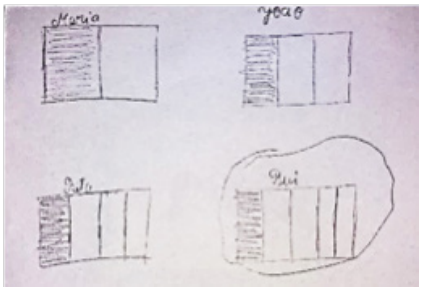
Partially correct answer given by student A7 to Task 3



The incorrect answer given by one of the students (6.25%) used the pictorial register and the student considered the number of pieces that each person had obtained after the division, but experienced difficulties when he tried to compare fractions with the same numerator and different denominators in this register (Figure 16).

Figure 16

Incorrect answer given by student A4 to Task 3



The difficulty that led to the incorrect answer given by student A4 is due to the quantity of pieces that each one obtained when the chocolate bar was divided and to the fact that he did not take into account that the size of each of the newly found pieces decreases as the number of chocolate pieces increases.

The analysis of the students' answers in terms of register shows that the pictorial register is the most widely used by the students regardless of the type of answer they provide (Table 5).

The use of the pictorial register allowed the students to visualize the concrete division of a rectangular figure, making it easier to understand how much each person would eat of a chocolate bar. The incorrect answer that used the pictorial register was due to the number

Table 5

Frequency of the types of register used by the students in Task 3

	Type of answers											
	C				PC				I			
	RG	RS	RLN	RP	RG	RS	RLN	RP	RG	RS	RLN	RP
Task 3	0	0	4	6	0	0	0	1	0	0	0	1
Total	0	0	4	6	0	0	0	1	0	0	0	1

Note: RG: graphical register; RS: symbolic register; RLN: register of natural language; RP: pictorial register.

Table 6

Frequency of the types of register used by the students when they learn non-negative rational numbers.

Topic	Types of answers											
	C				PC				I			
	RG	RS	RLN	RP	RG	RS	RLN	RP	RG	RS	RLN	RP
Unit fractions: Introduction	0	18	15	26	0	10	3	15	0	0	0	7
Unit fractions: Part-whole	0	23	22	63	0	24	26	35	0	11	1	22
Unit Fractions: Part-whole on a number line and in figures	2	5	17	2	21	11	28	21	11	5	16	12
Total	2	46	54	91	21	45	57	71	11	16	17	41

Note: RG: graphical register; RS: symbolic register; RLN: register of natural language; RP: pictorial register.

of pieces into which the figure was divided, and the student failed to understand that each person would only eat one piece of chocolate, regardless of the division carried out.

The analysis and interpretation of the 2nd grade students' answers showed us how important it would be to summarize the types of registers of semiotic representation that were used by the pupils in learning about unit fractions (Table 6).

The analysis of Table 6 reveals that the most widely used register of semiotic representation was the pictorial register, in all kinds of responses. This register is constantly present in the learning process of students since Pre-school Education and this familiarity might have influenced its use in the proposed tasks. The symbolic registers and natural language, on the other hand, were used mainly to complement the students' responses, and were therefore used less frequently than the pictorial register. The graphical register was rarely used, which shows that students feel uncomfortable when they have to represent fractions on a number line. When the students used this register, they showed difficulties putting at risk their learning of rational numbers and, in this case, of unit fractions. It was difficult for students to make representations using this register because of the subdivision of the unit and because of the lack of additional information on the origin and on the unit itself.

The registers of representation chosen for solving tasks was, several times, influenced by the instructions received. However, when the instructions given did not suggest the type of register of representation that should be used, students tended to use the pictorial register. It was followed by the symbolic register and by the register of natural language.

Students found it difficult to carry out some of the tasks, namely: representing and dividing geometric figures with many sides; converting symbolic register representations into the register of natural language; distinguishing between the term 'fraction' and the symbol $\frac{1}{2}$; interpreting the instructions given to carry out the task; converting the colouring of geometric figures into rational numbers; and representing rational numbers using the graphical register. The work carried out with representations on a number line was not thorough enough for students to be prepared to use it correctly. It was therefore hard for them to complete the tasks involving graphical register.

The mistakes the students made while performing the tasks had to do with: identifying the coloured part in a geometric figure divided into equal parts; associating the concept of "half" with all the unit fractions; failure to use the fraction bar between the natural numbers that form it; using everyday terms to represent the fractions in natural language, for example, using terms such as 'one second' and 'one-third' to refer to the fractions $\frac{1}{2}$ and $\frac{1}{3}$; the confusion between the different registers of representation when it comes to carrying out a conversion; and the incorrect representation of the numbers 1, 2 and 3, that make students refer to the number 'two' as 'one half" in the register of natural language.

Conclusions

This study shows that the pictorial register of semiotic representation is the register most widely used by 2nd graders when they present the line of reasoning that supports the resolution of the mathematical tasks used to teach them about 'rational numbers', more precisely about 'unit fractions'. The importance of pictorial representations in the learning of mathematics is highlighted by several authors, especially in the first years of schooling (Brocardo & Carrillo, 2019; Canavarro & Pinto, 2012; Guerreiro et al., 2018). In this regard, Canavarro and Pinto (2012) emphasize that "teachers need to use these representations to foster the presentation of conventional mathematical symbols and the writing of mathematical expressions, linking them to the corresponding iconic representations" (p. 76).

The mathematical tasks proposed in this study were fundamental to introduce students to the different registers of semiotic representation and were also

important to promote their understanding of rational numbers and help them distinguish mathematical objects from their representations (Duval, 2017). According to this author, mathematical understanding comes from distinguishing between mathematical objects and their representations, and to achieve such a goal, working with the different registers becomes increasingly relevant. These registers allow students to engage in mathematical work and through it they are able to build knowledge about the objects studied, since these objects do not have a tangible existence (Bonomi, 2015; Duval, 1993, 2017).

In solving the tasks given to them, students predominantly use pictorial registers, which is understandable, given their level of education (Canavarro & Pinto, 2012; Duval, 1993). However, they are also strongly influenced by the representations proposed in the instructions they receive. Notwithstanding the predominance of the pictorial register, the symbolic register and the register of natural language have been useful to improve and enlarge what has been previously taught and learnt. These are two registers of representation of rational numbers that are at an early stage of development and not yet consolidated enough to allow for a more effective use (Duval, 2003, 2017). Furthermore, students are still struggling to learn how to write in their own natural language and this has undeniably affected the register of mathematical representations.

Analysis of students' resolutions of the proposed tasks revealed that the process of learning about unit fractions is quite difficult. These difficulties are related to the understanding of the concept of unit fractions and their different forms of semiotic representation, a critical problem in mathematics education that several authors have pointed out (Brandl et al., 2016; Canavarro & Pinto, 2012; Duval, 2017; Goldin & Shteingold, 2001; Kara & Incikabi, 2018; Oliveira, 2016). Students' difficulties also relate to the division of geometric figures, the representation of fractions using the natural language register, the consideration of the part corresponding to the fraction of a figure, the change from one register to another, the representation of fractions using the graphical register and the interpretation of task instructions. These difficulties are evident because students make mistakes when responding, which must be discussed in order to overcome future difficulties, as pointed out by several authors (Kara & Incikabi, 2018; Canavarro & Pinto, 2012; Özsoy, 2018).

Finally, this study shows the existence of a conceptual development in the learning of rational numbers as a result of the use of the different registers of semiotic representation, since they help to modify the numerical field that normally limits the construction of student knowledge about mathematical objects.

Acknowledgements

This work is funded by CIEd – Research Centre on Education, Institute of Education, University of Minho, projects UIDB/01661/2020 and UIDP/01661/2020, through national funds of FCT/MCTES-PT.

References

Barnett-Clarke, C., Fisher, W, Marks, R., & Ross, S. (2010). *Developing essential understanding of rational numbers for teaching mathematics in grades 3-5*. National Council of Teachers of Mathematics.

Brandl, E., Poffo, A. P., & Silva, A. R. (2016). Análise de atividades envolvendo os números racionais não negativos sob a ótica da teoria da registros de representação semiótica de Duval [Analysis of activities involving non-negative rational numbers from the perspective of Duval's theory of records of semiotic representations]. In *V Simpósio Nacional de Ensino de Ciência e Tecnologia. Universidade Tecnológica* Federal do Paraná. Acedido em 12 de janeiro, 2019, de http://www.sinect.com.br/2016/selecionados.php.

Brocardo, J., & Carrillo, J. (2019). Ensino e aprendizagem dos números e das operações [Teaching and learning numbers and operations]. *Quadrante, 28*(2), 1-5. https://doi.org/10.48489/quadrante.22880

Canavarro, A. P., & Pinto, M. E. (2012). O raciocínio matemático aos seis anos: Características e funções das representações dos alunos [Mathematical reasoning at age six: Characteristics and functions of student representations]. *Quadrante, 21*(2), 51-79.

Davis, P. J., & Hersh, R. (2020). *A experiência matemática* [The mathematical experience]. Gradiva.

Dreyfus, T. (2002). Advanced mathematical thinking processes. In D. Tall (Ed.), *Advanced mathematical thinking* (pp. 25-41). Kluwer Academic Publisher. https://doi.org/10.1007/0-306-47203-1_2

Duval, R. (1993). Registres de représentation sémiotique et fonctionnement cognitif de la pensée [Semiotic representation registers and cognitive functioning of thought]. *Annales de Didactique et de Sciences Cognitives* (pp. 37-65). IREM – ULP.

Duval, R. (1995). *Sémiosis et pensée humaine. Registres sémiotiques et apprentissages intellectuels* [Semiosis and human thought. Semiotic registers and intellectual learning]. Peter Lang.

Duval, R. (2003). Registros de representações semióticas e funcionamente cognitivo da compreensão em matemática [Records of semiotic and cognitive functioning representations of understanding in mathematics]. In S. D. Machado (Org.), *Aprendizagem em matemática: Registros de representação semiótica* (pp. 11-33). Coleção Papirus Educação, Papirus Editora.

Duval, R. (2017). *Understanding the mathematical way of thinking – The registers of semiotic representations.* Springer. https://doi.org/10.1007/978-3-319-56910-9_2

Erickson, F. (1986). Qualitative methods in research on teaching. In M. Wittrock (Ed.), *Handbook of Research on Teaching* (pp. 119-161). Macmillan.

Fernandes, M. S. L. (2013). *Ensinar Números Racionais no 1.º CEB – Uma experiência com alunos do 4.º ano em período de transição de documentos curriculares* [Teaching Rational Numbers in Pimary Education- An experience with 4th year students in a curricular documents transitional period]. Dissertação de Mestrado em Estudos da Criança, Universidade do Minho, Instituto de Educação, Portugal.

Goldin, G., & Shteingold, N. (2001). Systems of representations and the development of mathematical concepts. In A. Cuoco, & F. Curcio (Eds.), *Roles of representation in school mathematics - 2001 Yearbook* (pp. 1-23). National Council of Teachers of Mathematics.

Guerreiro, A., Tomás Ferreira, R., Menezes, L., & Martinho, M. H. (2015). Comunicação na sala de aula: A perspetiva do ensino exploratório da matemática [Communication in the classroom: The perspective of inquiry-based mathematics teaching]. *Zetetiké: Revista de Educação Matemática, 23*(4), 279-295.

Guerreiro, H. G., Morais, C., Serrazina, M. D. L., & Ponte, J. P. D. (2018). Múltiplas representações num percurso de aprendizagem dos números racionais [Multiple representations in a rational numbers learning trajectory]. *Livro de Atas do EIEM 2018 Encontro em Investigação em Educação Matemática- A Aula de Matemática* (pp. 551-561). Sociedade Portuguesa de Investigação em Educação Matemática.

Hodges, T., Cady, J., & Collins, L. (2008). Fraction representation: The not-so-common denominator among textbooks. *Mathematics teaching in the middle school, 14* (2), 78-84. https://doi.org/10.5951/MTMS.14.2.0078

Hunt, J., Tzur, R., & Westenskow, A. (2016). Evolution of unit fraction conceptions in two fifth-graders with a learning disability: An exploratory study. *Mathematical Thinking and Learning, 18*(3), 182-208. https://doi.org/10.1080/10986065.2016.1183089

Kara, F., & Incikabi, L. (2018). Sixth grade students' skills of using multiple representations in addition and subtraction operations in fractions. *International Electronic Journal of Elementary Education, 10*(4), 463–474. https://doi.org/10.26822/iejee.2018438137

Kieren, T. E. (1992). Rational and fractional numbers as mathematical and personal knowledge: Implications for curriculum and instruction. *Analysis of arithmetic for mathematics teaching,* 323-371.

Lamon, S. J. (2007). Rational numbers and proportional reasoning: Toward a theoretical framework for Research. In F. Lester (Ed.), *Second Handbook of research on mathematics teaching and learning* (pp. 629-667). Information Age Publishing.

Lemonidis, C., & Pilianidis, N. (2020). The 8th grade students' competencies in alternating different symbolic representations of rational numbers. *International Electronic Journal of Mathematics Education, 15*(3), 1-14. https://doi.org/10.29333/iejme/7865

Ministério da Educação e Ciência (MEC) (2013). *Programa e Metas Curriculares Matemática* [Mathematical Curriculum and Program]. Ministério da Educação e Ciência.

Morais, C., Cerca, R., Quaresma, M., & da Ponte, J. P. (2014). Os números racionais no 2.º ano: um estudo diagnóstico [The rational numbers in the 2nd grade: a diagnostic study]. In M. Martinho, H., Tomás Ferreira, R. A., A. M. Boavida, & L. Menezes (Eds.), *Atas do XXV Seminário de Investigação em Educação Matemática* (pp. 91–109). Associação de Professores de Matemática.

NCTM (2007). *Princípios e Normas para a Matemática Escolar* [Principles and Standards for School Mathematics]. Associação de Professores de Matemática.

Oliveira, L. M. (2014). *Aprendizagens no estudo do raciocínio proporcional* [Learning within the study of proportional reasoning]. Dissertação de Mestrado Ensino de Ciências e Educação Matemática, Universidade Estadual de Londrina, Brasil.

Özsoy, G. (2018). Pre-service teachers' use of visual representations. *International Electronic Journal of Elementary Education, 11*(1), 49–54. https://doi.org/10.26822/iejee.2018143960

Ponte, J. P., & Quaresma, M. (2012). Compreensão dos números racionais, comparação e ordenação: o caso de Leonor [Understanding rational numbers, comparison and ordering: Leonor's case]. *Interacções, 20,* 37-69. https://doi.org/10.25755/int.485

Ponte, J. P., Boavida, A. M., Graça, M., & Abrantes, P. (1997). *Didáctica da Matemática* [Didactics of Mathematics]. Ministério da Educação.

Ponte, J. P., Serrazina, L., Guimarães, H., Breda, A., Guimarães, F., Sousa, H., Menezes, L., Martins, G., & Oliveira, P. (2007). *Programa de Matemática do Ensino Básico* [Basic Education Mathematics Program]. Direção Geral de Inovação e de Desenvolvimento Curricular.

Scaptura,C., Suh, J., & Mahaffey, G. (2007). Masterpieces to mathematics: Using art to teach fraction, decimal, and percent equivalents. *Mathematics teaching in the middle school, 13 (*1), 24-28.

Silva, F. A., Santiago, M. M., & dos Santos, M. C. (2014). Significados e representações dos números racionais abordados no exame nacional do ensino médio – ENEM [Meanings and representations of rational numbers addressed in the national high school exam - ENEM]. *Bolema, 28*(50), 1485-1504. https://doi.org/10.1590/1980-4415v28n50a23

Woleck, K. (2001). Listen to their pictures: An investigation of children's mathematical drawings. In A. Cuoco, & F. Curcio (Eds.), *Roles of representation in school mathematics - 2001 Yearbook* (pp. 215-227). National Council of Teachers of Mathematics.

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 625-638

Educators' Experiences of Establishing Social and Emotional Learning Pedagogies in an Elementary School With At-Risk Students

Ben Dyson[a], Donal Howley[*,b], Yanhua Shen[c], Seunghyun Baek[d]

Received : 24 February 2021
Revised : 22 May 2021
Accepted : 15 June 2021
DOI : 10.26822/iejee.2021.217

[a]Ben Dyson, University of North Carolina at Greensboro, USA.
E-mail: bpdyson@uncg.edu
ORCID: https://orcid.org/0000-0001-5460-4836

[*,b]**Corresponding Author:** Donal Howley, University of North Carolina at Greensboro, USA.
E-mail: dfhowley@uncg.edu
ORCID: https://orcid.org/0000-0003-3534-6768

[c]Yanhua Shen, University of North Carolina at Greensboro, USA.
E-mail: y_shen2@uncg.edu
ORCID: https://orcid.org/0000-0001-9827-4330

[d]Seunghyun Baek, University of North Carolina at Greensboro, USA.
ORCID: https://orcid.org/0000-0002-3621-3011
E-mail: s_baek@uncg.edu

Abstract

There exists a need to explore educators' initial experiences of working to establish Social and Emotional (SEL) pedagogies like Restorative Practices (RP) at elementary school level to help avoid slippage in implementation and inform and sustain long term positive change within school communities. Adopting a social ecological perspective, the purpose of this qualitative study was to explore educators' experiences of establishing SEL pedagogies in an elementary school with at-risk students. Utilizing interviews, focus group, and researcher field notes, 14 educators were asked to reflect on their understandings and ongoing experiences of SEL continued professional development and implementation of restorative practices. Applying inductive and deductive analysis, three themes emerged: Establishing the Significance of SEL through CPD; Putting SEL into Practice; and Realities of Establishing SEL. The insights of educators highlight where gaps existed and further support was required in order to incorporate the wider community and the fundamental role and influence of family in development of their students. Compared with the quantitative methodologies that have dominated SEL literature, qualitative methods help elicit the nuanced contextual opportunities and challenges educators experience when it comes to understanding and practically implementing SEL pedagogies holistically.

Keywords:

Social and Emotional Learning, Continued Professional Development, Pedagogy, Restorative Practices, High-Needs Students.

Introduction

Research and practice involving the successful integration of Social and Emotional Learning (SEL) continues to be in sharp focus with educational researchers, policymakers, and practitioners (Garcia & Weiss 2016; Jones et al., 2019b; Oberle et al., 2016). SEL can be defined as "the process through which individuals learn and apply a set of social, emotional, behavioral, and character skills required to

succeed in schooling, the workplace, relationships, and citizenship" (Jones et al., 2019a p. 19). Within schooling, this process involves, but is not limited to, teachers implementing pedagogies which develop students' cognitive regulation, emotional processes, social/interpersonal skills, character, and mindset (Jones et al., 2017). Instead of implementing isolated SEL programs in schools, there have been calls to infuse SEL pedagogies into existing curricula "to enhance its sustainability and break the perceived barrier that there is a lack of time for SEL due to the pressures of the regular classroom curriculum" (Oberle & Schonert-Reichl, 2017, p. 183). Establishing such pedagogies in schools to promote SEL requires a longitudinal approach to bring about cultural change (Morrison, Blood & Thorsborne, 2005). However, such important work by teachers is all too often impeded by a lack of time, cultural and contextual sensitivity, ineffective design and implementation of pedagogies, limited training, struggles with conflict management, and a lack of support for teachers' wellbeing (Blyth et al., 2019; Kaynak Elcan, 2020). Literature has consistently highlighted failings in helping teachers experience effective SEL continued professional development (CPD) (Durlak, 2016), with schools lacking in-house experts and resources to facilitate teachers in "cohort-based, ongoing professional development experiences that provide continuous support" (Elias, 2019, p. 243). Such support is especially required for elementary schools with at-risk students, with challenging classroom, emotional climates, and limited mental health supports available for both teachers and students to enhance their SEL and broader learning (Brackett et al., 2011; Capella et al., 2008; Jacobson, 2019; Hoglund et al., 2015). The USA Department of Education (2021) defines this population as:

> *Students at risk of educational failure or otherwise in need of special assistance and support, such as students who are living in poverty, who attend high-minority schools, who are far below grade level, who have left school before receiving a regular high school diploma, who are at risk of not graduating with a diploma on time, who are homeless, who are in foster care, who have been incarcerated, who have disabilities, or who are English learners.*

Restorative Practices (RP) are peaceful, humanistic, non-punitive pedagogies for addressing harm, responding to violations of legal and human rights, and problem solving in cases of school indiscipline (Fronius et al., 2016; Ottmar et al., 2015; Wachtel, 2012; 2013), encompassing a multitude of "positive behavioral support approaches in a school that fosters communication, mutual respect, and understanding between all people" (Mansfield, Fowler, & Rainbolt, 2018, p. 306). It has been shown to build affective skills by focusing on relational practices that empower students as well as offering a range of relevant learning opportunities (Dyson, Howley, & Shen, 2019; Macready, 2009; Morrison et al., 2005). At the same time, research on school-based RP "is still at the infancy stage" (Fronius et al., 2016, p. 2). Within SEL research, there is a general lack of qualitative research and a predominance of quantitative research designs foregrounded in literature (Corcoran et al., 2018; Fraser et al., 2014; Hamre et al., 2013). There exists a need to explore educators' initial experiences of working to establish SEL pedagogies like RP at elementary school level to help avoid slippage in implementation and inform and sustain long term positive change within school communities. Compared with the predominantly quantitative methodologies found in meta-analyses and large-scale studies, a qualitative approach can help better identify and understand the nuanced opportunities and constraints educators experience when contextually implementing SEL pedagogies such as RP for the first time (Dyson et al., 2019; 2020). With this in mind, the purpose of this qualitative study was to investigate educators' experiences of establishing social and emotional learning pedagogies in an elementary school with at-risk students.

Theoretical Perspective

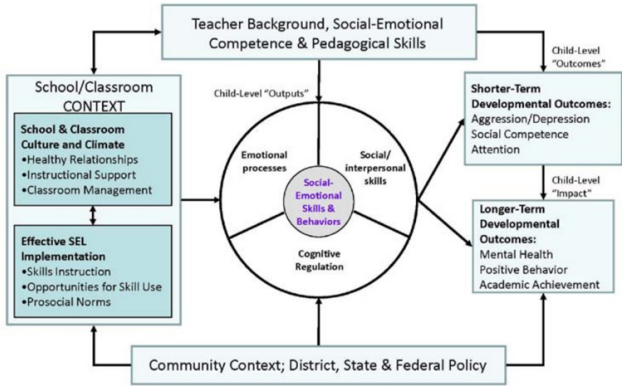
Social ecological theory (Bronfenbrenner, 1979, 1992) proposes that individuals develop within a multi-level system of environmental and social organizations, ranging from more proximal micro-level systems to more distal macro-level systems. School-based RP are conducted between students, teachers, administration, and the community (Karp & Breslin, 2001; Mullet, 2014), with the goal of establishing "environments where members of the community take responsibility to repair harm when it occurs, hold each other accountable, and build skills in collective problem-solving" (Gonzalez, 2012, pp. 300-301). Considering this, the teaching and learning of SEL pedagogies like RP requires recognition of the range and influence of the active ecosystems within which children belong, learn, and live in, such as family, school, and communities (Crosby, 2015; Dusenbury et al., 2019; Papadopoulos, 2020). Teachers must learn to understand and work within these systems along with students, their families, and others and vice versa. Framing social and emotional development in schools through a social ecological perspective makes explicit links between and among different levels and considers transactions among people within their social and physical settings, over time and across personal, cultural, and institutional levels (Bronfenbrenner, 1979; Panter-Brick et al., 2006; Stokols, 1992). Thus, the development of students' SEL competencies can be influenced by teacher-student and peer relationships in the classroom (micro-level system), school climate

and school administration (meso-level system), and outside of school in students' homes and communities (macro-level system) (Bornstein & Lamb, 2015).

This study is guided by the SEL framework proposed by Jones and Bouffard (2012) grounded in the social ecological theory (Figure 1). Consisting of three domains (cognitive regulation, emotional processes, social and interpersonal skills), it presents the constructs of SEL from a broad educational and ecological perspective. In this way, the teaching of SEL is recognized as being influenced by multi-level environmental systems and factors, including culture and climate within and beyond schools (Jones & Doolittle, 2017). The teacher's pedagogical skills help guide the child-level outcomes, leading to potentially improved child-level impacts. The social-cultural model extends out from the classroom and school to the wider community context. Understanding how these systems and factors intersect and impact the local environment can explain how SEL is successfully implemented or impeded by these factors (Jones et al., 2019b).

Figure 1

A framework for SEL (Jones and Bouffard, 2012)



Supplementing this, our work is grounded in social constructivist learning theory as a research-informed and practical guide to school-based research in an effort to position and understand the establishment of SEL pedagogies with schooling and classrooms (Vygotsky, 1978). SEL pedagogies like RP requires teachers to facilitate social processes which help students to learn through their relationships and interactions with others within and beyond the school context with a view to transfer across multiple contexts (Lipponen, Rajala, & Hilppö, 2018; Oberle & Schonert-Reichl, 2017). Such processes allow teachers and students to recognize and challenge behavioral, individualistic, and fragmented approaches to SEL by offering a unified and profoundly social conceptualization of learning (Vadeboncoeur & Collie 2013). In utilizing these conceptual frameworks to guide us, our intention is to build on existing knowledge through investigating the contextual establishment of SEL student pedagogies to improve learner outcomes.

Methodology

Context

The school and participants have all been given pseudonyms. This research used a case study design (Stake, 2006) to explore the establishment of SEL pedagogy in a K-5 Partnership School in North Carolina operated in collaboration with the school district and a local university. The North Carolina legislature established laboratory schools in 2016 to address the needs of low-performing students and schools and to prepare pre-service and in-service teachers to work more effectively in schools with at-risk students. Clonkeen served approximately 375 K-5 students (59% African American; 20% Caucasian; 11% Hispanic; 10% Multi-Racial), 98% of whom come from low-income families. In Clonkeen, students experienced regular conflict and disciplinary action. Teachers needed training in deescalating and working with students in proactive ways that focus on restorative tasks (Ex. class circle discussions) to work on positive conflict resolution. Using convenience sampling (Cooksey & McDonald, 2019), 14 educators, including the school director, curriculum director, principal, assistant principal, social worker, physical education, special education, and generalist teachers agreed to participate. Participant information is provided in Table 1.

Teachers had varying degrees of training in SEL. Thomas was a trained counsellor and a grade 4 teacher. Jackie and Thomas attended multiple RP workshops to receive a certificate in order to be the lead trainers in RP for the teachers. The seven teachers in the SELT committee all had attended an extra full-day training in RP before the research project began. The remaining teachers had not previously participated in workshops on RP. Led by the Clonkeen curriculum leader, a Committee named the Social and Emotional Learning Team (SELT) was set up and met monthly to discuss and create action plans for the development of SEL at Clonkeen. The committee was made up of seven lead teachers, the Social Worker, curriculum leader, the school director, and two researchers from the university. One of the main initiatives was the whole school adoption of RP. During this study every teacher, the school leaders, and two researchers were actively involved in a two-day workshop on RP. To make this training contextually relevant to the teachers and sensitive to their needs, the school Social Worker and a grade 4 teacher participated in extensive instructor training on RP. After their training the Social Worker and teacher developed and facilitated this CPD for the teachers and leaders at Clonkeen. Then lead

Table 1
Participant Information

Name	Position	Race/Ethnicity	Years of Experience
Teresa	Principal	African American	23
Chris	School Director	Caucasian	51
Auria	Associate Director for Curriculum	Caucasian	32
Mary	Teacher Inquiry Director	Caucasian	6
Matt	Assistant Principal	African American	10
Jackie	Social Worker	African American	10
James	K-5 PE Teacher	Caucasian	6
Jess	Grade 5 Teacher	Caucasian	24
Sarah	Grade 5 Teacher	Caucasian	19
Anne	Grade 5 Special Education Teacher	Caucasian	17
Kerry	Grade 4 Teacher	Caucasian	17
Thomas	Grade 4 Teacher	Hispanic	3
Brooke	Grade 2 Teacher	African American	9
Hannah	Grade 2 Special Education Teacher	Caucasian	3

teachers were tasked to go back to Clonkeen and provide examples of how teachers could implement RP in their classrooms. In the CPD, the teachers were given a unifying message and they were trying to integrate RP into their teaching. To facilitate the CPD for teachers during the SELT committee meetings, teachers presented examples of their positive and negative experiences of implementing RP in their classrooms.

The principal investigator and three researchers were assigned to the school as 'critical friends' to teachers. The 'critical friends were the principal investigator/ researcher and three Ph.D. students. The principal investigator had 30 years' experience teaching, researching, and working in schools. The graduate students were all trained teachers and had taken qualitative and quantitative research methods classes. The teachers positively viewed the critical friends who visited the school on regular schedule. For example, the principal investigator visited the school 19 times during the study from between two and five hours.

Therefore, there were frequent interactions, informal interviews, and emails with teachers over eight months of one school semester outside of data collection procedures (July-February). In addition, the principal investigator attended and contributed to all school SELT meetings, attending eight meetings. We intended to focus on their conversations and interviews to understand how SEL CPD and the use of SEL pedagogies were represented in their comments. Before this research was initiated, an IRB was approved by a state university.

Data Sources

Sources used for data collection included interviews (12), a focus group (1), and researcher field notes (12) (Miles et al., 2014). There were 12 sets of field notes from 12 different days of visits, in 12 different classrooms. Interviews and focus groups were approximately 45-60 mins in length and conducted before, during, and after classes, meetings, and the school day itself led by at least one member of the research team during organized visits to the school. These took place over the course of eight months (July-February). Educators were asked to reflect on their understandings and ongoing experiences of establishing SEL pedagogies in Clonkeen. This included questions on their understandings of SEL, previous and ongoing experiences of SEL CPD, examples of SEL pedagogies they implemented in class, and the challenges and opportunities that arose when implementing SEL pedagogies. Field notes, which included classroom observations, were also taken during these school visits.

Data Analysis

Qualitative procedures of inductive analysis and deductive analysis were used for data analysis (Miles et al., 2014). The process started by transcribing interviews, followed by importing all the data into NVivo 12 plus. This was followed by pattern coding, and then followed by axial coding, which aimed to identify conceptual links, discover relationships among categories, and generate themes by constant comparison and triangulation (Miles et al., 2014). Credibility was achieved by spending extended periods of time at Clonkeen with the teachers so

that the continual presence would reduce possible distortions in data credibility. Member checks with participants were conducted. Importantly, throughout the process, peer debriefing with research colleagues and teachers was an iterative process of the data analysis. The dependability of the findings was addressed by laying out an audit trail for a colleague familiar with the research who collectively challenged the logic behind interpretations and the conclusions drawn, resulting in a much more reflective process and account. Confirmability was presented as a reflexive, self-critical account by triangulating our findings and interpretations supervised by a university professor with 20-years of school-based qualitative research experience with three research assistants. Trustworthiness was confirmed by continually challenging the interpretations of the findings, identifying conceptual links, and uncovering key themes and sub-themes through frequent peer debriefing with the researchers and the educators at Clonkeen (Lincoln & Guba, 1985). The thematic findings which emerged from this process are presented in the next section.

Findings

This study analyzed the experiences of educators in establishing SEL pedagogies in an elementary school with at-risk students. From interviews, focus groups, and field notes, we elicited their voices and generated three main themes from a thorough data analysis process: *Establishing the Significance of SEL through CPD; Putting SEL into Practice; and Realities of Establishing SEL*.

Establishing the Significance of SEL through CPD

To assist in teaching SEL, all of the educators experienced varying forms of SEL CPD, which primarily focused on the implementation of RP within their classrooms and across the school's microsystem and mesosystem. This occurred through designated staff completing out of school workshops, followed by in-school training, monthly meetings, and informal interactions and follow-ups. All members of the SELT participated in out of school workshops. Following these, they then returned to Clonkeen and facilitated the rest of the staff in professional development focusing on the use of RP: "I was sent to a training for trainers. So now I can train people in RP specifically" (Thomas, Grade 4 Teacher); "I was trained as a trainer to be able to facilitate RP and professional development" (Jackie, Social Worker); "We received a lot of training upfront before the kids came...I felt like that was helpful" (Jess, Grade 5 Teacher). Following the in-school training prior to the beginning of the school year, the monthly staff meetings then helped the teachers discuss the ongoing establishment of SEL within their daily practices: "Every staff meeting we go over these things...It's giving awareness to all the staff about what we're doing and what we're trying to accomplish" (James, K-5 PE Teacher); "It has been very informative in helping us to think about how we respond to things" (Teresa, Principal). The value of discussing their experiences collectively and sharing ideas and resource was repeatedly alluded to: "The interactions that you have with your peers when you're going through it is so honest" (Sarah, Grade 5 Teacher); "We would share different ways we would use those discipline approaches and then talking about ones that didn't work and ones that did work" (Hannah, Grade 2 Special Ed Teacher). In addition to the monthly meetings, the teachers noted the ongoing informal guidance and support from the mesosystem level to implement SEL practices at a microsystem level in their classrooms. Teachers were also comfortable in seeking informal follow up support from the school social worker and administration who would regularly check in with and make themselves available to teachers outside of scheduled training and CPD when needed: "Our counselor is great... administration [and] is super helpful...we go to them if we ever need them" (Hannah).

Supplementing the emphasis placed on SEL practices within the ongoing experiences of CPD, the educators interviewed recognized the significance of teaching SEL and prioritized it as a fundamental prerequisite for broader learning that extended beyond the school: "Our kids need to learn how to be productively interactive, in order then to gain the academic and social skills that they need to be not only good students, but good citizens" (Chris, School Director); "It's definitely important for our students to learn about kindness about compassion about treating, treating one another with respect" (Jackie). The use of RP was seen as significant in changing the school's approach to behavior: "It's not just trying to reinforce particular behaviors; it's trying to kind of change the thinking that's behind that" (Thomas). Emphasizing the significance of SEL meant educators recognized the need to providing a more holistic approach to schooling that went beyond core curriculum and content: "They can't learn academics if these base needs and comforts, safety and security aren't met first" (Sarah). We observed and wrote in our field notes that owing to their appreciation of the significance of SEL and ongoing CPD, teachers found themselves establishing SEL practices more frequently in their classrooms.

Putting SEL into Practice

Teachers identified a number of SEL practices they were implementing at the microsystem and mesosystem level which had derived from their experiences of CPD to assist in developing students' cognitive regulation, emotional processes, and social/interpersonal skills.

RP, notably circle time and restorative conversations, and behavior modeling were seen as successful for teaching self-regulation and interpersonal skills. Circle time was seen as a successful practice for teaching SEL in groups. It allowed teachers to learn more about their students and improve teacher-student and peer relationships: "Too often students are spoken at, they're not spoken to...so we like to use the talking piece to hold them accountable for contributing to the conversation (Teresa); "For those teachers who are well schooled in doing a circle, they have been working well" (Chris); "My class they would circle all day long... it amazes me that they can open up like that...working on them being kind to each other". In smaller groups, restorative conversations were used in an effort to address and resolve conflict: "One person talks...then the other person gets to tell the other person what they did, what they don't like... then they just tell each other things that they like about each other to kind of restore that relationship" (Matt, Assistant Principal). In one-on-one situations, Jackie the Social Worker explained how she would get students to focus on "recognizing various different emotions...[and] discuss ways that they can deal with those emotions". Teachers also noted how modeling language and behaviors themselves to children as well as encouraging students to do so also was also a successful practice: "I should be able to control myself and that's what they need to see...the way that I try to keep my calm is very intentional and it's very difficult" (Sarah); "Having students be the models is so much more effective" (Hannah).

Through their experiences of establishing the significance of SEL, CPD, and subsequent implementation of practices, the educators observed development in students' SEL skills and behaviors. Teresa believed the establishment of SEL had led to better relationships and improved behavior across the school: "It's helped us develop a sense of community and it also has helped plant the seed of empathy within our students...definitely a decline in the number of days missed from school for discipline behavior". At the micro level, teachers noted that students were cooperating, communicating, and responding more constructively to them and their peers when learning in class: "They enjoy talking about themselves, they enjoy learning about their peers, they enjoy learning about their teachers, they enjoy knowing what happens if there's a conflict (Jackie); "They're learning how to work together a lot" (Kerry, Grade 4 Teacher); "I feel like students learn better and they're more open and receptive to ideas and with SEL" (Thomas).

The Realities of Establishing SEL

While teachers' experiences of putting their SEL CPD into practice with their students had led to improvements in practice and behavior, they were also faced with overcoming numerous hurdles that such work involves. These included differing understandings of SEL processes, embedding whole school buy-in, negotiating the sensitive school climate, facilitating time and care, and recognizing the role of family and community.

Understanding of SEL Processes

During the early stages of school wide SEL implementation, educators exhibited distinctive understandings of SEL processes, with no clear unified understanding of SEL or the processes involved to implement SEL appropriately. Instead, they interpreted and described SEL processes in different ways centered around supporting students' emotional well-being through deliberately developing social skills and behaviors, as well as addressing students' individual needs. This meant certain processes were identified and prioritized over others. At the mesosystem level, administrative educators broadly understood SEL as developing emotional well-being within the school community. Chris described SEL processes as "behaviors and skills and dispositions that people need to learn in order to interact with one another in productive ways," while Teresa identified them as "skill sets that allow you to be a part of a community." Jackie focused more on empathy, perspective-taking, and pro-social skills: "[Students] learn about kindness; about compassion; about treating one another with respect." Behaviors and skills were repeatedly identified and described in different ways. At the microsystem level, James described the main processes of SEL in terms of social and interpersonal skills: "working together collaboratively, feeling, problem-solving, thinking together." Thomas and Matt focused on self-awareness and self-management respectively: "understanding yourself and how you interact with other people in a positive way"; "build empathy and have students think about their behaviors and think about how their behaviors shape or affect others". Sarah was primarily concerned with students' emotional and behavioral regulation: "they can't learn academics if these base needs and comforts, safety, and security aren't met first." For Hannah, her understanding of SEL was contextual and centered on the "students' needs" rather than any particular set of processes: "I have had a few students that have the label of emotional disturbance and then also have students that have a disability...but need those needs met as well".

Embedding Whole-School Buy-In

The principal and assistant principal expressed uncertainty regarding the extent to which SEL practices were being embraced and implemented with fidelity across the mesosystem despite the CPD everyone had received and continued to participate

in: "[Teachers] are struggling, and being very honest, possibly being defeated in their classrooms" (Teresa); "I see it done with fidelity in some classrooms, maybe not all" (Matt). Such uncertainty was also noted amongst teachers: "Having everybody on board and doing this as a school might be a struggle" (Thomas); "I don't know if other teachers in the school are at the point where they feel overwhelmed?" (Sarah). Despite the efforts to establish SEL pedagogy as common practice, there existed a need to develop CPD and further buy-in across the school: "Most teachers struggle to incorporate RP, even though all the teachers had attended a two-day training and ongoing guidance" (FN, FB, December, 2019); "If it's going to be implemented correctly it needs to be 100% buy-in, everybody in the building speaking the same language, doing the same structure, the circles, and the questionings" (James).

Sensitive School Climate

At the microsystem level, Classroom teachers openly struggled with the shift in practice, which required them to regularly handle emotionally charged and sensitive encounters: "Some days I don't want to talk about it. Some days I just want to, you know, go sit down and move on" (Brooke, Grade 2 Teacher). When it came to SEL, Hannah struggled to know where to place her focus: "To heavily target one behavior when there are so many needs...that's a huge challenge". Dealing with students' SEL needs individually while still maintaining classroom management and a safe environment was a constant challenge: "Inappropriate behaviors are taking away from class time. And that becomes very frustrating" (Teresa). Teachers reported dealing with frequently charged emotional incidents in their classrooms: "I just feel a lot of anger...maybe a little bit of resentment and resistance. I see a lot of kids who are just sad" (Mary, Teacher Inquiry Director); "You turn around and they can just hate each other. And violently act against each other after they were being supportive... you can't turn your back for a second" (Sarah). The classroom situations and contextual challenges teachers were faced with in their teaching practice highlighted the difficult process of transferring CPD theory and learning into practice in their classrooms.

Time and Care

Educators noted that teaching SEL required a considerable amount of time and care: "You can't just give them a list and say, here, go do this. They've got to feel it...time is a tremendous inhibitor." (Chris); "It's a slow process...I think because it's a gradual process. That's a challenge." (Teresa); "It takes a lot of, a lot of time, a lot of energy" (Brooke). This was also reflected in field notes: "These teachers seem to sincerely care about their students, but they know that it takes time for meaningful change" (FN, FB, February, 2020). Teachers' time and care was directed towards their immediate classrooms at the microsystem level rather than the school as a whole: "I've been so deep in my class of needs, it's all I can do to get through my days and keep my sanity and try to keep my calm" (Sarah). Teachers emphasized the need for additional time to provide and seek emotional support and positive mentoring amongst themselves and administration as part of their CPD.

Reimagining the Role of Family and Community

When it came to the macrosystem, teachers acknowledged that the role of students' families and the communities had a huge bearing on their SEL development in school. However, rather than viewing family and the community as a positive element that could facilitate SEL, educators regularly identified it as an inhibitor: "I feel like in a population like ours, it has to be taught more so than in other populations where it may be a natural experience at home" (Teresa). While educators had observed early success in their immediate classrooms and around the school, extending this work beyond the school gates was something that they had struggled to get to grips with. They regularly cited shortcomings in their knowledge about students' lives beyond the school. There was at times a sense of acceptance and despondency in the language used by teachers around macro issues such as poverty, crime, violence, and trauma in the community which impacted students' learning and school engagement: "There's so much all the time with so many of them. Like 'Oh, another stabbing, another shooting, another murder'" (Sarah). "A lot of our students go home to a very non-nurturing destructive area or household...when they come here to us, they still have their defense up. They're being taught to have this very tough skin" (James). The "home-school disconnect" observed by Taylor was a source of frustration for many teachers and made it difficult for them to reimagine the role of family and community in the process, instead drawing deficit conclusions/assumptions: "If they aren't emotionally prepared, they end up in jail, they commit petty crimes" (Kerry);"We want to use the same strategies at school, at home, but parents are so overwhelmed too that that's hard to keep consistent" (Hannah); "I think a lot of parents, if somebody has done something to their child, they want that person punished" (Thomas). The pedagogical practice of circle time repeatedly elicited the challenging home life students lived in which led teachers to feel uncomfortable: "I think that things that come out [in the circles] are very, very disturbing" (Jess); It's overwhelming, some of their revelations that come out in front of the whole group are just a lot to take in" (Anne, Grade 5 Special Education Teacher).

As principal, Teresa recognized the need to bridge the disconnect between school and family: "I think [SEL] starts at home, but I think then it carries over, you know, into school". This was further echoed further by the assistant principal Matt: "Right now we don't have anything planned to talk to parents about their practices...that is another piece... giving them some tools that we use in school". While the early experiences of establishing SEL and CPD had brought about observed improvements at the microsystem and mesosystem levels in practice and behavior, educators in Clonkeen were acutely aware of the realties establishing a SEL pedagogy brought with it. Moreover, they had yet to fully reimagine and consider the need for such work to go beyond the school and into the community. In the next section, we discuss these contextually relevant findings in relation to the literature and look to inform future practice and CPD experiences for establishing SEL in an elementary school with at-risk students.

Discussion

Adopting a qualitative approach exploring educators' experiences of establishing SEL pedagogy in an elementary school with at-risk students helps demonstrate how the teaching and establishment of SEL is influenced by many multi-level environmental and political factors, including culture and climate (Dyson et al., 2011; Jones & Doolittle 2017). Pedagogies that prioritize SEL like RP are increasingly seen as critical prerequisites for at-risk students and can contribute to higher academic achievement (Hamre et al., 2013; Oberle et al., 2016). However, the priority of many elementary schools at present is to educate students to master essential academic content areas with an emphasis placed on a common core of subjects, assessments, and standardization (Berry, 2011). Frydenberg and Muller (2017) believe initiatives "that are not embedded in school culture tend to have a [short] shelf life" (p. 386). Within Clonkeen Elementary, there was a conscious emphasis being placed on the significance of SEL and its establishment at the microsystem and mesosystem levels in classroom practice and school culture through provisions for CPD for longer term developmental impact. The teachers established their own SEL support group that met monthly to discuss issues and concerns surrounding SEL in their classes, sporting events, and gymnasium. Not only was the focus on developing students' SEL, in addition the educators recognized the need to develop their own SEL competency. In this way, the knowledge they were sharing and generating helped support and inform their use of SEL pedagogies and allowed them to align and adapt these widely accepted practices to extend beyond their respective classrooms and across the school community. There was an emphasis on the need for refinement and continuous improvement, which led to new understandings and consistent approaches amongst all educators in the school.

School connectedness has been identified as a significant mediator to school climate and conduct problems (Panayiotou et al., 2019). Considering the microsystem and mesosystem, when schools like Clonkeen explicitly cultivate a culture of care and emotional support, this can in turn change the behavior of everyone within it (Espelage at al., 2013). Literature on school discipline highlights a significant inverse relationship between suspensions and achievement, along with a significant positive relationship between suspensions and dropouts (Noltemeyer et al., 2015). Too often, researchers and practitioners are more concerned with teaching and idealizing good behaviors that they forget the need to acknowledge and teach students that, for example, conflict is a natural and normal part of social interaction. In line with best practice, these educators tried to implement RP to teach SEL, not in isolation, but instead deliberately and consistently within the generalized curriculum in an effort to "support children's use and internalization of skills to support a positive classroom environment" (Schonert Reichl, 2019, p. 226).

Providing staff with consistent CPD and opportunities to develop their SEL competence, pedagogical skills, and share and reflect their experiences led to further establishment of RP that attempted to promote "communication, mutual respect, and understanding between all people" (Mansfield et al., 2018, p. 306). As teachers worked together and learned through CPD how to put SEL into practice, they could see gradual improvements in their own practice at the microsystem level which in turn was leading to short term developmental outcomes (Jones & Bouffard, 2012). In doing so, teachers were working with their students to create a healthier school climate by reinforcing SEL throughout the school day beyond singular classrooms (Smith & Low, 2013). Gradually, educators in Clonkeen were developing and establishing these practices and were able to observe the beginning of a shift in student classroom behavior towards "an environment that consistently fosters awareness, empathy, and responsibility in a way that is likely to prove far more effective in achieving social discipline than our current reliance on punishment and sanctions" (Wachtel, 2012, p. 9). Key to this was a consistent modelling of behavior and language by teachers which embodied SEL, and which students could experience and demonstrate with staff, amongst themselves, and potentially take home with them. In this way, SEL pedagogies were becoming a regular part of day-to-day schooling alongside the accomplishment of broader learning objectives. The initial CPD initiatives were successful in transforming

school culture and classroom environments, albeit in modest ways.

Yet, subjectively exploring the "black-box" of how all this was occurring and the extent to which the establishment of SEL pedagogies played out in practice demonstrates that such an approach was far from plain sailing. People influence their settings, and their settings exert influence over people's behaviors through cyclical processes (Estabrooks et al., 2008). The lived experiences of the educators in this study provide information that their ability to develop and implement SEL practices in the early days of the process varied and often lacked cohesion. In their classrooms, at the microsystem level, teachers had few opportunities to learn by collaborating with each other through forums facilitating voice, reflection, support, and improved practice (Darling-Hammond & McLaughlin, 2011; Darling-Hammond et al., 2020). At the mesosystem level their combined experiences of CPD varied outside of their monthly meetings. Individual understandings of what exactly they were looking to accomplish and target collectively at times differed amongst teachers implementing SEL at the microsystem level in their own classrooms. This further compounded by constraints of a high standardized academic curriculum and challenging situations involving at-risk students. Inconsistent implementation remains a significant obstacle for the implementation of SEL in classrooms (Evans et al., 2015). Zhai et al. (2015) attribute this to variations in program definitions, designs, and fidelity of implementations. Alongside improvements, educators in Clonkeen openly observed and expressed difficulty in in cursory implementation, fidelity in use, whole-school buy-in, and appropriate adult modelling. Staff were unquestionably dedicated in their broad commitment to SEL at the mesosystem level in their school meetings. However, as such work extended out from the classrooms and into school and family life, significant slippage was occurring and the extent to which the skills learned in school were transferring into students' broader lives was still difficult to determine.

The reality of their contextual conditions and frequent adverse classroom incidences weighed heavily on teachers. Even experienced and capable teachers were challenged in implementing RP, and their underlying beliefs, perceptions, and attitudes about programming appeared to influence implementation (Humphrey et al., 2018). There existed a mixed understanding and focus among educators as to the SEL skills they were each targeting and prioritizing. Reflecting the many factors involved in the process from a social ecological perspective, teachers' own SEL competence and well-being before, during, and after their day's work also played a pivotal role in influencing the infusion of SEL (Kaynak Elcan, 2020; Schonert- Reichl et al., 2015; Weissbourd et al., 2013). Implementing RP authentically was a daunting task for teachers as it led to managing moments of conflict and behavior, which may otherwise have gone unaddressed. A collaborative and holistic pedagogy such as RP asks teachers and students to embrace all the ranging facets of human emotion and behavior and is necessary in order to help teach SEL meaningfully (Darling-Hammond et al., 2020; Ginwright, 2016). This *warts and all* approach to SEL led to difficult moments on a day-to-day basis for students, and the educators themselves, who themselves admittedly often struggled to comprehend and manage.

Research into change in schools has usually been focused at either a macrosystem level or a microsystems level (Fullan, 1999, 2005). At the microsystem level there existed a clear need to further collectively uplift teachers as learners within their classrooms, providing them with more holistic and regular CPD to improve their understanding and establishment of SEL pedagogies, which then valued and reflected the whole school's culture at the mesosystem level to enhance broader learning (Elias & Leverett, 2011). However, in a systematic fashion, we propose that at Clonkeen, the macrosystem impacts both the teacher and child through its indirect influence on the microsystem and mesosystem (Espelage et al., 2013). The qualitative insights of educators in Clonkeen helped highlight where gaps existed and further support was critically required in order to incorporate the wider community (macrosystem level) and the fundamental role and influence of family in development of their students, but of themselves also. This was especially the case when it came to establishing SEL beyond the school and in the wider community. The educators' capacities to reimagine and engage with the culture of the wider community to transcend SEL beyond the school, even at such an early stage, was made problematic by their pre-existing perceptions of the community. Understanding how to better manage and bridge these ecological gaps is just as necessary for effective fostering of desired competencies in students (Ee & Wong, 2014; Zinsser et al., 2014). This was something the educators needed to learn by their own admission. While much had been accomplished by educators at Clonkeen, further persistence and effort was needed to establish and develop SEL practices beyond the initial phase of implementation so as to contribute to long term outcomes and improved academic achievement.

Conclusion

Considering the establishment of SEL from a social ecological perspective within Clonkeen highlights the need to understand the dynamic relationships between people and their environments. Successful

SEL approaches need to target multiple levels of the school social-ecological system. While meta-analyses support the general effectiveness of SEL programs, there is a lack of research focusing on differential effectiveness (i.e., what works, for whom it works, and under what conditions) (Jones et al., 2017). While RP are believed to have the potential to foster the type of reflection that enhances students' SEL development, further empirical evidence is still required in order to confirm this (Gregory & Fergus, 2017; Sumner, Silverman, & Frampton, 2010). This is especially the case when it comes to infusing SEL pedagogies such as RP within a generalized curriculum rather than in isolation. Unfortunately, the type of experiences and work observed in Clonkeen doesn't always result and manifest itself in instant transformation and improved academic test scores. Compared with the quantitative methodologies that have dominated SEL literature, this study shows us the nuanced contextual opportunities and challenges educators experience when it comes to initially understanding and practically establishing and implementing SEL pedagogies holistically. Just as recognizing what works in establishing and implementing SEL pedagogies in specific contexts, so too must such work be juxtaposed with an appreciation of what impedes it. Doing so openly and honestly under real-world conditions such as those the educators in Clonkeen faced every day can help better understand and enhance their translational value into and beyond the natural classroom setting (Carroll, Bower, Ashman, & Lynn 2017; Merrell & Gueldner, 2012).

Wigelsworth et al. (2016) who argue that rather than questioning "*does SEL work?*" we should instead question "*how does SEL work (or, why does it fail?)?*" (p. 368). While gradually developing SEL on the surface, a qualitative look shows the extent and intricacies of the realities educators faced in their commitment to such work and the slippage from theory to practice which was occurring. The ongoing CPD was beneficial, local knowledge and innovation can only be found through further working openly and honestly within the contexts of teachers' communities in order to theorize and construct their work (Cochran-Smith & Lytle, 1999). In order to meet the cultural sensitivity of schools like Clonkeen, more formal and localized communities of practice are needed to help cultivate such a unified approach to establishing SEL (Darling-Hammond & McLaughlin, 2011; Darling-Hammond et al., 2020). Using qualitative methods within a mixed-methods research design that gathers empirically based-evidence could provide a deeper understanding which can help us assess how CPD impacts educators' effectiveness in teaching SEL beyond just quantitative data. There is a lack of qualitative research and a predominance of quantitative research designs foregrounded in SEL literature (Dyson et al., 2019; 2020; Corcoran et al., 2018; 2020; Hamre et al., 2013) and in our research we seek a deeper understanding of the realities teachers' face every day doing the important work they do. In closing, we emphasize that on deeper qualitative inspection, initial student SEL learning outcomes that arose from educators' efforts in Clonkeen while continuing to be a work in progress, were certainly worthwhile – something which can often be overlooked using quantitative methods. Further appreciation and research as to how such well-intentioned work is made more successful or inhibited is necessary if teachers are to help students to perform effectively in schooling and improve academic achievement, while also supporting and preparing them to negotiate their lives beyond the classroom and into the future.

References

Berry, R. (2011). Assessment reforms around the world. In R. Berry& B. Adamson (Eds.), *Assessment reform in education: Policy and practice* (pp. 89–102). London, UK: Springer

Blyth, D.A., Borowski, T., Farrington, C.A., Kyllonen, P., & Weissberg, R.P. (2019). *Ten criteria for describing and selecting SEL frameworks.* Chicago, IL: Collaborative for Academic, Social, and Emotional Learning.

Bornstein, M. H., & Lamb, M. E. (2015). *Developmental Science: An Advanced Textbook* (7th ed.). Mahwah, NJ: Erlbaum.

Brackett, M. A., Reyes, M. R., Rivers, S. E., Elbertson, N. A., & Salovey, P. (2012). Assessing Teachers' Beliefs About Social and Emotional Learning. *Journal of Psychoeducational Assessment, 30*(3), 219–236. https://doi.org/10.1177/0734282911424879

Bronfenbrenner, U. (1979). *The Ecology of Human Development. Experiments by Nature and Design.* Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. (1992). Ecological systems theory. In R. Vasta (Ed.), *Six theories of child development: Revised formulations and current issues* (p. 187–249). Jessica Kingsley Publishers.

Cappella, E., Frazier, S. L., Atkins, M. S., Schoenwald, S. K., & Glisson, C. (2008). Enhancing schools' capacity to support children in poverty: An ecological model of school-based mental health services. *Administration and Policy in Mental Health and Mental Health Services Research, 35*(5), 395.

Carroll, A, Bower,J.M., Ashman, A.F., & and Lynn, S. (2017). Early Secondary High School—A Mindfield® for Social and Emotional Learning. In Frydenberg, E., Martin, A. J., & Collie, R. J. (Eds) *Social and Emotional Learning in Australia and the Asia-Pacific* (pp.335-352). Singapore: Springer

Cochran-Smith, M., & Lytle, S. L. (1999). Relationships of knowledge and practice: Teacher learning in communities. *Review of research in education, 24*(1), 249-305.

Cooksey, R., & McDonald, G. (2019). *Surviving and Thriving in Postgraduate Research*. Springer Singapore. https://doi.org/10.1007/978-981-13-7747-1

Corcoran, R. P., Cheung, A. C. K., Kim, E., & Xie, C. (2018). Effective universal school-based social and emotional learning programs for improving academic achievement: A systematic review and meta-analysis of 50 years of research. *Educational Research Review, 25,* 56–72. https://doi.org/10.1016/j.edurev.2017.12.001

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science, 24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Darling-Hammond, L., & McLaughlin, M. W. (2011). Policies That Support Professional Development in an Era of Reform. *Phi Delta Kappan, 92*(6), 81–92. https://doi.org/10.1177/003172171109200622

Durlak, J. A. (2016). Programme implementation in social and emotional learning: Basic issues and research findings. *Cambridge Journal of Education, 46*(3), 333–345.

Dyson, B., Howley, D., & Shen, Y. (2019). Teachers' perspectives of social and emotional learning in Aotearoa New Zealand primary schools. *Journal of Research in Innovative Teaching & Learning, 12*(1), 68–84. https://doi.org/10.1108/JRIT-02-2019-0024

Dyson, B., Howley, D., & Shen, Y. (2020). 'Being a team, working together, and being kind': Primary students' perspectives of cooperative learning's contribution to their social and emotional learning. *Physical Education and Sport Pedagogy,* 1–18. https://doi.org/10.1080/17408989.2020.1779683

Dyson, B., Wright, P. M., Amis, J., Ferry, H., & Vardaman, J. M. (2011). The Production, Communication, and Contestation of Physical Education Policy: The Cases of Mississippi and Tennessee. *Policy Futures in Education, 9*(3), 367–380. https://doi.org/10.2304/pfie.2011.9.3.367

Espelage, D. L., Rao, M. A., & Rue, L. D. L. (2013). Current research on school-based bullying: A social-ecological perspective. *Journal of Social Distress and Homelessness, 22*(1), 21–27. https://doi.org/10.1179/1053078913Z.0000000002

Estabrooks, P. A., Fisher, E. B., & Hayman, L. L. (2008). What is Needed to Reverse the Trends in Childhood Obesity? A Call to Action. *Annals of Behavioral Medicine, 36*(3), 209–216. https://doi.org/10.1007/s12160-008-9070-7

Ee, J., Zhou, M., & Wong, I. (2014). Teachers' Infusion of Social Emotional Learning. *Journal of Teaching and Teacher Education, 210*(1183), 1–19. https://doi.org/10.12816/0004407

Elias, M. J. (2019). What If the Doors of Every Schoolhouse Opened to Social-Emotional Learning Tomorrow: Reflections on How to Feasibly Scale Up High-Quality SEL. *Educational Psychologist, 54*(3), 233–245. https://doi.org/10.1080/00461520.2019.1636655

Elias, M. J., & Leverett, L. (2011). Consultation to Urban Schools for Improvements in Academics and Behavior: No Alibis. No Excuses. No Exceptions. *Journal of Educational and Psychological Consultation, 21*(1), 28–45. https://doi.org/10.1080/10474412.2010.522877

Evans R., Murphy S., & Scourfield J. (2015). Implementation of a school-based social and emotional learning intervention: Understanding diffusion processes within complex systems. *British Educational Research Journal, 16,* 754–764. doi: 10.1007/s11121-015-0552-0

Fraser, M. W., Thompson, A. M., Day, S. H., & Macy, R. J. (2014). The Making Choices Program: Impact of Social-Emotional Skills Training on the Risk Status of Third Graders. *The Elementary School Journal, 114*(3), 354–379. https://doi.org/10.1086/674055

Fronius, T., Darling-Hammond, S., Persson, H., Guckenburg, S., Hurley, N., Petrosino, A. (2019). *Restorative justice in U.S. schools: An updated research review.* Woburn, MA: WestEd Justice and Prevention Research Center.

Frydenberg, E. & Muller, D. (2017) SEL Approaches that Have Worked: A Case Study of the Role of Formative Evaluation. In Frydenberg, E., Martin, A. J., & Collie, R. J. (Eds) *Social and Emotional Learning in Australia and the Asia-Pacific* (pp.371-389). Singapore: Springer

Fullan, M. (1999) *Change Forces: the sequel.* London: Falmer Press.

Fullan, M. (2005) *Leadership and Sustainability Systems: thinkers in action.* Thousand Oaks, CA: Corwin Press.

García, E., & Weiss, E. (2016). *Making Whole-Child Education the Norm: How Research and Policy Initiatives Can Make Social and Emotional Skills a Focal Point of Children's Education.* Economic Policy Institute. https://eric.ed.gov/?id=ED568889

Ginwright, S. (2016). Hope and healing in urban education: How urban activist and teachers are reclaiming matters of the heart. New York: Routledge.

Gregory, A., & Fergus, E. (2017). Social and Emotional Learning and Equity in School Discipline. *The Future of Children, 27*(1), 117–136. JSTOR.

Gonzalez, T. (2012). Keeping kids in schools: Restorative justice, punitive discipline, and the school to prison pipeline. *JL & Educ., 41,* 281.

Hamre, B. K., Pianta, R. C., Downer, J. T., DeCoster, J., Mashburn, A. J., Jones, S. M., ... Brackett, M. A. (2013). Teaching through interactions: Testing a developmental framework of teacher effectiveness in over 4,000 classrooms. *The Elementary School Journal, 113*(4), 461-487.

Hoglund, W. L. G., Klingle, K. E., & Hosan, N. E. (2015). Classroom risks and resources: Teacher burnout, classroom quality and children's adjustment in high needs elementary schools. *Journal of School Psychology, 53*(5), 337–357. https://doi.org/10.1016/j.jsp.2015.06.002

Humphries, M. L., Williams, B. V., & May, T. (2018). Early Childhood Teachers' Perspectives on Social-Emotional Competence and Learning in Urban Classrooms. *Journal of Applied School Psychology, 34*(2), 157–179. https://doi.org/10.1080/15377903.2018.1425790

Jacobson, S. (2019). Social Justice Leadership for Academic, Organisational and Community Sustainability in High-Needs Schools: Evidence from New Zealand, Belize and the USA. In P.S. Angelle & D. Torrence (Eds.) *Cultures of Social Justice Leadership* (pp. 21-42). Cham, Switzerland: Palgrave Macmillan

Jones, S., Bailey, R., & Kahn, J. (2019a). The Science and Practice of Social and Emotional Learning: Implications for State Policymaking. *State Education Standard.*

Jones, S. M., & Bouffard, S. M. (2012). Social and Emotional Learning in Schools: From Programs to Strategies and commentaries. *Social policy report, 26*(4), 1-33.

Jones, S., Brush, K., Bailey, R., Brion-Meisels, G., McIntyre, J., & HKhan, J. (2017). *Navigating SEL from the inside out. looking inside and across 25 leading SEL programs: a practical resource for schools and OST providers.* Cambridge, MA: Harvard Graduate School of Education.

Jones, S. M., & Doolittle, E. J. (2017). Social and Emotional Learning: Introducing the Issue. *The Future of Children, 27*(1), 3–11.

Jones, S. M., McGarrah, M. W., & Kahn, J. (2019b). 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

Karp, D. R., & Breslin, B. (2001). Restorative justice in school communities. *Youth & Society, 33*(2), 249-272.

Kaynak Elcan, N. (2020). A close look at teachers´ lives: Caring for the well-being of elementary teachers in the US. *Journal of Emotional Education, 12*(1), 19-34.

Lipponen, L., Rajala, A., & Hilppö, J. (2018). "Compassion and Emotional Worlds in Early Childhood Education." In C.A. Pascal, T. Bertram, and M. Veisson (Eds) *Early Childhood Education and Change in Diverse Cultural Contexts* (pp. 162–173). New York: Routledge.

Macready, T. (2009). Learning social responsibility in schools: A restorative practice. *Educational Psychology in Practice, 25*(3), 211–220. https://doi.org/10.1080/02667360903151767

Mansfield, K. C., Fowler, B., & Rainbolt, S. (2018). The Potential of Restorative Practices to Ameliorate Discipline Gaps: The Story of One High School's Leadership Team. *Educational Administration Quarterly, 54*(2), 303–323. https://doi.org/10.1177/0013161X17751178

Merrell, K. W., & Gueldner, B. A. (2012). *Social and emotional learning in the classroom: Promoting mental health and academic success.* Guilford Press.

Miles, B.M., Huberman, A.M., & Saldana, J. (2014). Qualitative Data Analysis: A Methods Sourcebook. (3rd. Ed). Los Angeles: Sage.

Morrison, B., Blood, P., & Thosborne, M. (2005). Practicing restorative justice in school communities: The challenge of culture change. *Public Organization Review, 5*, 335–357.

Mullet, J. H. (2014). Restorative discipline: From getting even to getting well. *Children & Schools, 36*(3), 157-162.

Noltemeyer, A. L., Ward, R. M., & Mcloughlin, C. (2015). Relationship Between School Suspension and Student Outcomes: A Meta-Analysis. *School Psychology Review, 44*(2), 224–240. https://doi.org/10.17105/spr-14-0008.1

Oberle, E., Domitrovich, C. E., Meyers, D. C., & Weissberg, R. P. (2016). Establishing systemic social and emotional learning approaches in schools: A framework for schoolwide implementation. *Cambridge Journal of Education, 46*(3), 277–297. https://doi.org/10.1080/0305764X.2015.1125450

Oberle, E., & Schonert-Reichl, K. A. (2017). Social and Emotional Learning: Recent Research and Practical Strategies for Promoting Children's Social and Emotional Competence in Schools. In J. L. Matson (Ed.), *Handbook of Social Behavior and Skills in Children* (pp. 175–197). Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-64592-6_11

Ottmar, E. R., Rimm-Kaufman, S. E., Larsen, R. A., & Berry, R. Q. (2015). Mathematical Knowledge for Teaching, Standards-Based Mathematics Teaching Practices, and Student Achievement in the Context of the Responsive Classroom Approach. *American Educational Research Journal, 52*(4), 787–821. https://doi.org/10.3102/0002831215579484

Panayiotou, M., Humphrey, N., & Wigelsworth, M. (2019). An empirical basis for linking social and emotional learning to academic performance. *Contemporary Educational Psychology, 56,* 193–204. https://doi.org/10.1016/j.cedpsych.2019.01.009

Panter-Brick, C., Clarke, S. E., Lomas, H., Pinder, M., & Lindsay, S. W. (2006). Culturally compelling strategies for behaviour change: A social ecology model and case study in malaria prevention. *Social Science & Medicine, 62*(11), 2810–2825. https://doi.org/10.1016/j.socscimed.2005.10.009

Schonert-Reichl, K. A. (2019). Advancements in the Landscape of Social and Emotional Learning and Emerging Topics on the Horizon. *Educational Psychologist, 54*(3), 222–232. https://doi.org/10.1080/00461520.2019.1633925

Schonert-Reichl, K. A., Oberle, E., Lawlor, M. S., Abbott, D., Thomson, K., Oberlander, T. F., & Diamond, A. (2015). Enhancing Cognitive and Social–Emotional Development Through a Simple-to-Administer Mindfulness-Based School Program for Elementary School Children: A Randomized Controlled Trial. *Developmental Psychology, 51*(1), 52–66. https://doi.org/10.1037/a0038454

Smith, B. H., & Low, S. (2013). The Role of Social-Emotional Learning In Bullying Prevention Efforts. *Theory Into Practice, 52*(4), 280–287. https://doi.org/10.1080/00405841.2013.829731

Stake, R.E. (2006). *Multiple Case Study Analysis.* New York: Guilford Press.

Stokols, D. (1992). Establishing and maintaining healthy environments: Toward a social ecology of health promotion. *American Psychologist, 47*(1), 6–22. https://doi.org/10.1037/0003-066X.47.1.6

Sumner, M. D., Silverman, C. J., & Frampton, M. L. (2010). *School-based restorative justice as an alternative to zero-tolerance policies: Lessons from West Oakland.* Berkeley, CA: Thelton E. Henderson Center for Social Justice, University of California, Berkeley, School of Law.

United States Department of Education. (2021, February 20). *Race to the Top District Competitions Draft Definitions.* Retrieved from https://www.ed.gov/racetop/districtcompetition/definitions

Vadeboncoeur, J. A., & Collie, R. J. (2013). Locating Social and Emotional Learning in Schooled Environments: A Vygotskian Perspective on Learning as Unified. *Mind, Culture, and Activity, 20*(3), 201–225. https://doi.org/10.1080/10749039.2012.755205

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

Wachtel, T. (2012). Defining restorative. Retrieved from http://iirpds.pointinspace.com/pdf/ Defining-Restorative.pdf

Watchel, T. (2013). *Dreaming of a New Reality: How Restorative Practices Reduce Crime and Violence, Improve Relationships and Strengthen Civil Society.* Bethlehem, PA: The Piper's Press.

Weissbourd, R., Bouffard, S. M., & Jones, S. M. (2013). School climate and moral and social development. *School Climate Practices for Implementation and Sustainability, 30*, 1–5.

Wigelsworth, M., Lendrum, A., Oldfield, J., Scott, A., ten Bokkel, I., Tate, K., & Emery, C. (2016). The impact of trial stage, developer involvement and international transferability on universal social and emotional learning programme outcomes: A meta-analysis. *Cambridge Journal of Education, 46*, 347-376.

Zinsser, K. M., Shewark, E. A., Denham, S. A., & Curby, T. W. (2014). A Mixed-Method Examination of Preschool Teacher Beliefs About Social–Emotional Learning and Relations to Observed Emotional Support. *Infant and Child Development, 23*(5), 471–493. https://doi.org/10.1002/icd.1843

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 639-649

Teaching Evidence-Based Subject Didactics in Primary Teacher Education

Esta Sikkal[a], Krista Uibu[*,b], Irja Vaas[c], Tiia Krass[d]

Received : 14 December 2020
Revised : 27 May 2021
Accepted : 15 June 2021
DOI : 10.26822/iejee.2021.218

[a]Esta Sikkal, Institute of Education, University of Tartu, Tartu, Estonia
E-mail: esta.sikkal@ut.ee
ORCID: https://orcid.org/0000-0002-8278-2557

[*,b]**Corresponding Author:** Krista Uibu, Institute of Education, University of Tartu, Estonia.
E-mail: krista.uibu@ut.ee
ORCID: https://orcid.org/0000-0001-6740-1771

[c]Irja Vaas, Institute of Education, University of Tartu, Tartu, Estonia
E-mail: irja.vaas@ut.ee
ORCID: https://orcid.org/0000-0001-5559-8204

[d]Tiia Krass, Institute of Education, University of Tartu, Tartu, Estonia
E-mail: tiia.krass@ut.ee
ORCID: https://orcid.org/0000-0002-1247-4305

Abstract

For contemporary teaching, teachers need good knowledge of pedagogy, content, subject methodology and assessment. Although subject didactics have become an independent research area with interdisciplinary dimensions, few studies focus on the teaching of subject didactics. With the aim of developing a theoretical model for the systematic treatment of subject didactics, a scoping literature review was carried out to analyse the scientific literature. Twenty-five articles were chosen from different databases in the field of study. Data analyses revealed three domains of subject didactics: content knowledge, pedagogical content knowledge and knowledge of subject-specific assessment. These domains included various components which were used for developing a theoretical model for teaching subject didactics within the framework of primary teacher education. The results indicated how to organise university courses on subject didactics for primary teachers. First, teachers' content knowledge and pedagogical knowledge should be treated in an integrated way. Second, integrating pedagogical knowledge with subject didactics enables teacher education to be shaped so that students understand the teaching profession at an early stage. Third, studying subject didactics on both a theoretical and empirical level is the driving force for developing syllabi in primary teacher education.

Keywords:

Primary Teacher Education, Subject Didactics Model, Evidence-Based Teaching, Scoping Literature Review

Introduction

In order to teach successfully, teachers need a thorough knowledge of different areas; they need to know the content and structure of the subject they teach, as well as subject didactics and pedagogy. Although the core issues of didactics as a branch of pedagogy have been discussed in Europe as early as the 17th century, the more systematic development of didactics began in Germany during the 1950s (Klafki, 2000). It was through assessing the teaching process that questions emerged about how to treat and

define the dimensions between general didactics, i.e. the general objectives, forms and means of education, and subject didactics, i.e. the theoretical and practical foundations of education, teaching and pedagogy (Kansanen & Meri, 1999; Klafki, 2000). This approach is made particularly complex by the fact that the definitions of 'didactics' and 'methodology' are not clearly distinguished in conventional use, and their substantive semantic field remains somewhat blurred. Furthermore, it is not always easy to differentiate between the content of concepts of didactics and methodology.

There is consensus, however, that teacher's pedagogical content knowledge is a critical part of successful teaching, which includes subjective and individual decisions by the teacher and the understanding of how to present the subject taught in a manner that is appropriate and comprehensible for pupils (see Deng, 2018; Küçükaydın & Sağır, 2016; Ozmantar & Akkoç, 2017). The subjective nature of pedagogical content knowledge might be one of the reasons (Ozmantar & Akkoç, 2017) why teacher training lacks a holistic concept of teaching and developing different subject didactics (Doyle et al., 2019; Vollmer, 2014). The second reason may be that the simplified approach to pedagogical content knowledge only includes knowledge of teaching and how to use instructional methods, while their association with theoretical foundations remains superficial (Meijer, 2013). This is why it is considered important to focus on specific areas and components during empirical studies of subject didactics and to rely on proven theoretical approaches and models when planning subject didactics courses as a part of primary teacher education (Ozmantar & Akkoç, 2017; Park & Oliver, 2008).

There appears to be a lack of consensual understanding about what areas, components and connections to highlight in relation to teachers' pedagogic content knowledge (Gess-Newsome, 2017; Park & Oliver, 2008). Therefore, some topics and components are presented more frequently than others in models of subject didactics. There are two topics that are considered very important in innovative teaching, originating from Lee Shulman's studies (Shulman, 1986, 1987): the need to understand learners and their way of learning and teaching strategies and their application in the process of teaching.

The development of subject didactics as an independent field of research has been surprisingly dynamic in recent decades, both at the theoretical and practical level (Heizmann, 2013). Although different schools address the concepts of subject didactics somewhat differently, it has become an area of interdisciplinary dimension in which different research methods are used and are systematically developed. For example, in addition to quantitative research methods, case studies (Küçükaydın & Sağır, 2016) or documented lesson analysis (Bonnet, 2009) are also used, focusing on the design of knowledge, the scientific description of content and the analysis of practical comprehension and action. However, in Estonia, where diametrically opposed paradigms and values are evident in the education system, there is no historical tradition of studying the teaching of subject didactics at universities (Studies in Social and Educational Sciences, 2014). This study examines the areas and components of primary school teachers' pedagogical content knowledge and relations between them that belong in the model of contemporary subject didactics. Using the methodology of a scoping literature review, the scientific literature on subject didactics published within the last decade in English and German is analysed, and a theoretical model for the systematic teaching of subject didactics within the framework of teacher training is being developed.

Classification of Didactics

Didactics are classified in different ways. The most elementary option is to divide didactics into general didactics and subject didactics. General didactics can be described as a set of teaching patterns that are independent from the specific content of subjects, levels of education and characteristics (Unt, 2013). In contrast, subject didactics include a set of patterns required to teach one subject or group of subjects. This includes the planning, conducting and analysing of teaching, which are complemented by the patterns of general didactics (Unt, 2013). A second option for classifying didactics is to distinguish between theoretical and applied didactics or, according to Vollmer (2014), into normative and practical subject didactics. This approach is based on the belief that applied didactics that have practical content must proceed from theoretical models and rationales and that all practical actions must rely on theoretical didactics in a way that creates synergy between them (Kansanen & Meri, 1999; Vollmer, 2014). Applied didactics with practical content are used as a mediator (e.g. teaching is carried out at school in a specific situation) and are often a driving force for didactical innovation (Niermann, 2017; Vollmer 2014).

Based on such a hierarchical structure of didactics, Shulman (1987) identified the knowledge necessary for teachers' work and proposed a teacher knowledge model that includes three wider areas: 1) knowledge of the subject, i.e. content knowledge, 2) pedagogical knowledge, and 3) pedagogical content knowledge that unites pedagogy and subject knowledge. The main emphasis in this division is subject didactics,

or how, using pedagogical knowledge, to teach a subject or a certain topic as effectively as possible.

Pedagogical content knowledge of teachers can be considered a key element in their professional development (Park & Oliver, 2008; Richardson et al., 2018) as it differentiates them from experts in specific fields (Stender et al., 2017). Bohlmann (2016) describes pedagogical content knowledge as a fusion — an amalgam — of content knowledge and pedagogical knowledge, not a separate type of knowledge. For example, if a specialist in physics has good content knowledge in a narrow field, then the teachers of physics have to know more than physicists; they need to have superior knowledge of different aspects of physics and of numerous topics to be able to integrate different topics and provide adequate feedback to pupils (Kirschner, 2016). Studies have found that the pedagogical content knowledge of teachers has a major influence on the academic progress of pupils (Meschede et al., 2017; Reinfried et al., 2009). This raises the question of how teachers make the topic and their content knowledge understandable to their pupils (Kurt-Birel et al., 2020; Meschede et al., 2017; Ozmantar & Akkoç, 2017; Tröbst et al., 2018).

Areas and Components of Pedagogical Content Knowledge

In order to understand the nature of pedagogical content knowledge, four yes-no questions have to be answered (Rollnick, 2017). First: *Is content knowledge a component of pedagogical content knowledge or separate knowledge?* The question is whether knowing the subject or the content of the area is an important prerequisite for the development of pedagogical content knowledge or whether they should be approached separately. Despite the fact that many models of subject didactics have treated content knowledge as a separate component, it is still an important aspect of subject didactics. Second: *Is the pedagogical content knowledge collective or personal knowledge?* The pedagogical content knowledge that is used in practice is collective and theories on which the implementation of pedagogical content knowledge is based are canonical (Rollnick, 2017). Also, pedagogical content knowledge can be specific for each teacher, as it is formed though experiences gained in real teaching situations. Third: *Does pedagogical content knowledge find its expression in teachers' knowledge or actions?* Kirschner (2016) believes that the pedagogical content knowledge of teachers develops hand-in-hand with practice, but the transfer of knowledge to practical activities may not always take place. Fourth: *Is pedagogical content knowledge domain-specific, subject-specific or topic-specific?*

Some authors consider pedagogical content knowledge to be domain-specific knowledge that develops in practice and is unique to each teacher (Bohlmann, 2016; Kirschner, 2016; Rollnick, 2017). The uniqueness is expressed in the fact that teachers' pedagogical content knowledge is related to their personal values, beliefs and self-regulation (Kirschner, 2016). Other authors consider pedagogical content knowledge to be topic-specific, stressing that in order to teach any new topic, new pedagogical content knowledge must be acquired (Doyle et al., 2019; Park & Oliver, 2008; Rollnick, 2017).

Teachers' pedagogical content knowledge starts to evolve early. Tröbst et al. (2018) have introduced a three-phase development path of pedagogical content knowledge in which beliefs about teaching start to form as early as the pupil stage when students have experiences at school. During university studies, future teachers acquire theoretical knowledge in subject didactics courses, and, develop procedural pedagogical content knowledge with the support of teaching practices and reflexion. As a result of the diversity of teachers' knowledge, components of pedagogical content knowledge are defined differently in different approaches (Rollnick, 2017, Shulman, 1987; Stender et al., 2017).

For example, in simpler approaches, two components of knowledge are distinguished: knowledge of teaching strategies and knowledge of how pupils learn and understand the subject (Deng, 2018; Meschede et al., 2017; Tröbst et al., 2018). In the case of teaching strategies, it is important that teachers know their strengths and weaknesses and are able to present the content of different subjects (e.g. giving analogies and examples, conducting experiments and observations, offering explanations and carrying out demonstrations), as well as be ready to teach in various environments. According to this classification, pedagogical content knowledge is a combination of subject-specific teaching (content and teaching) and subject-specific learning (content and pupils) (Deng, 2018; Parchmann, 2013). In addition to these components, curriculum knowledge is also considered important (Ball et al., 2008; Rosenkränzer et al., 2017; Stender et al., 2017). Linking curriculum thinking with content knowledge leads to meeting the main goal of education — to improve human capabilities (Deng, 2018) — which helps to understand the educational system as a whole (Rosenkränzer et al., 2017).

On the basis of the classification of pedagogical content knowledge proposed by Gess-Newsome (2017), various models have been developed that are used in research and modified in the teaching of subject didactics in teacher training courses. In addition to knowledge of the subject, teaching

strategies, curriculum and learner's understandings about a subject, these models present knowledge about assessing pupils and the learning context (see Kirschner, 2016; Niermann, 2017; Reinfried et al., 2009; Stender et al., 2017). For example, for teaching natural science subjects, a model is used that highlights teaching strategies, curriculum and assessment, in addition to knowledge about the pupils, as well as the teacher's attitude towards teaching natural sciences (Deng, 2018; Richardson et al., 2018). When teaching design and technology subjects, a model is applied where different types of knowledge are linked to a teacher's specific experiences (Doyle et al., 2019). In foreign language teaching, a model of integrated pedagogical content knowledge is introduced, consisting of two specific components: the teacher's communication competence and intercultural operating competence (Eberhardt, 2013). In conclusion, different components are used in different models of subject didactics. A change in these components or an imbalance between the components leads to a change in teachers' pedagogical content knowledge (Richardson et al., 2018).

The Aim and Research Questions

The aim of the present study was to develop a theoretical model for the systematic treatment of subject didactics in primary teacher education at universities. In order to achieve that goal, the components of pedagogical content knowledge of teachers were analysed on the basis of scientific literature through a literature search and involving studies of different designs. Since the scoping literature review method is not used for seeking answers to narrow, specific questions, the quality of research was used as the main selection criterion (Dijkers, 2015). The analysis relied on the principles of drawing up an overview of literature developed by Arksey and O'Malley (2005). Three research questions were established.

1. What domains of knowledge are necessary for primary teachers to know subject didactics?
2. What components of pedagogical content knowledge are highlighted in empirical research and theoretical approaches?
3. What are the domains of knowledge that should be included in a well-functioning model of teaching subject didactics in primary teacher training?

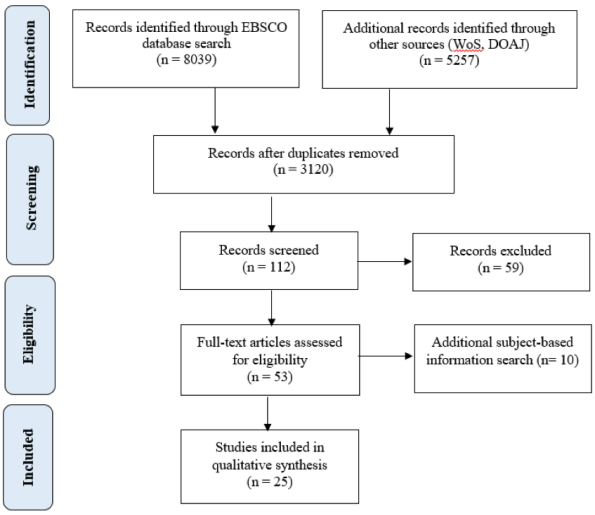
Method

Selection of Articles

A literature search was performed through the EBSCO search engine in databases that included the Academic Search Complete, PsycARTICLES, PsycINFO and the Teacher Reference Center. The search involved bibliography entries in English and German using the following criteria to limit the search: full text, peer reviewed scientific journals and the date of publication between 2008 and 2018. The flowchart of the procedure for the selection of articles is presented in Figure 1.

Figure 1

Literature search for the selection of articles



In the first phase of the search procedure, the research focused on identifying synonyms for the term 'subject didactics' and on defining the areas of topics. Several basic searches were necessary, using different keywords from the database thesaurus, e.g., 'pedagogical content knowledge', 'PCK' (acronym), 'subject-matter' and 'subject didactics' and their German equivalents: 'Fachdidaktik', 'Didaktik eines Faches', 'Fachwissen' and 'Pedagogisches Wissen'. The term 'general pedagogical knowledge' (GPK), was excluded from the search because the goal was to find articles related to teaching subject didactics. Next, the advanced search was used to define topics by combining the keywords AND and OR with the keywords that clearly indicated teacher training.

On the basis of the titles and abstracts of articles, the theories were identified where the authors had defined a base of knowledge necessary to teach subject didactics: 1) content knowledge, 2) pedagogical knowledge, and 3) pedagogical content knowledge. After reviewing the full texts of articles, those scientific articles were chosen for the qualitative synthesis that dealt with teachers' pedagogical content knowledge and its components, and whose full text was available in the database. As a result of the information search, 25 scientific articles in English and German were selected. An additional search for subject-specific scientific articles was also carried out because previously found articles were mainly about the didactics of the sciences.

Data Analysis

As a result of literature search, 25 articles were selected. This procedure was followed by the profound assessment of the articles during which two full texts were excluded, as they did not describe the components of subject didactics. Thereafter, 23 articles that were relevant to answer three research questions were coded and analysed using qualitative inductive content analysis (Mayring, 2014; Vaismoradi, 2013). In the first phase of the analysis, the authors independently read articles to determine the domains and components of subject didactics. Next, they cross-checked articles to confirm their relevance to the research questions. In the second phase, meaningful units (phrases or sentences) were marked in the full texts and initial codes were generated. After thorough discussions with the co-authors, a coding frame was developed. The codes representing similar content were assigned to sub-categories and categories and were structured in relation to the research questions. Double-coding of the articles was conducted to ensure the trustworthiness and the quality of the study (Patton, 2002). In the third phase of the analysis, a summary was drawn up on the basis of the analysis (see Appendix). Finally, two university teachers who taught subject didactics in primary teacher training were asked to give their expert assessment of the results. These assessments have been considered in creating a theoretical model of teaching subject didactics in primary teacher education.

Results and Discussion

Based on the analysis of the scientific articles, the concept of teaching subject didactics is presented in this article, proposing a theoretical model that covers different domains and components and enables the systematisation of teaching of subject didactics in primary teacher training.

Domains of Pedagogical Content Knowledge

First, an answer was sought to the question about what are the domains of knowledge necessary for a primary teacher to know subject didactics. The analysis of articles revealed that, within the teaching of subject didactics, two interconnected groups of knowledge can be distinguished: knowledge of pedagogy and knowledge of subject didactics. This knowledge can be practical as well as theoretical (Deng, 2018) and has a multifunctional character (Heitzmann, 2013). In addition, knowledge of didactics has a close relationship with pedagogy and psychology, specialised sciences and general didactics (Heitzmann, 2013; Niermann, 2017; Reinfried et al., 2009; Vollmer, 2014) is synthesised within all subjects. At the same time, Parchmann (2013) emphasised that when subject didactics is implemented, the knowledge in different areas cannot be arithmetically combined. Pedagogical content knowledge is the 'lesson theory' (Klafki, 2000), which allows for the creation of new knowledge and integration between and across subjects.

The teacher's pedagogical knowledge has been defined by Mishra and Koehler (2006) as a general type of knowledge that includes the understanding of pupils' cognitive and social processes, learning and teaching as well as educational goals and values. Pedagogical knowledge is necessary for primary teachers to understand the psychological processes related to learning. In this connection, it is important to know how to manage teaching practices in the classroom, how to plan and organise teaching and how to assess learning outcomes. Several authors analysed in this article have dealt with pedagogical knowledge together with knowledge on methods and techniques used in the classroom (Rosenkränzer et al., 2017; Stender et al., 2017), teaching strategies (Rollnik, 2017; Rosenkränzer et al., 2017) and the particular features of pupils (Deng, 2018; Niermann, 2017). Previous studies have also shown that teachers themselves tend to value their pedagogical knowledge higher than their content knowledge, and it is difficult for inexperienced teachers to interpret classroom situations on the basis of general pedagogical principles (Meschede et al., 2017). The reason for this may be that inexperienced teachers lack pedagogic knowledge to assess situations and to find meaning in them.

Teachers' pedagogical content knowledge as a larger set of knowledge differs from general pedagogical knowledge and content knowledge by the fact that it includes multiple disciplines (Niermann, 2017; Parchmann, 2013). This type of knowledge includes the formulation and presentation of concepts (Deng, 2018; Doyle et al., 2019; Rosenkränzer et al., 2017), pedagogical techniques (Deng, 2018; Rosenkränzer et al., 2017), and knowing why the acquisition of concepts is sometimes easy for pupils and sometimes difficult (Deng, 2018; Doyle et al., 2019; Mishra & Koehler, 2006; Rosenkränzer et al., 2017). Teachers can apply pedagogical content knowledge to deliver the content of a particular subject by choosing suitable teaching methods (Deng, 2018; Rollnik, 2017; Rosenkränzer et al., 2017). By implementing pedagogical content knowledge, teachers combine the content of the subject with general pedagogical knowledge and thereby improve the learning process (Doyle et al., 2019).

On the basis of the articles analysed in this study, three domains of knowledge were clearly distinguished in the group of pedagogical content knowledge: knowledge about the content of a subject, knowledge

about teaching a subject and knowledge of subject-specific assessment (see Appendix). Each of these domains included different components that are analysed and interpreted in the next chapter.

Components of Pedagogical Content Knowledge

Second, the study aimed to determine which components of pedagogical content knowledge were distinguished in empirical studies and theoretical approaches related to different domains of subject didactics. Subject didactics includes the choice of content, its legitimacy, the justification of the didactic reconstructions and teaching goals, and the methodological structuring of the learning process. As a result, the components of pedagogical content knowledge were divided into three groups.

Content Knowledge

The analysis showed that many authors paid attention to good content knowledge of a subject (Deng, 2018; Meschede et al., 2017; Parchmann, 2013) because the amount of subject knowledge supports the teacher most during the teaching of a subject (Shulman, 1986) and assessing the success of their pupils. Two components were clearly distinguished in content knowledge: the content of a subject and a teacher's knowledge about the subject (see Niermann, 2017). Knowledge about the content of a subject is domain-specific, and its importance has been highlighted in twelve articles. However, teachers' knowledge about subjects that are related to teachers' professionalism are more important than the content of subjects. Teachers' knowledge about subjects is understood as the knowledge about the substantive structure of the subjects (concepts, principles, frameworks) and the syntactical structure (methods of research, ways of presenting and certifying evidence) and the ability to transmit subjects (Porter, 2006). The articles analysed dealt much less with teachers' knowledge about subjects than the content of subjects (see Appendix Table 1). One reason may be that pedagogical content knowledge is not regarded as a different type of knowledge, but rather as a symbiosis of teachers' content and pedagogical knowledge (Bohlmann, 2016). Other authors (Heitzmann, 2013; Reinfried et al., 2009: Vollmer, 2014) highlighted the importance of subject knowledge and how to make the topics understandable to pupils and support their learning process. Thus, the broader the teachers' subject knowledge, the more they seek opportunities to transfer the subject content to their pupils (Rollnick, 2017). In passing on content, it is important to take into account the nature of the subjects and the curriculum, as well as the characteristics of the pupils of different ages and backgrounds (Deng, 2018; Meschede et al., 2017; Rosenkränzer et al., 2017).

Teaching a Subject

Three components related to teaching a subject were differentiated in the analysed articles: 1) learners' comprehension of a subject, 2) knowledge about the subject methodology and strategies, and 3) knowledge about the syllabus and curriculum, i.e. curriculum knowledge. Most of the authors (of a total of 20 articles) considered it important that teachers know how pupils learn, understand the subject and acquire knowledge (see in Appendix for Alonzo & Kim, 2005; Deng, 2018; Krauss et al., 2008). In doing so, Deng (2018) stressed that students' previously acquired knowledge and misunderstandings condition the acquisition of subject content. If teachers know about pupils' learning difficulties, they have a better understanding of the problems encountered during the learning process (Deng, 2018; Meschede et al., 2017).

Teachers who are acquainted with effective teaching methods choose those that are most suitable, taking into account pupils' abilities, age, individual characteristics and background (Deng, 2018; Heizmann, 2013). As to teaching methods, the analysed articles mostly highlighted the methods that facilitate the acquisition of more complex concepts, such as analogy, illustrations, examples, and generalisations (Deng, 2018; Meschede et al., 2017; Rosenkränzer et al., 2017). When implementing new methodological ideas, it is important to ensure that pupils understand the content of a subject, that they are interested in it, and that they acquire knowledge effectively (Parchmann, 2013). Several studies have confirmed that teachers choose teaching methods and their content knowledge, and the quality of their qualification in subject didactics affects the quality of teaching and pupils' academic progress (see Heitzmann, 2013). Thus, experienced teachers are more precise in their explanations and teaching than are inexperienced ones (see Gess-Newsome, 2017).

Teachers' curriculum knowledge includes knowledge about a syllabus and the relevant instructional programmes (Deng, 2018). The content of a subject comes directly from a syllabus that is built on an academic discipline with social, cultural and educational objectives (Porter, 2006). However, the articles analysed exhibited an interesting trend; the authors did not emphasise the necessity of curriculum knowledge when talking about the pedagogical content knowledge of teachers. The reason may be that the curriculum is an area that requires more extensive research in order to deal with it as part of teachers' pedagogical content knowledge. At the same time, it was noted that curriculum knowledge, together with knowledge about educational objectives, differentiates teachers from a subject

specialist (Rosenkränzer et al., 2017). For example, teachers choose the topics they teach based on what they consider to be most important, what they think pupils are ready to learn or what they like to teach (Porter, 2006).

Subject-Specific Assessment

Teachers' curriculum knowledge is closely linked to their knowledge of assessment (Stender et al., 2017). In order to understand the nature of education, it is necessary to know how to assess different aspects of a subject (Richardson et al., 2018). However, the analysed articles did not address assessment as an aspect of teachers' pedagogical content knowledge. The topic of assessment was distinguished only in six articles (e.g. Niermann, 2017; Stender et al., 2017), which may be because assessment is usually considered as a part of teachers' pedagogical knowledge. This study examines teachers' knowledge of subject-specific assessment within the context of certain subjects.

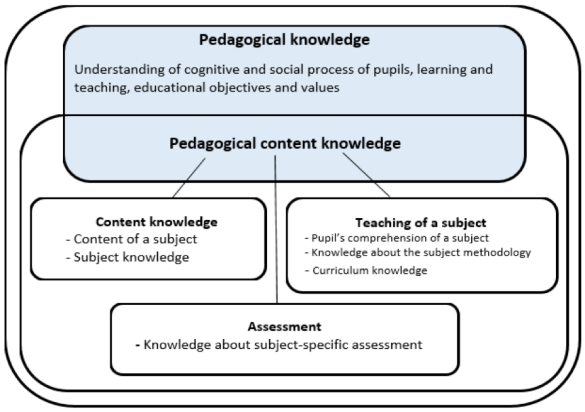
The Model of Teaching Subject Didactics

The authors of this article were interested in what pedagogical content knowledge and other types of knowledge should be included in a well-functioning model of subject didactics for primary teacher training. Having analysed the previous theoretical approaches, it appeared that researchers highlighted different components of teaching pedagogical content knowledge (Gess-Newsome, 2017; Niermann, 2017; Reinfried et al., 2010; Shulman, 1987; Stender et al., 2017). Several models describing teachers' knowledge are based on the Shulman concept (1987), which constitutes the basis for effective teaching. Shulman has identified specific knowledge, i.e. as content knowledge, pedagogical knowledge, and pedagogical content knowledge, as the knowledge necessary for teaching and assessing pupils' learning outcomes. Later studies differ from this model in terms of the number of components and their descriptions (see in Appendix for Deng 2018; Doyle et al., 2019; Parchmann, 2013; Park & Oliver, 2008; Reinfried et al., 2009; Stender et al., 2017). However, until now, it has not been defined how to integrate teachers' content knowledge and skills, with their knowledge of assessment, pupils, curricula and characteristics of subjects and topics. These components were taken into account in this study when creating the model for teaching subject didactics to primary teachers at the university level (see Figure 2).

Based on the results of the literature search, the teachers' pedagogical content knowledge was divided into three areas. Teacher's pedagogical content knowledge can be regarded as an integrated part of pedagogical knowledge. In addition to content knowledge and the knowledge of how to teach the subject, a new area of knowledge, i.e. the knowledge about subject-specific assessment, was added to the model. Subject knowledge was added as a component of content knowledge and the teaching of a subject was broadened by adding knowledge about subject methodology. Whilst creating the model, we had to bear in mind that changing the components or the balance between the components would result in a change in teachers' pedagogical content knowledge (see Richardson et al., 2018) and their understanding of teaching.

Figure 2

Model of teaching subject didactics.



Limitations and Conclusions

This study was an attempt to organise the theoretical foundations of the teaching of subject didactics and to develop a structure for the systematic treatment of subject didactics in primary teacher training. To this end, scientific articles were analysed using the method of a scoping literature review. In doing so, some methodological limitations were encountered. First, information searches were carried out mainly through the EBSCO search engine, limiting articles to those published in the last decade. Consequently, English language articles dominated the relevant scientific articles. However, by expanding the search, the number of German language theoretical approaches can be increased.

On the basis of a theoretical model of pedagogical content knowledge, several recommendations can be made on how to organise the courses of subject didactics in primary teacher education.

1. The model is suitable for the development of disciplines teaching subject didactics, especially those that focus on preparing primary teachers. Teachers' content knowledge and knowledge of pedagogy should be treated in an integrated way.

2. There is a discussion about the great fragmentation between different areas and disciplines related to subject didactics (Vollmer, 2014). Integrating pedagogical knowledge with subject didactics enables the shaping of primary teacher education of students to understand the teaching profession at an early stage.

3. Studying subject didactics on the theoretical and empirical levels is the driving force for developing syllabi in primary teacher education.

Acknowledgement

The study was supported by European Social Fund, project 2014-2020.1.02.18-0645 (Enhancement of Research and Development Capability of Teacher Education Competence Centre Pedagogicum). We would also express our gratitude to Anu Palu for her comments on the model of teaching subject didactics.

References

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology: Theory and Practice, 8*(1), 19–32.

Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59,* 389–407.

Bohlmann, M. (2016). Science Education: Empirie, Kulturen und Mechanismen der Didaktik der Naturwissenschaften. *Studien zum Physik- und Chemielernen, 211*(10/12), 44–50.

Bonnet, A. (2009). Die Dokumentarische Methode in der Unterrichtsforschung: Ein integratives Forschungsinstrument für Strukturrekonstruktion und Kompetenzanalyse. Social Science Open Access Repository. https://www.ssoar.info/ssoar/handle/document/33987

Deng, Z. (2018). Pedagogical content knowledge reconceived: Bringing curriculum thinking into the conversation on teachers' content knowledge. *Teaching and Teacher Education, 72,* 155–164.

Dijkers, M. (2015). What is a scoping review? *KT Update, 4*(1). http://ktdrr.org/products/update/v4n1.

Doyle, A., Seery, N., Gumaelius, L., Canty, D., & Hartell, E. (2019). Reconceptualising PCK research in D&T education: proposing a methodological framework to investigate enacted practice. *International Journal of Technology and Design Education, 29*(3), 473–491.

Eberhardt, J. (2013). Interkulturelle Kompetenzen im Fremdsprachenunterricht. Auf dem Weg zu einem Kompetenzmodell für die Bildungsstandards. *Zeitschrift für Interkulturellen Fremdsprachenunterricht, 20*(1). TU Darmstadt.

Gess-Newsome, J. (2017). A model of teacher professional knowledge and skill including PCK. In A. Berry, P. Friedrichsen, & J. Loughran (Eds.), *Re-examining pedagogical content knowledge in science education* (pp. 28–42). Routledge.

Heitzmann, A. (2013). Entwicklung und Etablierung der Fachdidaktik in der schweizerischen Lehrerinnen- und Lehrerbildung: Überlegungen zu Rolle und Bedeutung, Analyse des Ist-Zustands und Reflexionen für eine produktive Weiterentwicklung. *Beiträge zur Lehrerinnen- und Lehrerbildung, 31*(1), 6–17. https://www.pedocs.de/frontdoor.php?source_opus=13830.

Kansanen, P., & Meri, M. (1999). The didactic relation in the teaching-studying-learning process. In B. Hudson, F. Buchberger, P. Kansanen, & H. Seel (Eds.), Didaktik/Fachdidaktik as Science(-s) of the Teaching Profession. *TNTEE Publications, 2*(1), 107–116.

Kirschner, S. (2016). Professionelle Kompetenz von Lehrkäften. *PLUS LUCIS.* https://www.univie.ac.at/pluslucis/PlusLucis/162/S15.pdf.

Klafki, W. (2000). School quality, school program, and teacher self-evaluation. *European Education, 31*(4), 73–91.

Küçükaydın, M. A., & Sağır, Ş. U. (2016). An investigation of primary school teachers' PCK towards science subjects using an ınquiry-based approach. *International Electronic Journal of Elementary Education, 9*(1), 87–108.

Kurt-Birel, G., Deniz, Ş., & Önel, F. (2020). Analysis of Primary School Teachers' Knowledge of Geometry. *International Electronic Journal of Elementary Education, 12*(4), 303–309.

Mayring, P. (2014). *Qualitative content analysis: theoretical foundation, basic procedures and software solution.* Klagenfurt. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-395173

Meijer, P. C. (2013). Kogenud õpetaja praktiline teadmine õpetajakoolituse osana [Experienced teachers' practical knowledge as part of teacher education]. *Estonian Journal of Education, 1,* 8–24. http://dx.doi.org/10.12697/eha.2013.1.02.

Meschede, N., Fiebranz, A., Moller, K., & Steffensky, M. (2017). Teachers' professional vision, pedagogical content knowledge and beliefs: On its relation and differences between pre-service and in-service teachers. *Teaching and Teacher Education, 66,* 158–170.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Niermann, A. (2017). *Professionswissen von Lehrerinnen und Lehrern des Mathematik- und Sachunterrichts.* https://www.pedocs.de/frontdoor.php?source_opus=12587.

Ozmantar, M. F., & Akkoç, H. (2017). Voices and values in shaping the subjectivity of pedagogical content knowledge. *Cogent Education, 4,* 1401195. https://doi.org/10.1080/2331186X.2017.1401195.

Parchmann, I. (2013). Wissenschaft Fachdidaktik – Eine besondere Herausforderung. *Beiträge zur Lehrerinnen- und Lehrerbildung, 31*(1), 31–41. https://core.ac.uk/download/pdf/83643118.pdf.

Park, S., & Oliver, J. S. (2008). Revisiting the conceptualisation of pedagogical content knowledge (PCK): PCK as a conceptual tool to understand teachers as professionals. *Research in Science Education, 38*(3), 261–284.

Patton, M. Q. (2002). Two Decades of Developments in Qualitative Inquiry: A Personal, Experiential Perspective. *Qualitative Social Work, 1*(3), 261–283.

Porter, A. (2006). Curriculum assessment. In J. L. Green, G. Camilli, & E. L. Elmore (Eds.), *Handbook of complementary methods in education research* (pp. 141–159). American Educational Research Association.

Reinfried, S., Mathis, C., & Kattmann, U. (2009). Das Modell der Didaktischen Rekonstruktion. Eine innovative Methode zur fachdidaktischen Erforschung und Entwicklung von Unterricht. ***Beiträge zur Lehrerinnen- und Lehrerbildung, 27***(3), 404–414.

Richardson, G. M., Byrne, L. L., & Liang, L. L. (2018). Making learning visible: Developing preservice teachers' pedagogical content knowledge and teaching efficacy beliefs in environmental education. *Applied Environmental Education & Communication, 17*(1), 41–56.

Rollnick, M. (2017). Learning about semi - conductors for teaching—the role played by content knowledge in pedagogical content knowledge (PCK) development. *Research in Science Education, 47,* 833–868. doi: 10.1007/s11165-016-9530-1.

Rosenkränzer, F., Hörsch, C., Schuler, S., & Riess, W. (2017). Student teachers' pedagogical content knowledge for teaching systems thinking: Effects of different interventions. *International Journal of Science Education, 39*(14), 1932–1951.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14. doi: https://doi.org/10.3102/0013189X015002004.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57,* 1–23.

Stender, A., Brückmann, M., & Neumann, K. (2017). Transformation of topic-specific professional knowledge into personal pedagogical content knowledge through lesson planning. *International Journal of Science Education, 39*(12), 1690–1714.

Studies in Social and Educational Sciences from 2008 to 2013. From Theory into Practice. (2014). [Sotsiaal- ja kasvatusteaduste valdkonna uuringud 2008–2013. Teooriast praktikasse.] (2014). Eesti Teadusagentuur. https://www.etag.ee/wp-content/uploads/2014/04/kasvatusuuringud.pdf.

Tröbst, S., Kleickmann, T., Heinze, A., Bernholt, A., Rink, R., & Kunter, M. (2018). Teacher knowledge experiment: Testing mechanisms underlying the formation of preservice elementary school teachers' pedagogical content knowledge concerning fractions and fractional arithmetic. *Journal of Educational Psychology, 110*(8), 1049–1065.

Unt, I. (2013). Didaktika. [Didactics]. In Mikser, R. (Ed.), *Haridusleksikon.* Eesti Keele Sihtasutus.

Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & Health Sciences, 15*(3), 398-405.

Vollmer, (2014). Fachdidaktik and the development of generalised subject didactics in Germany. https://journals.openedition.org/educationdidactique/1861?lang=en.

Appendix

Domains and components of subject didactics in the literature search

Empirical studies	Domains and components of subject didactics						
	Pedagogical knowledge	Content knowledge		Pedagogical content knowledge			
				Teaching of a subject			Subject-specific assessment
		Content of a subject	Subject knowledge	Comprehension of pupils about the subject	Knowledge about the subject methodology	Curriculum knowledge	
Alonzo & Kim (2015)				+	+		
Blömeke et al. (2008)				+	+	+	
Deng (2018)	+	+		+		+	
Doyle et al. (2019)	+	+					
Gess-Newsome et al. (2017)	+	+	+	+	+		
Gramzow (2015)				+	+	+	+
Heitzmann (2013)	+		+				
Krauss et al. (2008)				+	+		
Meschede et al. (2017)	+	+		+			
Niermann (2017)	+	+	+	+			+
Olszewski (2010)				+	+	+	
Parchmann (2013)	+	+	+	+	+		
Park & Oliver (2008)				+	+	+	+
Reinfried et al. (2009)	+		+	+			
Richardson et al. (2018)	+	+		+		+	
Rosenkränzer et al. (2017)	+	+		+			
Rollnik (2017)	+	+		+		+	
Schmelzing et al. (2013)				+	+		
Smith & Banilower (2015)				+	+		+
Stender et al. (2017)	+	+		+		+	+
Tepner et al. (2012)				+	+		
Tröbst et al. (2018)	+	+					
Vollmer (2014)	+		+				

This page is intentionally left blank.

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 651-671

Effects of a Morpheme-Based Spelling Intervention Challenging Previous Results

Viktoria Jöbstl[*,a], Reinhard Kargl[b], Anna E. Prattes[c], Elisabeth Beyersmann[d], Karin Landerl[e]

Received : 13 February 2021
Revised : 9 May 2021
Accepted : 7 June 2021
DOI : 10.26822/iejee.2021.219

[*,a] **Corresponding Author:** ViKtória Jöbstl,
Institute of Psychology, University of Graz, Austria.
E-mail: viktoria.joebstl@uni-graz.at
ORCID: https://orcid.org/0000-0002-1343-3871

[b] Reinhard Kargl, Institute for Reading and Spelling, Graz, Austria.
E-mail: legasthenie@aon.at

[c] Anna E. Prattes, Institute of Psychology, University of Graz, Austria.
E-mail: anna.prattes@gmail.com

[d] Elisabeth Beyersmann, Department of Cognitive Science and Macquarie University Centre for Reading, Macquarie University, Sydney.
E-mail: lisi.beyersmann@mq.edu.au
ORCID: https://orcid.org/0000-0001-9653-6106

[e] Karin Landerl, Institute of Psychology, University of Graz, Austria and Department of Cognitive Science and Macquarie University Centre for Reading, Macquarie University, Sydney, Australia.
E-mail: karin.landerl@uni-graz.at
ORCID: https://orcid.org/0000-0003-4074-0233

Abstract

Morpheme-based literacy training programs are widely used in German primary schools. This study investigated whether (1) morphological training is effective early in development (Grade 2) and (2) literacy gains can be attributed to advanced morphological processing. Fifty-two German-speaking second-graders participated in an eight-week morpheme-based training program, while an age-matched control group (n = 41) attended regular language classes. All children completed spelling, reading and morphological awareness tasks and participated in a masked primed lexical decision experiment, once before training, and then again following training. We observed training effects for spelling and reading morphologically complex words, with bigger increases in the intervention than the control group. In addition, the masked priming results revealed that lexical decision times decreased more strongly in the intervention than the control group, but there was no clear training impact on the pattern of morphological priming. However, the performance on standardized reading tests and a morphological awareness task did not differ across participant groups. Thus, while written language processing improved, it is unclear whether these effects can be attributed to morphological processing or rather general gains in orthographic knowledge.

Keywords:

Morpheme-Based Spelling Intervention; Spelling; Reading; Visual Word Processing; Morphological Priming

Introduction

This study aimed to investigate to what extent young German-speaking children can benefit from a morpheme-based spelling intervention. We also wanted to examine whether any gains in spelling (and reading) proficiency could be directly related to improvements in morphological abilities or are simply due to an increase in orthographic knowledge. Morpheme-based instruction and intervention were aimed at teaching children how to identify the semantic building blocks within morphologically complex words (morphemes). For example, the compound "cowboy" consists of two stem morphemes ("cow" and

"boy"). The verb "played" consists of the stem morpheme ("play") and a grammatical morpheme marking past tense ("-ed"). There is increasing interest in morpheme-based instruction and intervention in children's reading acquisition (e.g., Bowers & Bowers, 2018; Bowers & Kirby, 2010), and a number of arguments in favor of such approaches within the Indo-European language context have been proposed.

Transparency of Morphological Information in Print

While there is large variability among orthographic systems in their transparency and reliability of letter-sound correspondences (De Simone et al., 2021; Schmalz et al., 2016), Indo-European orthographies typically represent morphological structure in a consistent way (e.g., Ulicheva et al., 2018). The orthographic principle of morphological constancy has been mostly discussed for English, which is notoriously inconsistent and irregular at the letter-sound level. Arguably, many inconsistencies at the phonological level are a by-product of the fact that orthography makes linguistically "deeper" morpho-semantic relations transparent, which are not directly evident on the surface level of phonology (Chomsky & Halle, 1968). For example, although the vowel in the two words "heal" and "health" is pronounced differently, their spelling reflects their morpho-semantic relation, and the silent letter "w" in "two" relates it to "twice", "twin", and "twenty". Morpheme-based interventions are assumed to help children deal with the phonological inconsistencies and irregularities of English orthography (Apel et al., 2013; Bowers & Bowers, 2017, 2018).

In many other orthographies, like Spanish, Greek, or German, morphological information is not mandatory in order to decode word pronunciations during reading, as letter-sound relations are mostly consistent and transparent to the reader. Still, these orthographies adhere to the principle of morpheme constancy, meaning that morphemic units are spelt consistently across word forms. In morphologically rich languages this is particularly important as the same stem morpheme can appear in a large number of different word forms (e.g., German "fahr" – Engl.: drive; "fahren", "fährst", "fährt", "gefahren", "vorfahren", "Fahrer", "Gefahr", "Gefährt", "Einfahrt", "Auffahrt", "Zufahrt" and in a multitude of compounds like "Fahrstuhl", "Fahrschule", "Radfahrer", etc.). Identical spelling of the stem morpheme helps the reader to access word semantics and identical spelling of the numerous inflectional and derivational morphemes helps to quickly identify the grammatical form of the particular word. Thus, recognizing the building blocks of morphologically complex words can support word reading, especially for long words like German "hinterhergegangen" (Engl.: went after) or the compound "Schulsportwettbewerb" (Engl.: school sports competition).

Morphological knowledge is particularly important for spelling (e.g., Ulicheva et al., 2018). Even in "shallow" orthographies with consistent grapheme-phoneme correspondences, phoneme-grapheme correspondences can be highly inconsistent. In German, for instance, the frequent prefix "ver-" is consistently spelt with "v" and not with "f", although both letters represent the same labiodental fricative and "f" is overall more frequently used for this sound. Orthographic marking of vowel length is particularly inconsistent in German (see Landerl, 2017 for details). For each vowel, there are two or three different spelling alternatives (e.g., /a:/ in "Wal" – Engl.: whale, "Wahl" – Engl.: election, and "Aal" – Engl.: eel) and short vowels are often marked by a subsequent double consonant ("kommen" – Engl.: come) that is retained when followed by another consonant only if this consonant is the onset of a new morpheme ("kommt" – Engl.: he/she/it comes vs. monomorphemic "Hund" – Engl.: dog). Memorizing the spelling of the most frequent word stems and grammatical morphemes can thus help children to correctly spell a large number of words (Bowers & Kirby, 2010; Scheerer-Neumann, 1979).

Morphological Skills and Written Language Processing

Children use morphology productively early in their language development (Mussar et al., 2020). In preschool, they are well able to adapt unfamiliar forms morphologically, as for example demonstrated by Berko´s (1958) classic wug-test (e.g., "This is a wug. Now there is another one. There are two of them. There are two ___.") and numerous studies since (e.g., Apel et al., 2013; Berninger et al., 2010; Casalis & Louis-Alexandre, 2000; Rispens et al., 2008). The ability to segment and recombine morphemic units is referred to as *morphological awareness* (Apel, 2014; Carlisle, 2000). Variance in morphological awareness explains unique variance in reading (e.g., Deacon & Kirby, 2004; Kirby et al., 2012), and spelling skills (e.g., Kargl & Landerl, 2018; Rispens et al., 2008) above and beyond phonological awareness or vocabulary skills (e.g., Kirby et al., 2012; Levesque et al., 2017).

Despite the evidence for the early development of children's morphological awareness, the automatization and integration of morphological knowledge into more implicit reading processes does not appear to take place until much later in children's reading development (e.g., Beyersmann et al., 2012; Dawson et al., 2018; Schiff et al., 2012). Evidence for rapid, automatic morphological processing comes primarily from masked morphological priming, a task that has been extensively used in skilled readers (initially introduced by Longtin et al., 2003 and Rastle et al., 2004) and has by now also been applied in a growing number of studies with developing readers (e.g., Beyersmann et al., 2012; Beyersmann, Grainger, et al., 2015; Beyersmann et al., 2019; Beyersmann et al., 2021; Quémart et al., 2011). In a typical masked

priming paradigm, a mask (e.g., a string of hash keys) is presented for 500 ms, followed by the presentation of the prime for about 50 ms, and the target word, for which participants perform a lexical decision response. The key comparison in this body of research has been between prime-target pairs sharing a semantically transparent morphological relationship (e.g., "farmer – farm"), a semantically opaque morphological relationship (e.g., "corner – corn") and a purely orthographic relationship (e.g., "cashew – cash"). The widely replicated pattern of results from skilled readers show significant priming in the "farmer – farm" and "corner – corn" conditions, but not in the "cashew – cash" condition, suggesting that adults rapidly decompose morphologically complex words, independently of semantics (for reviews, see Amenta & Crepaldi, 2012; Rastle & Davis, 2008). As opposed to adults however, younger readers appear to rely on more semantically driven morphological processing techniques ("farmer – farm"; Beyersmann et al., 2012; Schiff et al., 2012; but see Quémart et al., 2011).

More recently, there has been a new push in the literature towards the examination of morphologically complex nonwords in developing readers (e.g., Beyersmann, Grainger, et al., 2015; Beyersmann et al., 2020; Beyersmann et al., 2021; Hasenäcker et al., 2016, 2020; Mousikou et al., 2020). The key comparison in this task is between four different prime conditions: a suffixed word condition (e.g., "flexible – flex"), a suffixed nonword condition (e.g., "flexify – flex"), a non-suffixed nonword condition (e.g., "flexint – flex"), and an unrelated control condition (e.g., "faulty – flex"). This paradigm has the advantage that the same targets can be used across all four conditions, cancelling out uncontrolled differences between target words. Moreover, the use of complex nonwords allows to remove any apparent semantic relationship between the prime (e.g., "flexify") and the target (e.g., "flex"), thus making it possible to investigate the automaticity of morphological processing in a context in which it is impossible to fall back onto processing of the whole letter string.

The overall pattern of results shows that lexical decision times for monomorphemic target words are faster when a preceding prime was a suffixed word, a suffixed nonword, or a non-suffixed nonword, compared to the unrelated control (adults: e.g., Beyersmann, Casalis, et al., 2015; Beyersmann, Cavalli, et al., 2016; Heathcote et al., 2018; Morris et al., 2011; children: Beyersmann, Grainger, et al., 2015; Beyersmann, et al., 2021; Hasenäcker et al., 2016, 2020). This suggests that stems embedded in complex nonwords are rapidly activated independently of whether or not they are accompanied by a suffix or a non-suffix. Additionally, there seems to be an advantage, when the prime and the target share a semantic relationship (suffixed word primes; Beyersmann, Grainger, et al., 2015).

Morphological Intervention Programs

In their meta-analysis based on 30 studies, Goodwin and Ahn (2013) found positive intervention effects on morphological knowledge, phonological awareness, vocabulary, decoding, and spelling, but not reading comprehension or fluency. An ongoing discussion concerns the age at which students can profit from morphological interventions. Interestingly, about half of the studies analysed by Goodwin and Ahn did not start before Grade 4, perhaps based on the assumption that morphological information might be too complex for younger children. However, effect sizes were larger for preschoolers and early elementary school children than for students beyond Grade 2. Similarly, in their systematic review of 22 morphological intervention studies, Bowers et al. (2010) found that training effects for younger children (preschool – 2nd grade) were as large or even larger than those for older children (3rd – 8th grade). This is in line with Bowers and Bowers´ (2018) dedicated call for early morphological instruction (see also Bowers et al., 2010). The authors argued that early morphological instruction can support children's understanding as to why sometimes the same letter cluster has different pronunciations (e.g., "heal – health") and at other times different letter clusters have the same pronunciation (e.g., "bald – balled"). Knowledge of frequent stems and affixes may support children in their decoding of unfamiliar words by breaking them down into morphemic sub-units. However, current meta-analyses and reviews are almost exclusively based on studies in English (Bowers et al., 2010; Goodwin & Ahn, 2010, 2013) and therefore do not necessarily generalize to more transparent orthographies like German.

In German-speaking countries, reading and spelling instruction in Grades 1 and 2 is heavily based on phonics (Landerl, 2017). Although phoneme-based sounding out is reliable and successful (though slow and laborious) for reading, it is insufficient for spelling. Simply translating each sound of a spoken word with a phonologically adequate grapheme leads to phonologically plausible but incorrect spellings unless morpheme constancy is regarded. Still, the curriculum for the first two school years contains only very basic morphology instruction. For example, children are encouraged to derive unknown spellings from similar familiar words (e.g., derive plural "Straßen" – Engl.: streets – from singular "Straße") and spell nouns with an uppercase first letter, according to the German capitalization rule.

One program in particular was designed for poor spellers in late elementary school (Grade 4 and beyond). The MORPHEUS program (Kargl & Purgstaller, 2010) was developed at the same time as the English Structured Word Inquiry (SWI) program (Bowers & Kirby, 2010) and has many conceptual similarities. Both programs introduce children to the concept

of word stems and affixes and encourage them to identify, segment and (re)combine high frequency morphemes. While the objective of the English SWI is to communicate different approaches to investigate written words (combining etymology, morphology and phonology), the German MORPHEUS program focuses on morphology and teaching the most common morphemes to improve children's spelling. In previous intervention studies, MORPHEUS was mostly delivered as a two- to five-week program, in small group settings. Children received teaching lessons complemented by homework consisting of paper-and-pencil as well as computerized tasks. A number of small-scale studies provided evidence that this program can enhance spelling (Kargl et al., 2008; Schneeberger et al., 2011) as well as reading proficiency (Gebauer, Fink, Kargl, et al., 2012; Weiss et al., 2010) in typical as well as poor spellers in Grades 3 to 8 compared to untrained control groups.

The Present Study

The first aim of the present study was to investigate whether in the transparent German orthography, younger children in Grade 2 can also profit from a morpheme-based intervention. In Grade 2, reading and spelling instruction mostly focus on grapheme-phoneme and phoneme-grapheme translations, supplemented by only minor morpheme-based information for spelling (see above). Children are encouraged to sound out words during reading and phonologically adequate spellings are often accepted, even if they deviate from the orthographically correct spellings. Children at this stage have clear mastery of the alphabetic principle. Here we asked if explicit morphological instruction via the MORPHEUS program leads to improved spelling and reading skills in children as young as Grade 2.

While we expected the intervention to induce larger gains in written language processing skills compared to a control group receiving standard school instruction, it is unclear if any such training effects are directly related to gains in morphological knowledge, or due to an increased focus on spelling practice during the training period. Thus, our second aim was to investigate to what extent any training effects can directly be related to changes in explicit as well as more implicit morphological processing skills. The explicit measure was a standard morphological awareness task requiring children to adapt verbally presented nonwords to a given sentence frame (e.g., "1. Gestern habe ich gewornt. 2. Es wäre gut, wenn du heute ___ (wornst)." – Engl.: 1. Yesterday I worned. 2. It would be great, if you could ___ (worn) today.). Given that MORPHEUS trains participants' morphological awareness, gains were to be expected in this task. Indeed, earlier studies found improvements in this type of task after morpheme-based intervention (Apel et al., 2013; Arnbak & Elbro, 2000; Kargl et al., 2008).

Two tasks were used to investigate more implicit mechanisms of morphemic processing, a nonword reading task and a masked primed lexical decision task. In the nonword reading task, children read aloud existing stems that were either combined with an existing prefix or suffix (e.g., "wahrlein" – Engl.: truelet) or with a matched letter cluster that did not constitute an affix (e.g., "wahrnauf" – Engl.: truenauf). We expected faster and more accurate response times to affixed compared to non-affixed nonwords following training.

The masked primed lexical decision task was based on a widely replicated nonword priming paradigm (Beyersmann, Casalis, et al., 2015; Beyersmann, Grainger, et al., 2015; Beyersmann, et al., 2021; Hasenäcker et al., 2016) using four different prime conditions: a suffixed word condition (e.g., "flexible – flex"), a suffixed nonword condition (e.g., "flexify – flex"), a non-suffixed nonword condition (e.g., "flexint – flex"), and an unrelated control condition (e.g., "faulty – flex"). Embedded word priming effects were expected prior to training (Beyersmann, Grainger, et al., 2015; Beyersmann, et al., 2021; Hasenäcker et al., 2020). We further hypothesized that depending on the underlying mechanisms, training may lead to three different priming patterns. 1. If explicit practice in recognizing, storing, and retrieving frequent stems and affixes boosts morphological processing, the training group should show a more marked increase in priming effects for the affixed conditions, compared to the non-affixed conditions. 2. If the morpheme training mostly impacts embedded word activations, priming in all related conditions should increase from pre- to post-test in the training group. 3. If children do not benefit from the training, the priming pattern should not differ at pre- and post-test in both groups.

Method

Participants

Ninety-three German-speaking second-graders participated in this study. The participants were selected from three different schools. The intervention was carried out during language lessons. In two of the schools, children (n = 52, M_{age} = 8.29 years, SD_{age} = 0.50) from four classrooms received the eight-week intervention. In the third school, children functioned as a business-as-usual control group receiving standard language classes (six classrooms; n = 41, M_{age} = 8.33 years, SD_{age} = 0.47). The children from the two schools did not differ in the nonverbal IQ-test given at pre-test (description, see below, intervention: mean z-score = 0.09, SD = 0.86; control: mean z-score = -0.10, SD = 0.67; $t(88) = 1.116$, $p = .267$).

A total of 122 children completed the classroom administered tasks. However, children who did not speak German at first-language level ($n_{intervention}$ = 15,

$n_{control}$ = 5), had identified special needs ($n_{intervention}$ = 2, $n_{control}$ = 3) or whose parents did not agree to contributing their children´s data to the research project ($n_{intervention}$ = 2, $n_{control}$ = 2) were excluded.

A power analysis was conducted to ensure that the sample size was large enough to find the expected training effect on spelling and thereby reduce the probability of a type II error. Based on recent studies administering a similar intervention (Gebauer, Fink, Kargl, et al., 2012; Kargl et al., 2008; Schneeberger et al., 2011) we set our expected effect size (η_p^2) to be at least .11. According to a power analysis calculated in G*power (Faul et al., 2007) not more than 56 participants are necessary to reduce the type II error to .05. Our sample size clearly exceeded this *N*.

All parents provided written consent for assessment and/or training procedures, which were also approved by the local school authorities.

Procedure

Pre-tests were carried out in January, followed by an eight-week training period (intervention group) or regular German classes (control group), followed by post-tests. A measure of nonverbal IQ was administered at pre-test only, while all other tasks were carried out before and after the intervention period. One of the reading measures (sentence reading), spelling and non-verbal intelligence were administered in the classroom (50-60 minutes total duration), while the remaining reading tasks (word and nonword reading), morphological awareness and a lexical decision task (with morphological priming) were assessed individually (30-45 minutes total duration) in a quiet room in the school. The time between the group and one-on-one sessions varied between one and five days.

Tasks

Non-Verbal Intelligence

The subtests series and *classification* of the German version of the Culture Fair Test (CFT 20-R, Scale 1; Weiß, 2006) were given as classroom tests to control for group differences in children's non-verbal intelligence. The series completion task required children to identify the item that completed a series of shapes (5 minutes). In the classification task, children had to find the item that violated a logical rule (5 minutes). The number of correct items per subtest was z-transformed and averaged to obtain one IQ-score for each child.

Spelling

The spelling test of the Lese- und Rechtschreibtest (SLRT-II; Moll & Landerl, 2010) was used to evaluate children's spelling proficiency. To make possible training effects more observable the longer format with 48 words (standardized for third- and fourth-graders) was used (the standard version for second-graders terminates after 24 words). Children were given a booklet containing 48 sentences with one missing word in each sentence. The experimenter first read out the missing word, then the sentence and then repeated the missing word. Children's task was to fill in the gap. In addition to the number of correctly spelt items, three scores were generated: correctly spelt morphological stems, orthographic stems and affixes. Stems were considered morphological if knowledge of related words could facilitate spelling (e.g., "Bäume <- Baum" – Engl.: trees <- tree). The SLRT-II provides two parallel versions (A & B), which were counterbalanced during pre-test. At post-test the order of versions was reversed to minimize repetition effects.

Reading – Fluency

Reading fluency was assessed using the Salzburger Lese-Screening (SLS 1-4; Mayringer & Wimmer, 2003) and the Lese- und Rechtschreibtest (SLRT-II; Moll & Landerl, 2010). The SLS 1-4 was administered in class. Participants were given three minutes to silently read as many sentences as possible. After every sentence, a check mark or a cross had to be circled depending on whether or not the sentence was correct (e.g., "Strawberries are blue."). The dependent measure was the number of sentences marked correctly. The SLRT-II was carried out one-on-one. Children were asked to read aloud a list of words and a list of nonwords as fast as possible for one minute each. The dependent measure was the number of items read correctly within the time limit. The two parallel forms were counterbalanced and all children received different forms at pre- and post-test.

Reading of Morphologically Complex Stimuli

To investigate training effects on reading fluency, four reading lists with morphologically complex items were created. Each list contained 24 nonwords consisting of existing stems combined with real or pseudo-affixes. The stem was either paired with (1) a prefix (e.g., "umfinden"), (2) a pseudo-prefix (e.g., "arfinden"), (3) a suffix (e.g., "gesetzisch") or (4) a pseudo-suffix (e.g., "gesetzucht"). For the prefixed verb stimuli, the infinitive morpheme "-en" was added to the stem to create possible verb forms (in German, verb forms without a suffix do not exist in the present tense). A parallel form was generated for each list by reversing item order. The parallel forms were counterbalanced during pre-test and children were always given the other parallel form during post-test. They were instructed to read out loud all items as fast as possible, without making mistakes. The score was the number of correctly read nonwords per minute. Cronbach's alpha across the four item lists was .98 at pre- as well as post-test.

Morphological Awareness

This task was based on a German test of morphological awareness for children aged 10 or older (Test zur Erfassung der morphematischen Bewusstheit, TMB; Kargl et al., 2006). Although the original test is administered in print, we made the test more accessible for our younger participants by presenting the stimuli verbally. Sentences containing a nonword were presented. Children then had to manipulate the nonword in such a way that it would complement the next sentence (e. g.: "1. Gestern habe ich gewornt. 2. Es wäre gut, wenn du heute ___ (wornst)." – Engl.: Yesterday I worned. 2. It would be great, if you could ___ (worn) today.). All items required the morphologically adequate manipulation of a pre- and/or suffix. Correctly derived nonwords mirrored either pseudo-nouns (derivation, inflection), -adjectives (derivation, building the comparative and/or superlative) or -verbs (past participle, inflection). Mistakes in pronunciation of the stem were not rated. The score was the number of correctly manipulated words (max. 24). Cronbach's alpha was .83 at pre-test and .77 at post-test.

Masked Morphological Priming

A lexical decision paradigm with masked morphological priming was used to assess the relevance of morphological segments in written word processing. Materials and procedure were adapted from a study by Beyersmann et al. (2021). Two sets of target words each containing 48 items were selected from the childLex corpus (Schroeder et al., 2015). Target words in the prefix condition were the infinitive forms of verbs and target words in the suffix condition were nouns or adjectives. Each target was preceded by an affixed word prime (e.g., prefix: "mitdenken – DENKEN" – Engl.: think along – THINK; suffix: "steinchen – STEIN" – Engl.: little stone – STONE), an affixed nonword prime (e.g., prefix: "hindenken – DENKEN" – Engl.: think towards – THINK; suffix: "steinkeit – STEIN" – Engl.: stonity – STONE), a non-affixed nonword prime (e.g., prefix: "kardenken – DENKEN" – Engl.: karthink – THINK; suffix: "steinucht – STEIN" – Engl.: stonel – STONE), and an unrelated prime (e.g., prefix: "karhasten – DENKEN" – Engl.: carpaint – THINK; suffix: "piratucht – STONE" – Engl.: pirate – STONE). The prefixed words included the prefixes "auf-", "mit-", "ab-", and "an-", the suffixes "-chen", "-haft", "-heit", and "-lich", which were each repeated 12 times.

Nonword primes were created using the target word (e.g., "denken" – Engl.: think, "stein" – Engl.: stone), and combining it with a prefix (e.g., "hin-" – Engl.: towards) or suffix (e.g., "-keit" – Engl.: -ity), such that the whole letter string was not a real word (e.g., prefix: "hindenken" – Engl.: think towards; suffix: "steinkeit" – Engl.: stonity). Non-affixed nonword primes were created by combining the same word (e.g., "denken" – Engl.: think; "stein" – Engl.: stone) with a common, non-morphemic letter-sequence (e.g., "kar-"; "-ucht"), such that the whole letter string was not a real word ("kardenken" – Engl.: karthink; "steinucht" – Engl.: stonel). Unrelated primes were non-affixed nonwords and orthographically unrelated to the target. All nonwords were orthographically legal and pronounceable. The four prime conditions were matched on length.

For the purpose of the lexical decision task, 98 nonword targets (48 for the prefixed materials and 48 for the suffixed materials) were created from words by replacing one or two letters (e.g., "laufen" – Engl.: to run -> "laupen"; "ganz" – Engl.: whole -> "galz"). In both the prefixed and suffixed materials, nonword targets were matched to real word targets on length. To mimic the structure of the primes preceding real word targets, primes preceding nonword targets were selected in a similar fashion. Each nonword target was preceded by four different types of primes, by combining the nonword targets with an affix (e.g., "anlaupen – LAUPEN"; "galzhaft – GALZ"), with a different affix (e.g., "umlaupen – LAUPEN"; "galzisch – GALZ"), with a non-morphemic letter sequence (e.g., "emlaupen – LAUPEN"; "galztern – GALZ"), and by combining an unrelated nonword with a non-morphemic letter sequence (e.g., "emliezen – LAUPEN"; "zelptern – GALZ").

At pre- and post-test each participant completed the prefixed and suffixed masked priming experiments. Within each set of materials, target order was randomized. To ensure that every child encountered each target and prime only once, four lists per condition were generated and counterbalanced across participants. The presented lists at pre-test were always different from the lists a child received at post-test.

Targets were presented at the center of a laptop screen. Each trial started with a 500 ms forward mask of hash keys (########) followed by the prime (50 ms) in lowercase and then the target in uppercase. The target remained present until a response had been made. The children were instructed to indicate as quickly and accurately as possible whether the presented target was a word or not by pressing either the "K" (yes) or "D" (no) button.

Morpheme-Based Training

The administered morpheme-based spelling training was an adaptation of the computer-aided training program MORPHEUS (Kargl & Purgstaller, 2010). The training was provided in the classroom by two graduate students who were trained and supervised

by the developers of the program. At the start of the intervention, all participants received a folder in which they collected their weekly worksheets. Additionally, a quarter to a third of the time they worked on tablets with an especially designed app. The central aim of the program was to increase children's awareness of the morphological structure of words (prefix, stem, suffix) and thereby learn that words are often composed of familiar elements. The basic idea was to familiarize children with the correct spellings of a limited number of high-frequency morphemes, in order to enable them to correctly spell a multitude of morphologically complex words containing those morphemes (Bowers & Kirby, 2010; Scheerer-Neumann, 1979).

The training phase lasted eight weeks. On two days each week altogether three training lessons (one double and one single lesson) were held during language lessons in school and children received materials for about one hour of homework per week. The progress was checked regularly by reviewing worksheets and controlling whether all previous chapters on the tablets were completed. Chapters with an accuracy rate of 75 % or lower were repeated. After the first half of the training there was a one-week break from school for all participating children.

The training consisted of three levels, which were composed of overall 14 chapters (see online Appendix for exemplary tasks). Level one (chapters 1 and 2) introduced the concepts of word families and word classes (nouns, verbs, adjectives), including the spelling rule of capitalization for nouns. Children learned to identify words from the same word family (i.e., including the same stem) in a set of presented words and to build derived words by combining given prefixes, stems, and suffixes. First, they learned that nouns (referred to as "name words" in German – meaning that nouns often notify the name of objects) always start with an uppercase letter (e.g., "Tür", "Freund", "Haus" – Engl.: door, friend, house) and are often accompanied by an article ("die", "der", "das" – Engl.: the). Verbs describe what someone does and adjectives how someone/something is. Verbs and adjectives are not capitalized. Subsequently, the newly acquired knowledge was practiced by assigning different words to the corresponding word class.

Level two (chapters 3 to 6) introduced word families with stems that involve variation of vowel pronunciation and spelling across word forms (e.g., "ich sprech-e – du sprich-st"; "Baum – Bäum-e" – Engl.: I speak – you speak; tree – trees). Children also learned that certain suffixes ("-keit", "-chen", "-ung", "-er", "-erin") always notify nouns. For example, when the adjective stem "dunkel" (Engl.: dark) is combined with the suffix "-heit" (Engl.: -ness) it becomes the noun "Dunkelheit" (Engl.: darkness) and must be capitalized. Tasks in these chapters were combining prefixes, stems, and/or suffixes into words, segmenting words into their constituent morphemes, identifying the stems in word forms with vowel change ("Bäume → Baum" – Engl.: trees → tree) and memorizing high-frequency morphemes by repeatedly reading given prefixes and stems.

Level three was by far the largest, consisting of chapters 7 to 13. Each of those chapters focused on word stems containing specific letter combinations that are frequently misspelt. These letter clusters typically concerned orthographic marking of vowel length (i.e., double consonants, "tz", or "ck" following short vowels; "ß", "ie", silent "h", or double vowels marking long vowels). Children practiced to identify vowels in word stems (but not those present in pre- or suffixes, e.g., "be-komm-en"; Engl.: get). The short vowel in this stem is marked by a subsequent double consonant and this orthographic pattern is consistent across all word forms including this stem, even when the next morpheme also starts with a consonant (e.g., "er kommt" – Engl.: he comes). Children also learned that certain suffixes (e.g., "-lich") can be used as indicators for adjectives, which are not capitalized. Across chapters, children were familiarized with high frequency stems (including specific orthographic patterns) and used them to build and segment morphologically complex words, including inflectional and derivational processes involving pre- as well as suffixing of nouns, verbs and adjectives, and also compounding (e.g., "Spiel-platz" – Engl.: play-ground), which is highly productive in German. The overarching concept was to practice the principle of morpheme constancy exemplified by stems, pre- and suffixes with high frequency of occurrence. In Chapter 14 previously learned contents were recapped and revised.

Business-as-usual control group

During the training period, the control group received standard German language lessons based on the workbook Karibu 2 (Eichmeyer et al., 2013). The dominant structural unit in this program is the syllable: Children are encouraged to segment polysyllabic words in German texts into syllabic units during reading and spelling. To practice spelling monosyllabic words ending in a stop consonant, which is always devoiced in German pronunciation, children were asked to extend words to make voiced consonants perceptible in intervocalic position (e.g., "Dieb – Diebe" – Engl.: thief – thieves). This strategy helps to identify if a syllable final consonant needs to be doubled, as double consonants are ambisyllabic between two vocalic syllable nuclei (e.g., "kommt – kommen" – Engl.: comes – come). This word extension strategy usually involves morphological processes (e.g., noun pluralization or

verb inflection), but is not explicitly alluded to children. The program contains some morphological aspects as required by the national curriculum: Children are taught the concept of "name words" (nouns) and that they are consistently spelt with a capital first letter. In the last third of the one-year program, children typically start building words in the context of verb inflection (e.g., "ich male, du malst, er malt" – Engl.: I paint, you paint, he paints). Even later in the program, the terminology "word family" is introduced for words including the same stem (for more details regarding the administration of Karibu 2 over the course of the school year see Eichmeyer & Zoltan, 2013). The Karibu 2 program is supplemented by unspecific semantically structured language exercises (e.g., seasons or months of the year, the weather, emotions) that involve reading and writing short texts.

Results

Standardized Tests of Spelling and Reading.

The main goal of our training was to improve children's spelling skills. Earlier studies (Gebauer, Fink, Kargl, et al., 2012; Weiss et al., 2010) had also demonstrated gains in reading. Thus, we first investigated whether the training was indeed able to induce specific gains in the standardized measures of spelling and reading. Pre- and post-test scores are displayed in Table 1. ANOVAs with time (pre-/post-test) as within-subjects factor and group (intervention/control) as between-subjects factor were run in SPSS Statistics 26.0.

Children in both groups showed improvements in their overall spelling skills (number of words spelt correctly) from pre- to post-test, $F(1,85) = 47.10$, $p = < .001$, $\eta_p^2 = .357$). Importantly, this improvement was larger in the training than in the control group, $F(1,85) = 5.58$, $p = .020$, $\eta_p^2 = .062$. There was no main effect of group, $F(1,85) = 1.39$, $p = .240$, $\eta_p^2 = .016$. Planned comparisons did not reveal group differences at pre-test, $t(85) = 0.51$, $p = .611$; $d = 0.11$, or post-test, $t(85) = 1.85$, $p = .067$; $d = 0.39$.

Depending on the administered parallel form (A or B; SLRT-II) 54 % or 58 % of the words in the spelling test were morphologically complex in that they consisted of two or more morphemes. In order to get a more specific impression whether the improvements in spelling were directly related to morphological skills, we analysed the number of correctly spelt affixes and stems separately (see Table 1). For stems, we differentiated between morphological stems the spelling of which could be derived based on morphological information (e.g., "Bäume <- Baum" – Engl.: trees <- tree; A: 14 of 48 stems; B: 16 out of 49 stems) and orthographic stems, which had to be accessed from orthographic memory (e.g., "wohnen" – Engl.: to reside/to live; A: 34 out 48 stems; B: 33 out of 49 stems).

There was an interaction between type of stem, time and group, $F(1,84) = 9.17$, $p = .003$, $\eta_p^2 = .098$. Consequently, time and group effects regarding spelling of morphological and orthographic stems were analysed separately. Spelling of both, morphological and orthographic stems improved over time, morphological: $F(1,84) = 41.98$, $p < .001$, $\eta_p^2 = .333$; orthographic: $F(1,84) = 37.85$, $p < .001$, $\eta_p^2 = .311$, but a group x time interaction was only observed for morphological stems, $F(1,84) = 8.97$, $p = .004$, $\eta_p^2 = .096$, and not orthographic stems, $F(1,84) = 0.41$, $p = .526$, $\eta_p^2 = .005$. There also was a main effect of group for morphological, $F(1,84) = 5.81$, $p = .018$, $\eta_p^2 = .065$, but not orthographic stems, $F(1,84) = 0.46$, $p = .501$, $\eta_p^2 = .005$. Planned comparisons on morphological stems confirmed that there were no group differences at pre-test, $t(84) = 1.18$, $p = .242$; $d = 0.26$, but at post-test the intervention group spelt more morphological stems correctly than the control group, $t(84) = 3.15$, $p = .002$; $d = 0.69$. No significant effects were observed for affixes (all *ps* > .05).

All three standardized reading measures indicated overall improvements from pre- to post-test (sentence reading: $F(1,83) = 74.08$, $p < .001$, $\eta_p^2 = .472$; word reading: $F(1,88) = 112.28$, $p < .001$ $\eta_p^2 = .561$; nonword reading: $F(1,88) = 66.29$, $p < .001$, $\eta_p^2 = .430$). However, no time x group interaction was observed for sentence reading, $F(1,83) = 1.02$, $p = .316$, $\eta_p^2 = .012$, and word reading, $F(1,88) = .27$, $p = .603$, $\eta_p^2 = .003$, and the time x group interaction for nonword reading, $F(1,88) = 4.61$, $p = .034$, $\eta_p^2 = .050$, was due to a larger improvement in the control than in the experimental group. The group effect was also not significant for any of the reading measures (sentence reading: $F(1,83) = 2.13$, $p = .148$, $\eta_p^2 = .025$; word reading: $F(1,88) = 0.12$, $p = .729$, $\eta_p^2 = .001$; nonword reading: $F(1,88) = 0.09$, $p = .764$, $\eta_p^2 = .001$). Thus, there was no evidence for training-related improvements in the standardized reading measures.

Reading of Morphologically Complex Stimuli

Separate ANOVAs were run for the prefix- and the suffix conditions. Affix type (pseudo-/real affix) and time (pre-/post-test) were within-subjects factors and group (intervention/control) the between-subjects factor. Distributions were normalized by winsorizing scores more than 3 *SD*s above the mean to the reading time corresponding to 3 *SD*s above the mean (this affected only 10 scores altogether). Number of nonwords read correctly per minute and condition are displayed in Table 2.

For the (pseudo-) prefixed lists there was a main effect of affix type, $F(1,88) = 167.87$, $p < .001$, $\eta_p^2 = .656$, as well as time, $F(1,88) = 138.31$, $p < .001$, $\eta_p^2 = .611$, but not group, $F(1,88) = 0.04$, $p = .841$, $\eta_p^2 = .000$. Stems with existing prefixes were read more efficiently than stems with

Table 1
Standardized Spelling and Reading Tests: Means and Standard Deviations for Pre- and Post-Test

	Intervention		Control			
Task	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	Min|Max	Min|Max
Spelling	17.85 (10.51)	23.14 (10.98)	16.74 (9.70)	19.32 (8.30)	1|42	3|44
Morphological stems	37.33 (21.26)	53.24 (24.17)	32.50 (15.40)	38.35 (18.23)	0.00|92.86	0.00|93.75
Orthographic stems	55.84 (22.75)	63.18 (21.42)	52.07 (19.67)	61.11 (18.32)	6.06|94.12	14.71|97.06
Affixes	79.60 (10.56)	79.23 (12.73)	76.02 (10.03)	74.46 (9.41)	36.67|100	51.72|100
Sentence reading	22.38 (7.09)	26.02 (8.76)	19.53 (7.46)	24.13 (7.58)	7|37	10|46
Word reading	42.12 (16.53)	49.86 (18.71)	40.46 (14.27)	49.00 (19.92)	13|80	11|98
Nonword reading	30.67 (9.36)	32.92 (10.08)	29.24 (9.53)	33.10 (10.92)	10|55	12|64

Note: Spelling: Number of correctly spelt words. Morphological stems, orthographic stems, affixes: % correctly spelt morphemes. Sentence reading: Read sentences in 3 minutes. Word and nonword reading: Number of read items in 1 minute.

pseudo-prefixes (prefix: *M* = 33.58, *SD* = 14.39; pseudo-prefix: *M* = 24.35, *SD* = 10.17) and both groups read more items per minute correctly after than before the training period (pre-test: *M* = 25.61, *SD* = 11.25; post-test: *M* = 32.32, *SD* = 13.25). Importantly, there was an interaction affix type x time, $F(1,88) = 17.49$, $p < .001$, $\eta_p^2 = .166$, and affix type x time x group, $F(1,88) = 6.06$, $p = .016$, $\eta_p^2 = .064$. Follow-up ANOVAs separately for the two groups revealed a significant affix type x time interaction for the intervention, $F(1,48) = 25.88$, $p < .001$, $\eta_p^2 = .350$, but not for the control group, $F(1,40) = 1.26$, $p = .268$, $\eta_p^2 = .031$., showing that from pre- to post-test, only the intervention group showed larger improvements for prefixed than pseudo-prefixed nonwords.

For the (pseudo-) suffixed lists we found main effects of affix type, $F(1,88) = 76.79$, $p < .001$, $\eta_p^2 = .466$, and time, $F(1,88) = 86.16$, $p < .001$, $\eta_p^2 = .495$, but not group, $F(1,88) = 0.27$, $p = .605$, $\eta_p^2 = .003$. There was a significant interaction affix type x time, $F(1,88) = 5.10$, $p = .026$, $\eta_p^2 = .055$, but no other interactions were significant (F_s (1,88) between 0.20 and 0.54, all $p_s > .1$). Again, stems with existing suffixes were read more efficiently than stems with pseudo-suffixes (suffix: *M* = 22.84, *SD* = 9.78; pseudo-suffix: *M* = 19.45, *SD* = 8.03), performance was better after than before the training (pre-test: *M* = 19.14, *SD* = 8.21; post-test: *M* = 23.15, *SD* = 9.72), and improvements were larger for suffixed compared to pseudo-suffixed items. However, in the suffixed condition we did not see any evidence for effects directly related to the training.

Morphological Awareness

Children showed better performance in the morphological awareness task during post- than pre-test, $F(1,88) = 133.85$, $p < .001$, $\eta_p^2 = .603$ (see Table 2). However, there was no time x group interaction, $F(1,88) = 0.00$, $p = .965$, $\eta_p^2 = .000$, and no main effect group, $F(1,88) = 0.01$, $p = .917$, $\eta_p^2 = .000$. Thus, we have no evidence that the improvement in task performance was related to the morphological training.

Masked Morphological Priming

Because this task turned out to be quite difficult for our young participants, we decided to exclude four children (one from the training and three from the control group) who were obviously still struggling with basic reading (percentile 10 or below on word reading during post-test). Children who performed at or below guessing rate (50 % accurate) in the lexical decision paradigm were also excluded (pre-test: one child each from the prefix and suffix condition; post-test: seven children from the prefix and six from the suffix condition). Three words from the suffix condition and two words from the prefix condition were excluded from analysis because of generally low accuracy rates. The analysis of response times (RTs) was based on correct responses on word targets. RTs below 300 ms and above 7000 ms were excluded as we assumed that they resulted from task unrelated factors (2.34 % of correct responses). To meet the normality assumptions

Table 2
Reading of Morphological Complex Stimuli and Morphological Awareness: Means and Standard Deviations for Pre- and Post-Test

	Intervention		Control			
Task	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
	M (SD)	M (SD)	M (SD)	M (SD)	Min|Max	Min|Max
Prefix	28.71 (14.41)	39.11 (15.98)	29.64 (12.68)	36.39 (15.82)	6.58|72.00	9.62|84.71
Pseudo-prefix	21.68 (9.17)	26.61 (10.50)	21.72 (10.08)	27.08 (12.19)	4.64|51.43	4.62|62.61
Suffix	20.55 (9.34)	25.67 (11.24)	20.13 (8.35)	24.77 (11.08)	5.22|46.45	4.17|55.00
Pseudo-suffix	17.99 (8.15)	21.89 (8.18)	17.50 (7.90)	20.26 (9.13)	5.75|40.00	3.33|47.50
Morphological awareness	12.37 (5.39)	17.06 (4.51)	12.29 (4.87)	16.95 (3.26)	2|23	5|24

Note: Reading lists: Numbers of correctly read nonword per minute (after winsorizing). Morphological awareness: Means and standard deviations of correct responses.

data-points with standardized residuals bigger than 2.5 in absolute values were excluded (see Baayen, 2008) and reactions times were transformed (-1/RT; see Kliegl et al., 2010).

Training effects in accuracy and RTs of the lexical decision task were analysed with (generalized) linear mixed-effects models using the statistic software R (R Core Team, 2019) with the packages lme4 (Bates et al., 2015), car (Fox & Weisberg, 2019) and lmerTest (Kuznetsova et al., 2017). Suffix and prefix conditions were analysed separately. Fixed factors were prime type (affixed word, affixed nonword, non-affixed nonword, unrelated), time (pre-/post-test), and group (intervention/control), subject and item were random factors. In order to find the optimal number of factors fixed factors and interactions were only included if they improved the model's fit in a backward stepwise model selection procedure.

Mean response accuracy was 89.79 % (*SD* = 30.27 %) in the prefix and 89.64 % (*SD* = 30.47 %) in the suffix condition. Neither in the prefix, nor in the suffix condition main effects of time or group, or the interactions time x group or prime type x time x group were significant.

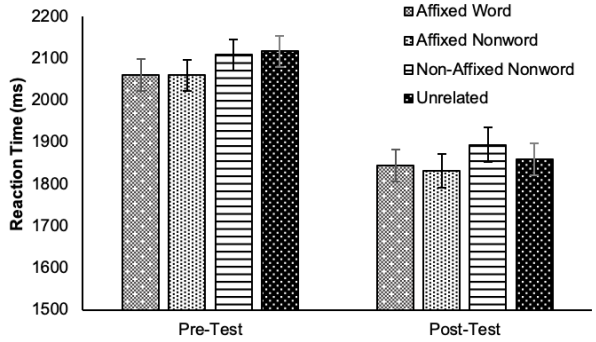
Mean RTs averaged across groups at pre- and post-test are presented separately for prefix- and suffix conditions in Figures 1 and 2. Mean RTs separately for the intervention and control groups are presented in Figure 3 and 4. In the prefix condition there was a main effect time, $\chi^2(1) = 259.12$, $p < .001$. Children were faster at post-test than pre-test. Prime type was marginally significant, $\chi^2(3) = 7.25$, $p = .064$. Post-hoc contrasts showed that the affixed word, $z = 2.02$, $p = .044$, and affixed nonword condition, $z = 2.42$, $p = .016$, but not the non-affixed nonword condition, $z = 1.23$, $p = .219$, differed from the unrelated condition. There was no difference between the affixed word and the affixed nonword condition, $z = -0.41$, $p = .680$, the affixed word and non-affixed nonword condition, $z = 0.78$, $p = .434$, and between the affixed nonword and non-affixed nonword condition, $z = 1.19$, $p = .234$. There was no main effect group but there was an interaction time x group, $\chi^2(1) = 17.76$, $p < .001$. The groups did not differ at pre-test, $z = -0.06$, $p = .530$, or post-test, $z = 0.43$, $p = .665$, but the decrease in reaction times was larger in the intervention than in the control group, i.: $z = -16.09$, $p < .001$ (265 ms) vs. c.: $z = -8.28$, $p < .001$ (180 ms). No other interactions were significant.

In the suffix condition we observed main effects of time, $\chi^2(1) = 478.08$, $p < .001$, and prime type, $\chi^2(3) = 9.69$, $p = .021$, with lower reaction times at post- than pre-test. Post-hoc contrasts showed that the affixed word, $z = -15.33$, $p < .001$, but not the affixed nonword, $z = 1.56$, $p = .119$, and the non-affixed nonword condition, $z = 1.42$, $p = .155$, differed from the unrelated condition. Again, there were no differences between the affixed word and affixed-nonword condition, $z = 1.44$, $p = .150$, the affixed word and the non-affixed nonword, $z = 1.59$, $p = .113$, and the affixed nonword and the non-affixed nonword condition, $z = 1.42$, $p = .887$. The group effect was not significant but there was an interaction time x group, $\chi^2(1) = 30.84$, $p < .001$. Like in the prefix condition there was a stronger decrease in overall RTs in the intervention than in the control group (300 vs. 229 ms). There were no group differences at pre-test, $z = -0.02$, $p = .985$, and post-test, $z = 1.32$, $p = .186$, and

reaction times decreased in both groups, i.: z = -21.88, p < .001; c.: z = -12.04, p < .001. No other interactions were significant.

Figure 1

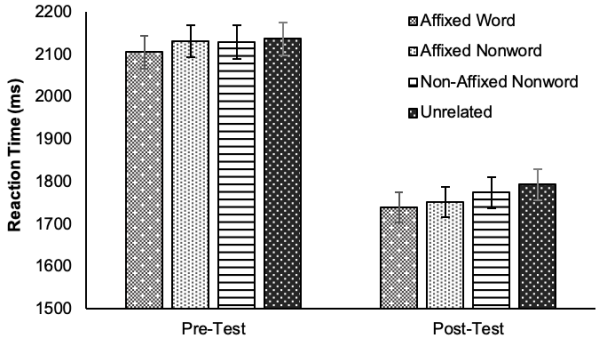
Reaction Times—Prefix Condition



Note: Mean RTs (lexical decision task) averaged across groups at pre- and post-test. Each of the four bars represents the mean reaction time after "seeing" one out of the four possible masked primes (affixed word, affixed nonword, non-affixed nonword, unrelated). Error bars show standard errors.

Figure 2

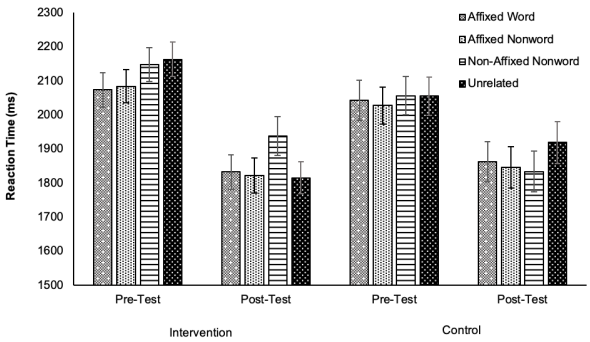
Reaction Times—Suffix Condition



Note: Mean RTs (lexical decision task) averaged across groups at pre- and post-test. Each of the four bars represents the mean reaction time after "seeing" one out of the four possible masked primes (affixed word, affixed nonword, non-affixed nonword, unrelated). Error bars show standard errors.

Figure 3

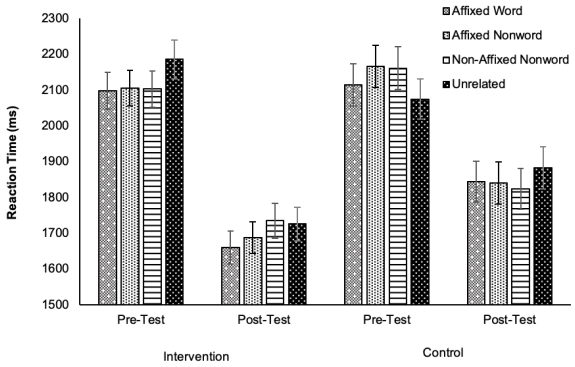
Reaction Times—Prefix Condition



Note: Reaction times (lexical decision task) after a morpheme-based training or alternatively before and after eight weeks of regular German classes. Each of the four bars represents the averaged reaction time after "seeing" one out of the four possible masked primes (affixed word, affixed nonword, non-affixed nonword, unrelated). Error bars show standard errors.

Figure 4

Reaction Times—Suffix Condition



Note: Reaction times (lexical decision task) after a morpheme-based training or alternatively before and after eight weeks of regular German classes. Each of the four bars represents the averaged reaction time after "seeing" one out of the four possible masked primes (affixed word, affixed nonword, non-affixed nonword, unrelated). Error bars show standard errors.

Discussion

Morpheme-based instruction programs have recently attracted an increasing amount of attention among researchers and practitioners (Allen & Lembke, 2020; Apel et al., 2013; Bowers & Bowers, 2017, 2018; Bowers et al., 2010; Gebauer, Fink, Filippini, et al., 2012; Goodwin & Ahn, 2013; Zhang & Zou, 2020). Explicit phonics-based instruction helps children to understand and apply the alphabetic principle of Indo-European orthographies (Ball & Blachman, 1988, 1991; Bus & van Ijzendoorn, 1999; Ehri et al., 2001; Fischer & Pfost, 2015). More recently, it has been proposed that explicit training of morphological knowledge may support children's reading development (Arnbak & Elbro, 2000; Bowers & Bowers, 2017; Bowers & Kirby, 2010). Crucially, in many orthographies the morphological principle tends to overrule the alphabetic principle.

The current study investigated the efficiency of a morpheme-based instruction in German-speaking second-graders and expanded the research literature in several ways. First, the vast majority of training studies published in international scientific journals were carried out in the phonologically opaque English orthography and only very few studies focused on more transparent orthographies like German (Kargl et al., 2008; Schneeberger et al., 2011; Walter et al., 2007; Weiss et al., 2010). German orthography is more consistent than English, and is also characterized by a richer morphology and strong reliance on morphological knowledge within the spelling system. Second, while several studies have demonstrated the efficiency of morpheme-based interventions for older German children (Gebauer, Fink, Filippini, et al., 2012; Gebauer, Fink, Kargl, et al., 2012; Kargl et al., 2008; Schneeberger et al., 2011; Walter et al., 2007; Weiss et al., 2010), we investigated if children in Grade 2, who

typically receive a largely phonics-based teaching approach, would also benefit from explicit morphemic instruction.

An important further aim of our study was to investigate if the intervention program would more generally boost children's spelling or reading skills. As morphological interventions in school-aged children typically involve the reading and spelling of morphemes and words, it is possible that training effects are caused by memory effects. That is, children may memorise the trained words and word parts and use this knowledge during written language processing. Training effects would then be evident due to the fact that the word material used during training overlaps with that occurring in pre- and post-test.

Training Effects on Spelling and Reading

The first important finding was that second-graders who received eight weeks of morpheme-based instruction showed significantly stronger improvements in spelling than children who received the business-as-usual teaching. Note that the morpheme-based training was provided as part of children's language classes, so the amount of teaching was comparable between the two groups. In contrast, the standard Grade 2 curriculum in Austria is more strongly focused on phoneme segmentation and blending. This finding thus extends earlier research on morphological intervention in older German students (Schneeberger et al., 2011; Walter et al., 2007). It further suggests that children as young as Grade 2 can profit from morphologically structured spelling instruction in a phonologically transparent orthography (for converging evidence from English, see Bowers et al., 2010; Goodwin & Ahn, 2013).

A more fine-grained analysis of the spelling results showed that the larger improvement in the training group was mostly related to more accurate spellings of word stems for which morphological information was helpful. Our data suggest that the intervention helped children to understand the principle of morpheme constancy. Orthographic stems, the spelling of which must be fully memorized (e.g. that the word form "wohnt" is spelt with a so-called "silent h" because all words containing the stem "wohn-" – Engl.: to reside, are spelt that way), did not show a training-specific improvement. Moreover, affix spellings did not improve from pre- to post-test, probably because the test contained mostly phonologically simple affixes, which were already spelt correctly at pre-test.

For reading, we also saw significant improvements from pre- to post-test. However, the improvements in the training group were not larger than those in the control group. Earlier evaluations of morphological intervention on older German speaking students reported mixed effects on reading. Some studies reported training effects on sentence reading efficiency and comprehension, but only compared to control groups not receiving any intervention (Gebauer, Fink, Kargl, et al., 2012; Weiss et al., 2010), while others failed to replicate training effects on reading (Gebauer, Fink, Filippini, et al., 2012; Schneeberger et al., 2011). Since the focus of the current intervention was on spelling, the absence of a training effect on reading was less surprising. The finding that nonword reading improved more in the control than in the training group is likely due to the phonics-oriented instruction these children received during the training period. While children in the intervention group were instructed to use their morphological knowledge during spelling and reading, children in the control group practiced sounding out and blending phonemes, which seemed to particularly benefit their nonword reading efficiency. Thus, our findings provide tentative evidence that phonics-based teaching more effectively builds phonological decoding skills than a morpheme-based instruction.

For the two standardized word reading measures (silent sentence reading and oral word reading fluency), both teaching approaches were equally efficient. However, these reading measures were not specifically designed to test for morpheme-based reading strategies. They probably required a mix of phoneme-, morpheme-, and word-based strategies and may not be sufficiently sensitive to specific improvements in either of these strategies. In the morpheme-based reading tasks, we contrasted conditions in which an existing stem was combined with a real pre- or suffix or with a matched letter cluster that did not correspond to a morpheme. An impact of morphology on reading was directly evident in these tasks as all children found it easier to read the affixed compared to the matched pseudo-affixed condition, and both groups showed stronger improvements from pre- to post-test in the affixed compared to the pseudo-affixed conditions. Interestingly, the results revealed a specific training-related improvement in this task: In the prefix condition, the difference in improvement between prefixed and pseudo-prefixed conditions was larger in the intervention than the control group. We did not see such a specific training-related change in the suffix condition, where both groups showed comparable training effects across conditions (suffixed and pseudo-suffixed). It is possible that the position of suffixes at the end of items was less prominent for children processing words in a left-to-right fashion. The finding of a specific, training related effect on prefixes, is, however, promising.

Training Effects on Morphological Awareness

A standard morphological awareness task in which children had to adapt word forms to a given

sentence was used to assess training effects on explicit morphological knowledge. While both groups performed clearly better during post- than pre-test, we did not see any evidence for intervention-related improvements. There are several reasons for the absence of an intervention effect on morphological awareness. First, the control group received some degree of morphological training as part of their language classes (even though this was not a specific focus). It is possible that this input was already sufficient to build their morphological awareness skills to a similar extent as the training group. Second, during training, only existing, high-frequency stems were combined with existing affixes, while in the morphological awareness task, pseudo-stems were used, which were (obviously) not in children´s lexicon. It is possible that these pseudo-stems confused our relatively young participants. It should also be noted that our morphological awareness task was adapted from a written version for older students (TMB; Kargl et al., 2006). Indeed, an earlier study with poor and typical readers in Grades 3 to 8 reported larger improvements in training compared to control groups (Kargl et al., 2008) for the written form of the same task. In the current study, we used a spoken version of the task as children´s spelling skills were probably not yet sufficiently developed for the written version. It is not clear if the verbal task version was sufficiently sensitive to capture changes in morphological awareness.

Training Effects on Morphological Processing

For the first time, we included a masked priming paradigm to investigate children's morphological segmentation skills during written language processing. Two findings are particularly important. First, we observed an overall larger improvement in visual word recognition speed in the intervention compared to the control group, suggesting that students became more proficient at rapidly identifying printed words. Second, there was no evidence for training related changes in priming patterns that would indicate a boost in children's morphological processing skills. It is possible, that the masked priming paradigm was not sufficiently sensitive to capture small effect changes after an eight-week training period. More intensive, longer-term training may be required to induce more robust changes. The present findings suggest that the MORPHEUS intervention program did not elicit any changes in children's automatic morphological segmentation processes. However, the program did provide a boost to participants' overall word recognition speed.

Despite the absence of a training effect on masked priming, the observed priming effects shed light on how young readers decompose morphologically complex stimuli into their morphemic constituents during reading. Significant priming effects in the two prefixed conditions suggest that children rapidly decomposed letter strings into prefix + stem, regardless of whether the morpheme combinations formed a real word (e.g., "mitdenken – DENKEN" – Engl.: think along – THINK) or a nonword (e.g., "hindenken – DENKEN" – Engl.: think towards – THINK). If the stem occurred in combination with a non-morphemic unit, priming effects were not observed (e.g., "kardenken – DENKEN"; Engl.: karthink – THINK). This pattern is similar to findings in skilled readers (Beyersmann, Ziegler, et al., 2016; Rastle & Davis, 2008; Rastle et al., 2004) who seemingly decompose words into their components by rapidly and automatically "stripping off" any orthographic string that resembles an affix, therefore also referred to as affix-stripping (Traft & Forster, 1975). In the suffix condition, however, only primes with a semantic relation to the target (word primes) induced priming effects. This pattern is different from other studies with children (Beyersmann, Grainger, et al., 2015; Beyersmann et al., 2021; Hasenäcker et al., 2016, 2020) and is suggestive of whole word processing (Giraudo & Grainger, 2001). These differences in priming patterns may be due to inherent differences of prefixes and suffixes regarding their semantic information. While manipulating both prefixes and suffixes can change the meaning of a word entirely, several prefixes like those used in this study ("auf-", "mit-", "ab-", "an-") can occur as separate prepositions and carry meaning on their own. Suffixes on the other hand need a stem to convey meaning (e.g., "-ly" typically marks an adverb). Therefore, prefixes have been described as having a quasi-lexical status (Beyersmann, Ziegler, & Grainger, 2015). In addition, if processing follows the reading direction (left to right), prefixes, at the beginning of a word, might be processed and detached first. Suffixes would only be detectable after stem identification. Our findings suggest that morphological processing may not strictly follow a whole-word-then-segmentation route or vice versa but rather allows for the parallel processing of whole words and morphemes. This would be in line with Grainger and Beyersmann's (2017) framework of a multiple-route model of word processing. Grainger's and Beyersmann's theoretical framework builds on the idea that embedded stems and also affixes can be activated via an entirely non-morphological process, with direct mappings from orthography to the lexical level (see also, Beyersmann et al., 2019).

The exact processes involved in and developmental trajectories of morphological priming should be subject to future research. In any case, the here reported morphological priming effects demonstrate that children as young as Grade 2 already make use of the structure inherent in morphologically complex words.

Limitations

One limitation of our study is that it was not possible to randomly assign students to the experimental or control groups, because the training was delivered as part of children's language classes. For administrative reasons, we also decided against random assignment of classrooms. The classrooms that received the intervention were selected so that they were reachable for the two graduate students who carried out the teaching lessons.

A further limitation is that the business-as-usual control group also received some degree of morpheme-based instruction, which corresponded to the Grade 2 curriculum. The capitalization rule of German orthography is morpheme-based (all nouns are capitalized), such that the recognizing "name words" has always been part of the early spelling curriculum. Word building and word family exercises, such as recognizing the identical stem in word families, occurred occasionally in the control group, while it was the central focus within the morphology-intervention group. Thus, the two groups clearly differed in the amount of morpheme-based input. Note that we found more marked training effects on spelling in spite of the (reduced) occurrence of morphological instruction in the control group. As argued earlier, it is possible that the minimal morpheme-based input in the control group was sufficient to induce improvements in morphological processing similar to the trainings group, thus explaining the lack of group differences in these tasks. It is also possible that the eight-week training period was too short to reveal effects on morphological processing. More extensive training may be necessary to fully benefit from the morpheme-intervention program. Finally, it would have been interesting to carry out a follow-up assessment one or two months after the end of the intervention in order to test for long-term effects. Unfortunately, the time-line of the project and the academic year prevented such an additional assessment.

Conclusions

The current study showed significant training-related improvements in orthographic spelling as well as in oral reading of morphologically complex words. These findings suggest that the MORPHEUS intervention program led to an overall boost in children's orthographic knowledge. At the same time, we were unable to provide direct evidence of training-related changes to children´s explicit or implicit morphological processing skills. This may be due to methodological limitations of our tasks and study design, but it is also possible that the improvements in spelling and reading were not induced by improvements in morphological processing, but rather by more general factors like gaining knowledge on frequent letter patterns or orthographic learning of individual words rather than morphemes.

Acknowledgement

Elisabeth Beyersmann was supported by a Discovery Early Career Researcher Award (DECRA) by the Australian Research Council (DE190100850).

Reinhard Kargl discloses that he is the co-author of the commercial intervention program MORPHEUS.

The study design followed the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments.

All parents provided written consent for assessment and/or training procedures, which were also approved by the local school authorities.

All authors agreed with the content and gave explicit consent to submit.

References

Allen, A. A., & Lembke, E. S. (2020). The effect of a morphological awareness intervention on early writing outcomes. *Learning Disability Quarterly.* https://doi.org/10.1177/0731948720912414

Amenta, S., & Crepaldi, D. (2012). Morphological processing as we know it: An analytical review of morphological effects in visual word identification. *Frontiers in Psychology, 3,* Article 232. https://doi.org/10.3389/fpsyg.2012.00232

Apel, K. (2014). A comprehensive definition of morphological awareness: Implications for assessment. *Topics in Language Disorders, 34*(3), 197–209. doi:10.1097/TLD.0000000000000019

Apel, K., Brimo, D., Diehm, E., & Apel, L. (2013). Morphological awareness intervention with kindergartners and first- and second-grade students from low socioeconomic status homes: A feasibility study. *Language, Speech, and Hearing Services in Schools, 44*(2), 161–173. https://doi.org/10.1044/0161-1461(2012/12-0042)

Arnbak, E., & Elbro, C. (2000). The effects of morphological awareness training on the reading and spelling skills of young dyslexics. *Scandinavian Journal of Educational Research, 44*(3), 229–251. https://doi.org/10.1080/00313830050154485

Ball, E. W., & Blachman, B. A. (1988). Phoneme segmentation training: Effect on reading readiness. *Annals of Dyslexia, 38*(1), 208–225. https://doi.org/10.1007/BF02648257

Ball, E. W., & Blachman, B. A. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly, 26*(1), 49–66.

Baayen, R. H. (2008). *Analyzing linguistic data: A practical introduction to statistics using R*. Cambridge University Press.

Bates, D., Maechler, M., Bolker, B., & Steve Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1–48. http://dx.doi.org/10.18637/jss.v067.i01

Berko, J. (1958). The child's learning of English morphology. *WORD, 14*(2–3), 150–177, https://doi.org/10.1080/00437956.1958.11659661

Berninger, V. W., Abbott, R. D., Nagy, W., & Nagy, W. (2010). Growth in phonological, orthographic, and morphological awareness in Grades 1 to 6. *Journal of Psycholinguistic Research, 39*(2), 141–163. https://doi.org/10.1007/s10936-009-9130-6

Beyersmann, E., Casalis, S., Ziegler, J. C., & Grainger, J. (2015). Language proficiency and morpho-orthographic segmentation. *Psychonomic Bulletin & Review, 22*(4), 1054–1061. https://doi.org/10.3758/s13423-014-0752-9

Beyersmann, E., Castles, A., & Coltheart, M. (2012). Morphological processing during visual word recognition in developing readers: Evidence from masked priming. *The Quarterly Journal of Experimental Psychology, 65*(7), 1306–1326. https://doi.org/10.1080/17470218.2012.656661

Beyersmann, E., Cavalli, E., Casalis, S., & Colé, P. (2016). Embedded stem priming effects in prefixed and suffixed pseudowords. *Scientific Studies of Reading, 20*(3), 220–230. https://doi.org/10.1080/10888438.2016.1140769

Beyersmann, E., Grainger, J., Casalis, S., & Ziegler, J. C. (2015). Effects of reading proficiency on embedded stem priming in primary school children. *Journal of Experimental Child Psychology, 139*, 115–126. https://doi.org/10.1016/j.jecp.2015.06.001

Beyersmann, E., Grainger, J., & Castles, A. (2019). Embedded stems as a bootstrapping mechanism for morphological parsing during reading development. *Journal of Experimental Child Psychology, 182*, 196–210. https://doi.org/10.1016/j.jecp.2019.01.010

Beyersmann, E., Mousikou, P., Javourey-Drevet, L., Schroeder, S., Ziegler, J. C., & Grainger, J. (2020). Morphological processing across modalities and languages. *Scientific Studies of Reading, 24*(6), 500–519. https://doi.org/10.1080/10888438.2020.1730847

Beyersmann, E., Mousikou, P., Schroeder, S., Javourey-Drevet, L., Ziegler, J. C., & Grainger, J. (2021). The dynamics of morphological processing in developing readers: A cross-linguistic masked priming study. *Journal of Experimental Child Psychology, 208*. https://doi.org/10.1016/j.jecp.2021.105140

Beyersmann, E., Ziegler, J. C., Castles, A., Coltheart, M., Kezilas, Y., & Grainger, J. (2016). Morpho-orthographic segmentation without semantics. *Psychonomic Bulletin & Review, 23,* 533–539. https://doi.org/10.3758/s13423-015-0927-z

Beyersmann, E., Ziegler, J. C., & Grainger, J. (2015). Differences in the processing of prefixes and suffixes revealed by a letter-search task. *Scientific Studies of Reading, 19*(5), 360–373. https://doi.org/10.1080/10888438.2015.1057824

Bowers. J. S., & Bowers, P. N. (2017). Beyond phonics: The case for teaching children the logic of the English spelling system. *Educational Psychologist, 52*(2), 124–141. https://doi.org/10.1080/00461520.2017.1288571

Bowers, J. S., & Bowers, P. N. (2018). The importance of correctly characterizing the English spelling system when devising and evaluating methods of reading instruction: Comment on Taylor, Davis, and Rastle (2017). *Quarterly Journal of Experimental Psychology, 71*(7), 1497–1500. https://doi.org/10.1177/1747021818759477

Bowers, P. N., & Kirby, J. R. (2010). Effects of morphological instruction on vocabulary acquisition. *Reading and Writing: An Interdisciplinary Journal, 23*(5), 515–537. https://doi.org/10.1007/s11145-009-9172-z

Bowers, P. N., Kirby, J. R., & Deacon, S. H. (2010). The effects of morphological instruction on literacy skills: A systematic review of the literature. *Review of Educational Research, 80*(2), 144–179. https://doi.org/10.3102%2F0034654309359353

Bus, A. G., & van IJzendoorn, M. H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. *Journal of Educational Psychology, 91*(3), 403–414. https://doi.org/10.1037/0022-0663.91.3.403

Carlisle, J. F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing: An Interdisciplinary Journal, 12*(3), 169–190. https://doi.org/10.1023/A:1008131926604

Casalis, S., & Louis-Alexandre, M. (2000). Morphological analysis, phonological analysis and learning to read French: A longitudinal study. *Reading and Writing: An Interdisciplinary Journal, 12*(3), 303–335. https://doi.org/10.1023/A:1008177205648

Chomsky, N., & Halle, M. (1968). *The sound pattern of English*. Harper & Row, Publishers.

Dawson, N., Rastle, K., & Ricketts, J. (2018). Morphological effects in visual word recognition: Children, adolescents, and adults. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 44*(4), 645–654. http://dx.doi.org/10.1037/xlm0000485

Deacon, S., & Kirby, J. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics, 25*(2), 223–238. https://doi.org/10.1017/S0142716404001110

De Simone, E., Beyersmann, E., Mulatti, C., Mirault, J., & Schmalz, X. (2021). Order among chaos: Cross-linguistic differences and developmental trajectories in pseudoword reading aloud using pronunciation Entropy. *PLoS ONE, 16*(5), Article e0251629. https://doi.org/10.1371/journal.pone.0251629

Ehri, L. C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly, 36*(3), 250–287. https://doi.org/10.1598/RRQ.36.3.2

Eichmeyer, A., Gönning, M., Kunze, H., Warnecke, A., von Werder, K., & Zoltan, G. (2013). *Karibu 2: Sprachbuch* [Karibu 2: Language book]. E. DORNER.

Eichmeyer, A., & Zoltan, G. (2013). *Karibu 2: Material für Lehrerinnen und Lehrer* [Karibu 2: Material for teachers]. E. DORNER.

Faul, F., Erdfelder, E., Lang, A-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175–191. https://doi.org/10.3758/BF03193146

Fischer, M. Y., & Pfost, M. (2015). Wie effektiv sind Maßnahmen zur Förderung der phonologischen Bewusstheit [How effective are measures to increase phonological awareness]? *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie, 47*(1), 35–51. https://doi.org/10.1026/0049-8637/a000121

Fox, J., & Weisberg, S. (2019). An {R} *Companion to Applied Regression* (Third Edition). Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Gebauer, D., Fink, A., Filippini, N., Johansen-Berg, H., Reishofer, G., Koschutnig, K., Kargl, R., Purgstaller, C., Fazekas, F., & Enzinger, C. (2012). Differences in integrity of white matter and changes with training in spelling impaired children: A diffusion tensor imaging study. *Brain Structure and Function, 217*(3), 747–760. https://doi.org/10.1007/s00429-011-0371-4

Gebauer, D., Fink, A., Kargl, R., Reishofer, G., Koschutnig, K., Purgstaller, C., Fazekas, F., & Enzinger, C. (2012). Differences in brain function and changes with intervention in children with poor spelling and reading abilities. *PLoS ONE, 7*(5), Article e38201. https://doi.org/10.1371/journal.pone.0038201

Giraudo, H., & Grainger, J. (2001). Priming complex words: Evidence for supralexical representation of morphology. *Psychonomic Bulletin & Review, 8*(1), 127–131. https://doi.org/10.3758/BF03196148

Goodwin, A. P., & Ahn, S. (2010). A meta-analysis of morphological interventions: Effects on literacy achievement of children with literacy difficulties. *Annals of Dyslexia, 60*(2), 183–208. https://doi.org/10.1007/s11881-010-0041-x

Goodwin, A. P., & Ahn, S. (2013). A meta-analysis of morphological interventions in English: Effects on literacy outcomes for school-age children. *Scientific Studies of Reading, 17*(4), 257–285. https://doi.org/10.1080/10888438.2012.689791

Grainger, J., & Beyersmann, E. (2017). Edge-aligned embedded word activation initiates morpho-orthographic segmentation. In B. H. Ross (Ed.), *The Psychology of Learning and Motivation: Vol. 67* (pp. 285–317). Elsevier Academic Press.

Hasenäcker, J., Beyersmann, E., & Schroeder, S. (2016). Masked morphological priming in German-speaking adults and children: Evidence from response time distributions. *Frontiers in Psychology, 7*, Article 929. https://doi.org/10.3389/fpsyg.2016.00929

Hasenäcker, J., Beyersmann, E., & Schroeder, S. (2020). Morphological priming in children: Disentangling the effects of school-grade and reading skill. *Scientific Studies of Reading, 24*(6), 484–499. https://doi.org/10.1080/10888438.2020.1729768

Heathcote, L., Nation, K., Castles, A., & Beyersmann, E. (2018). Do 'blacheap' and 'subcheap' both prime 'cheap'? An investigation of morphemic status and position in early visual word processing. *Quarterly Journal of Experimental Psychology, 71*(8), 1645–1654. https://doi.org/10.1080%2F17470218.2017.1362704

Kargl, R., & Landerl, K. (2018). Beyond phonology. *Topics in Language Disorders, 38*(4), 272–285. doi:10.1097/TLD.0000000000000165

Kargl, R., & Purgstaller, C. (2010). *MORPHEUS: Morphemunterstütztes Grundwortschatz-Segmentierungstraining* [Morpheme-based vocabulary-segmentation training]. Hogrefe.

Kargl, R., Purgstaller, C., Weiss, S., & Fink, A. (2006). *Test zur Erfassung der morphematischen Bewusstheit (TMB)* [Test to measure morphological awareness (TMB)]. Unveröffentlichtes Testverfahren [unpublished]. Lese-Rechtschreibinstitut Graz.

Kargl, R., Purgstaller, C., Weiss, S., & Fink, A. (2008). Effektivitätsüberprüfung eines morphemorientierten Grundwortschatz-Segmentierungstrainings (MORPHEUS) bei Kindern und Jugendlichen [Examining the effects of a morpheme-based vocabulary-segmentation training]. *Heilpädagogische Forschung, 34*(3), 147–156.

Kirby, J. R., Deacon, S. H., Bowers, P. N., Izenberg, L., Wade-Woolley, L., & Parrila, R. (2012). Children's morphological awareness and reading ability. *Reading and Writing: An Interdisciplinary Journal, 25*(2), 389–410. https://doi.org/10.1007/s11145-010-9276-5

Kliegl, R., Masson, M. E. J., & Richter, E. M. (2010). A linear mixed model analysis of masked repetition priming. *Visual Cognition, 18*(5), 655–681. https://doi.org/10.1080/13506280902986058

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in linear mixed effects models. *Journal of Statistical Software, 82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Landerl, K. (2017). Learning to read German. In L. Verhoeven, & C. Perfetti (Eds.), *Learning to read across languages and writing systems* (pp. 299–323). Cambridge University Press.

Levesque, K. C., Kieffer, M. J., & Deacon, S. H. (2017). Morphological awareness and reading comprehension: Examining mediating factors. *Journal of Experimental Child Psychology, 160,* 1–20. https://doi.org/10.1016/j.jecp.2017.02.015

Longtin, C.-M., Segui, J., & Hallé, P. A. (2003). Morphological priming without morphological relationship. *Language and Cognitive Processes, 18*(3), 313–334. https://doi.org/10.1080/01690960244000036

Mayringer, H., & Wimmer, H. (2003). *Salzburger Lese-Screening für die Klassenstufen 1-4* [Salzburg reading-screening for Grades 1-4]. Huber.

Moll, K., & Landerl, K. (2010). *Lese- und Rechtschreibtest (SLRT-II)* [Reading and spelling test (SLRT-II)]. Huber.

Morris, J., Porter, J. H., Grainger, J., & Holcomb, P. J. (2011). Effects of lexical status and morphological complexity in masked priming: An ERP study. *Language and Cognitive Processes, 26*(4–6), 558–599. https://doi.org/10.1080/01690965.2010.495482

Mousikou, P., Beyersmann, E., Ktori, M., Javourey, L., Crepaldi, D., Ziegler, J. C., Grainger, J., & Schroeder, S. (2020). Orthographic consistency influences morphological processing in reading aloud: Evidence from a cross-linguistic study. *Developmental Science, 23*(6). https://doi.org/10.1111/desc.12952

Mussar, R., Sénéchal, M., & Rey, V. (2020). The development of morphological knowledge and spelling in French. *Frontiers in Psychology, 11.* Article 146 https://doi.org/10.3389/fpsyg.2020.00146

Quémart, P., Casalis, S., & Colé, P. (2011). The role of form and meaning in the processing of written morphology: A priming study in French developing readers. *Journal of Experimental Child Psychology, 109*(4), 478–496. https://doi.org/10.1016/j.jecp.2011.02.008

Rastle, K., & Davis, M. H. (2008). Morphological decomposition based on the analysis of orthography. *Language and Cognitive Processes, 23*(7–8), 942–971. https://doi.org/10.1080/01690960802069730

Rastle, K., Davis, M. H., & New, B. (2004). The broth in my brother's brothel: Morpho-orthographic segmentation in visual word recognition. *Psychonomic Bulletin & Review, 11*(6), 1090–1098. https://doi.org/10.3758/BF03196742

R Core Team. (2020). R: *A language and environment for statistical computing.* R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/

Rispens, J. E., McBride-Chang, C., & Reitsma, P. (2008). Morphological awareness and early and advanced word recognition and spelling in Dutch. *Reading and Writing: An Interdisciplinary Journal, 21*(6), 587–607. https://doi.org/10.1007/s11145-007-9077-7

Scheerer-Neumann, G. (1979). *Intervention bei Lese-Rechtschreibschwäche. Überblick über Theorien, Methoden und Ergebnisse* [Interventions for reading and spelling difficulties. Overview of theories, methods and results]. Kamp.

Schiff, R., Raveh, M., & Fighel, A. (2012). The development of the Hebrew mental lexicon: *When morphological representations become devoid of their meaning. Scientific Studies of Reading, 16*(5), 383–403. https://doi.org/10.1080/10888438.2011.571327

Schmalz, X., Beyersmann, E., Cavalli, E., & Marinus, E. (2016). Unpredictability and complexity of print-to-speech correspondences increase reliance on lexical processes: More evidence for the orthographic depth hypothesis. *Journal of Cognitive Psychology, 28*(6), 658–672. https://doi.org/10.1080/20445911.2016.1182172

Schneeberger, B., Kargl, R., Purgstaller, C., Kozel, N., Gebauer, D., Vogl, J., Rohrer, S., & Fink, A. (2011). Förderung von Kindern und Jugendlichen mit Problemen im Schriftspracherwerb [Supporting children and teenagers with difficulties in written language acquisition]. *Zeitschrift für Heilpädagogik, 12*, 476–483.

Schroeder, S., Würzner, K.-M., Heister, J., Geyken, A., & Kliegl, R. (2015). childLex–Eine lexikalische Datenbank zur Schriftsprache für Kinder im Deutschen [childLex – A lexical database for written language for children - in German]. *Psychologische Rundschau, 66*(3), 155–165. https://doi.org/10.1026/0033-3042/a000275

Traft, M., & Forster, K. (1975). Lexical storage and retrieval of prefixed words. *Journal of Verbal Learning and Verbal Behavior, 14*(6), 638–647. https://doi.org/10.1016/S0022-5371(75)80051-X

Ulicheva, A., Harvey, H., Aronoff, M., & Rastle, K. (2018). Skilled readers' sensitivity to meaningful regularities in English writing. *Cognition, 195.* https://doi.org/10.1016/j.cognition.2018.09.013

Walter, J., Schliebe, L., & Barzen, S. (2007). Evaluation eines morphemorientiert-strategischen Rechtschreibtrainings in schulischen Fördergruppen mit Grundschülern der 3. Klasse [Evaluation of a morpheme-oriented strategic spelling training with third graders]. *Heilpädagogische Forschung, 33*(3), 143–154.

Weiß, R. H. (2006). *Grundintelligenztest Skala 2* (CFT 20-R) [Intelligence scale]. Hogrefe.

Weiss, S., Grabner, R. H., Kargl, R., Purgstaller, C., & Fink, A. (2010). Behavioral and neurophysiological effects of morphological awareness training on spelling and reading. *Reading and Writing: An Interdisciplinary Journal, 23*(6), 645–671. https://doi.org/10.1007/s11145-009-9177-7

Zhang, H., & Zou, W (2020). Morphological intervention in promoting higher-order reading abilities among college-level second language learners. *Sustainability, 12*(4), 1465. https://doi.org/10.3390/su12041465

Appendix

Examples for Training Tasks (Tablet and Paper-Pencil Tasks)

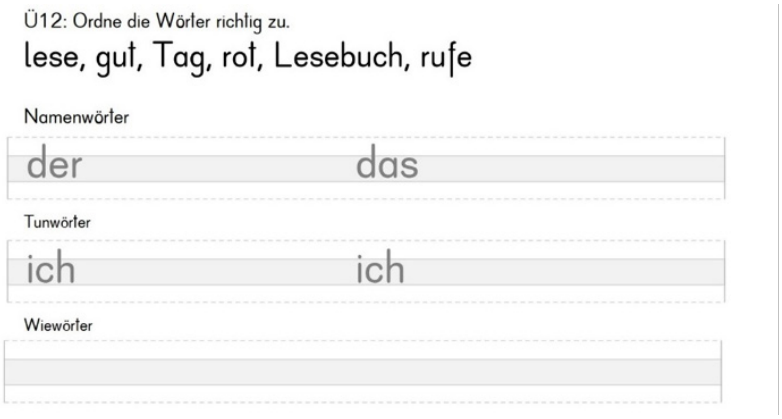
Figure 1A

Level 1: Identifying Words From the Same Word Family (Tablet).

Note: Children place each word in a specific box, depending on the stem morpheme, e.g., lesen, vorlesen,Leser (Engl.: to read, read to sb., reader) are placed into the box for the stem morpheme LES.

Figure 2A

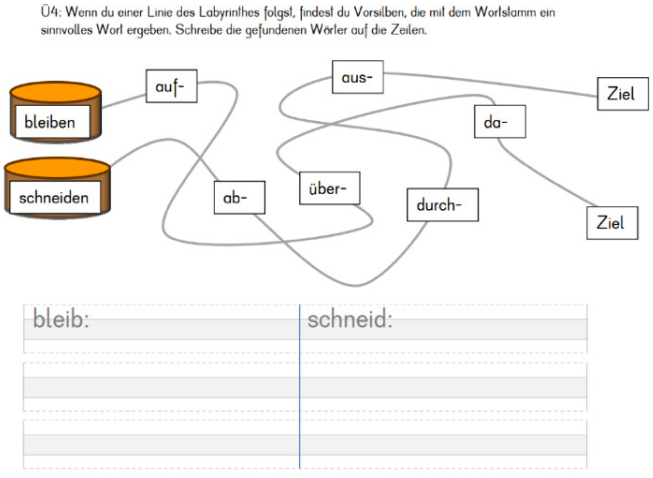
Level 1: Assigning Different Words to the Corresponding Word Class (Paper-Pencil Task).



Note: Presented words are written into the corresponding row: noun (Namenwort, Engl.: name word; e.g., der Tag – Engl.: the day), verb (Tunwort, Engl. do-word; e.g., lese – Engl.: read) or adjective (Wiewort, Engl: how-word; e.g., rot – Engl.: red).

Figure 3A

Level 2: Combining Prefixes and Words Into Derived Words (Paper-Pencil Task).



Note: The stem morpheme at the beginning of the line can be combined with each of the prefixes along the line, e.g., bleiben - aufbleiben, überbleiben ... (Engl.: to stay – stay awake, remain ...).

Figure 4A

Level 3: Sorting Words According to Stem + Identifying (Short) Vowels Followed by Double Consonant (Paper-Pencil Task).

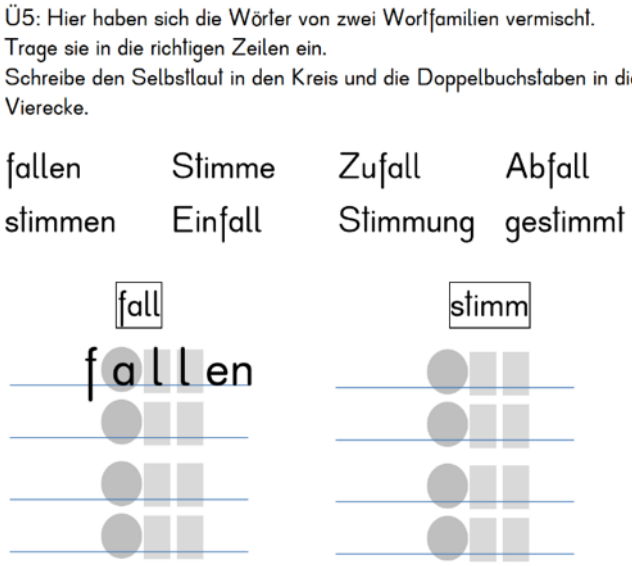
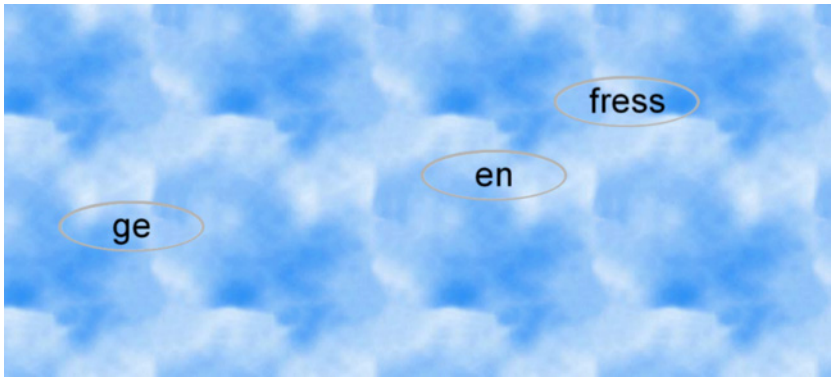


Figure 5A

Level 3: Assembling Morphemes (Tablet).



Note: A prefix (ge), stem (fress) and suffix (en) need to be tapped in the right order to build a morphologically complex word (gefressen; Engl.: eaten).

Figure 6A

Level 3: Segmenting Morphologically Complex Words Into Prefix, Stem, and Suffix (Paper-Pencil Task).

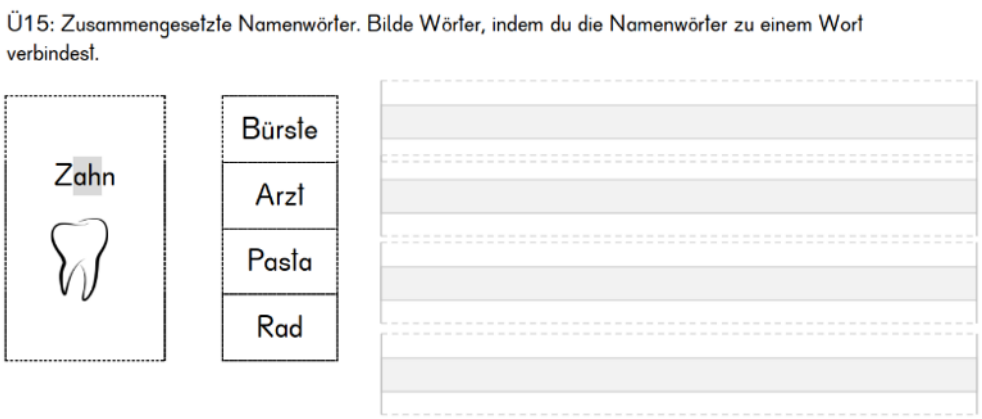
Ü6: Trage die Wörter und ihre Bestandteile in die Tabelle ein.

verbieten, vorspielen, anbieten, verspielen, mitspielen

Vorsilbe	Wortstamm	Nachsilbe
ver	biet	en

Figure 7A

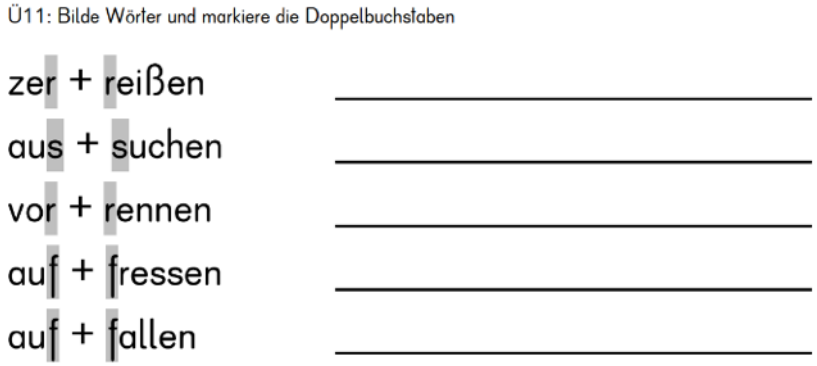
Level 3: Compounding (Paper-Pencil Task).



Note: Stems are combined into compounds and written down (e.g., Zahnbürste, Zahnarzt, ...; Engl.: toothbrush, dentist, ...), each containing the noun Zahn (Engl.: tooth).

Figure 8A

Level 3. Morpheme Constancy (Paper-Pencil Task).



Note: Children practice to combine and correctly spell words in which the prefix ends and the stem starts with the same letter.

This page is intentionally left blank.

www.iejee.com

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 673-685

The Relationship between Formative Assessment and Summative Assessment in Primary Grade Mathematics Classrooms*

Tuba Gezer[a], Chuang Wang[*,b] , Andrew Polly[c], Christie Martin[d], David Pugalee[e], Richard Lambert[f]

Received : 21 February 2021
Revised : 24 May 2021
Accepted : 15 June 2021
DOI : 10.26822/iejee.2021.220

* This project was supported by the North Carolina Department of Public Instruction's Mathematics and Science Partnership grant program.

[a] Tuba Gezer, University of North Carolina at Charlotte, Charlotte, USA.
E-mail: tgezer@uncc.edu
ORCID: https://orcid.org/0000-0001-9819-4146

[*,b] **Corresponding Author:** Chuang Wang, University of Macau, Taipa, Macau, China.
E-mail: wangc@um.edu.mo
ORCID: https://orcid.org/0000-0002-3810-9277

[c] Andrew Polly, University of North Carolina at Charlotte, Charlotte, USA.
E-mail: drew.polly@uncc.edu
ORCID: https://orcid.org/0000-0003-2370-4409

[d] Christie Martin, University of South Carolina, Columbia, USA.
E-mail: martinc1@mailbox.sc.edu
ORCID: https://orcid.org/0000-0001-7896-6882

[e] David Pugalee, University of North Carolina at Charlotte, Charlotte, USA.
E-mail: dkpugale@uncc.edu
ORCID: https://orcid.org/0000-0002-3356-1600

[f] Richard Lambert, University of North Carolina at Charlotte, Charlotte, USA.
E-mail: rglamber@uncc.edu
ORCID: https://orcid.org/0000-0002-5791-962X

Abstract

This study used hierarchical linear modeling to examine the relationship between an internet-based mathematics formative assessment and data from a mathematics summative assessment for primary grade learners (ages 5-7). Results showed a positive relationship between formative assessment data related to the concepts of counting and decomposing numbers and summative data. This relationship was more robust in classrooms where students demonstrated lower average performance on the formative assessment data. The results suggest that formative assessment can be more beneficial to encourage low achieving students in primary-grade mathematics classrooms. Therefore, we recommend teachers to use formative assessment practices more frequently in low achieved primary grade classrooms. The formative assessment process includes the cycle of data collection, data analysis, planning future instruction, and examining the impact of that instruction through cycling back to data collection. This study contributes to the field by providing more empirical data about the relationship between formative and summative assessment with primary grades' learners.

Keywords:

Elementary Education, Formative Assessment, Hierarchical Linear Modeling, Mathematics Education, Summative Assessment, Number Sense

Introduction

Teaching mathematics effectively continues to be a challenge (Chapman, 2012). Thames and Ball (2010) stated that specific skills and knowledge are required to engage in the complex process of teaching mathematics. In this sense, required knowledge refers to pedagogical and content knowledge; however, employing this knowledge to create a classroom that facilitates effective instruction also requires knowing the students. One of the benefits of assessment is learning about student progress. Connor

et al. (2018) articulated that teaching mathematics in small flexible learning groups using assessment data to individualize instructions was associated with a significant increase in students' mathematics achievement. Classroom assessment techniques, which embed assessment within the instructional process, help teachers to understand better students' understanding and misconceptions (Veldhius & Heuvel-Panhuizen, 2019).

In classrooms, formative assessment is used to gather data about the student learning process. Formative assessment and the effective use of data about students' performance may also lead to long-term gains on mathematics assessments (Polly et al., 2017; Black & Wiliam, 1998; NCTM, 2014). Formative assessment is important because it is situated within the learning process, and the purpose of formative assessment is not for summative measurement. Heritage (2007) concurred that the use of formative assessment instruments could yield information about students' learning that teachers can use directly to inform future instructions. Also, she emphasized that formative assessment should be situated within a learning paradigm and not as another test within a measurement paradigm.

While formative assessment uses student data to improve teaching and learning, summative assessment uses data to evaluate the learning outcomes (American Educational Research Association, American Psychological Association, & the National Council on Measurement in Education [AERA, APA & NCME], 2014). Formative assessment is usually informal, ongoing, and during instruction, whereas summative assessment is tended to be formal, cumulative, and after instruction (Dixson & Worrell, 2016). The purpose of the study is to examine the relationship between formative assessment and a state summative mathematics assessment. The researchers further examined the relationship between formative and summative assessment based on the average classroom achievement in primary grades (ages 5-7).

Literature Review

Formative assessment is considered an assessment for learning because the target audience of formative assessment is teachers and students, while summative assessment is considered as an assessment of learning due to giving updated information to stakeholders about teacher and student performances (Burke, 2010; Heritage, 2013). The distinguishing characteristics of summative assessment are classifying students' performances and being administered at the end of a unit or semester, whereas the goal of formative assessment is to determine students' strengths and weaknesses so that teachers and students could decide the beneficial activities to reach educational goals (Cizek, 2010).

Formative assessment is the most frequent assessment with the smallest scope, whereas summative assessment is the least frequent assessment with the most substantial scope, including teachers and school districts. Interim assessments are between formative assessment and summative assessment in terms of frequency and scope (Perie et al., 2009). Teachers commonly use interim assessment to identify the weakness of content or students for planning purposes (Riggan & Olah, 2011). On the other hand, an advantage of formative assessment is active class participation (Randel et al., 2016).

Perie et al. (2009) posited that the label of formative assessment was used to describe interim assessments, and Shepard (2008) suggested considering the purpose of the instrument when labeling formative assessment. Shepard's focus is on the interactions between the teacher and students when labeling an assessment, and she suggests that an interim assessment may produce the interactions that would be considered formative and situated in the learning paradigm. This framework means that when formative assessments are analyzed over time, they can offer the same benchmark insights as interim assessments.

The Relationship between Formative Assessment and Summative Assessment

Formative assessment and summative assessment are commonly used in educational settings to give information regarding student achievement (Hattie, 2003). However, the implications of formative assessment and summative assessments are different. While formative assessment is strongly tied to local curriculum and administered according to students' needs (Shepard et al., 2018), summative assessment uses data to assess students' knowledge (American Educational Research Association, American Psychological Association, & the National Council on Measurement in Education [AERA, APA & NCME], 2014). The concern of covering all the curricular objectives to prepare students for end-of-year summative assessment may influence teachers' formative assessment practices (Box et al., 2015; Govender, 2019).

In the seminal Cognitively Guided Instruction (CGI) project, teachers participated in professional development to learn about students' mathematical thinking, listen and notice students' thinking, and adjust their future work based on the data (Fennema et al., 1996). Thus, the goal of CGI is to help teachers to understand their students' mathematical thinking in order to make instructional decisions based on

students' thinking (Fennema et al., 1996), which indicated that teachers use the data as a formative assessment tool. The researchers investigated 21 teachers' instruction and beliefs about students' thinking for four years and concluded that the changes in teachers' instruction improved students' mathematic achievement (Fenema et al., 1996). In addition, as students' mathematic achievement increase, teachers were encouraged to use CGI strategies to understand students' mathematical thinking (Carpenter & Franke, 2004). Similarly, Stewart (2016) analyzed the predictive validity of formative assessment in 3rd-grade mathematics classrooms. They concluded that formative assessment, which is unit-based curriculum assessments, predicted students' performance on state-wide academic readiness assessment.

Formative Assessment and Feedback

McMillan (2010) articulated that formative assessment is shaped by educational goals and contextual factors such as classroom environment, grade level, or student ability. Besides, Heritage (2007) stated that by design, formative assessment could give feedback on multiple levels, such as providing feedback to teachers and students regarding students' learning processes. Also, Heritage mentioned that feedback could have a strong influence on student motivation and self-efficacy. Faber et al. (2016) examined the effect of digital formative assessment tools on student motivation and success using a randomized experimental design. The feedback feature of formative assessment tools contributed to students' mathematics achievement. The researchers further concluded that teachers benefited from the feedback feature of digital formative assessment more than their students. Similarly, Atjonen (2014) found that teachers emphasize the importance of using multiple assessment methods and interactive techniques to provide constructive feedback. Some researchers noted that delayed feedback might benefit high achieving students, especially with complicated tasks, whereas low achieving students need immediate feedback (Mason & Bruning, 2001). These studies (Atjonen, 2014; Faber et al., 2016; Mason & Bruning, 2001) highlighted that feedback is a crucial aspect of formative assessment for teachers and students.

Crossouard and Pryor (2012) stated that formative assessment includes examining small tasks and controlling observable behaviors. The researchers explained the formative assessment process as describing learning goals, setting assessment criteria, and providing feedback. Crossouard and Pryor suggested using open-ended questions in order to support students' high-level thinking. Similarly, Clark (2010) highlighted the quality of the interaction between teacher and student and concluded that feedback is a part of formative assessment as long as it leads students to critical thinking to reach learning goals. When process-oriented feedback is provided multiple times during the unit, formative assessment may influence student perception of the usefulness of the assessment (Rakoczy et al., 2019). Additionally, formative assessment can increase students' learning and student motivation (Faber et al., 2016).

Use of Technology in Formative Assessment

Pachler et al. (2010) defined "formative e-assessment" as processes that involve technology that produce data about students' understanding connected to objectives. This data enables both the teacher and the learner to take action to increase learning and improve teaching. This definition shows that any technology with the right conditions can be used for formative assessment. The benefit of using online classroom response systems in formative assessment presents information to teachers and students right after and during instructional practices (Irving, 2015). Considering the time limit during classroom activities, Ramsey and Duffy (2016) concluded that two strengths of using technology in the formative assessment process were saving time for interactive learning activities and facilitating individualized learning. Elmahdi et al. (2018) examined the usage of a tech-tool, Plickers, in formative assessment and concluded that using technology-based tools could improve the quality of formative assessment and students' learning outcomes. Besides examining four aspects of formative assessment, feedback, discussions, personalized options, and game-based learning, interactive whiteboards demonstrated a significant positive correlation between formative assessment activities and math achievement (Chen et al., 2020).

Numerous online formative assessment tools are available to support teachers' planning implementation of modified instruction. While some instruments function as an adaptive learning program by assessing students' outcomes as well as instructional activities, others provide formative assessment data to teachers so that teachers can evaluate students' learning outcomes and individualized instructional strategies. AMC Anywhere is an online-based formative assessment tool that allows teachers to collect data through diagnostic interviews regarding students' learning of mathematics concepts (Richardson, 2012). AMC Anywhere is used in one-on-one settings, and during these sessions, students use manipulatives such as counters and snap cubes to demonstrate number concepts.

The goal of AMC Anywhere is to provide information to teachers about students' conceptual understanding

of number sense so that teachers could use the information to modify instructional activities (Richardson, 2012). The AMC Anywhere assessment tool provides continuous feedback during the assessment process so that teachers would not waste time on too easy or difficult assessments (Martin & Polly, 2015). The tool assists the teachers in combining assessment data, generate individual or class reports according to assessment data, and collaborating with their colleagues (Polly et al., 2016). To sum up, the benefits of the AMC Anywhere tool are saving time on assessment practices, improving the quality of collaboration and feedback, and serving as formative assessment in mathematics classrooms (Martin & Polly, 2015).

Teachers who used AMC Anywhere reported challenges of finding the time and using formative assessment data (Martin, Polly et al., 2016). Despite these difficulties, teachers reported modifying instructional activities based on their students' mathematics achievement (Polly et al., 2016). Further, a positive relationship was reported between the frequency of applied formative assessment activities and students' mathematics achievement, and frequent formative assessment is also to make students know about their own processes (Polly et al., 2018).

Number Sense

Both national and state standards in the primary grades require teachers to focus on developing their students' understanding of the numbers, their relations, and number systems, symbolizing numbers (Common Core State Standards for Mathematics, 2010; National Council of Teachers of Mathematics, 2000; <state blinded> Department of Education, 2017). Number sense is defined as "a child's fluidity and flexibility with numbers, the sense of what numbers mean and an ability to perform mental mathematics and to look at the world and make comparisons" (Gersten & Chard, 1999, p. 18). The primary focuses of early childhood education are counting, addition, subtraction, and understanding of place value (Richardson, 2012). However, children sometimes generate the number sequences without understanding the meaning of the numbers (Yilmaz, 2017). The same study suggested that teachers should assess students' number sense and design instructions with task-based interviews or activities to meet student needs. Considering the inadequate number sense development during early childhood education could be a reason for difficulty with mathematics even in adulthood (Jordan & Levine, 2009), the use of formative assessment in early childhood mathematics education becomes crucial.

Formative assessment is the pedagogical intersection of curriculum and assessment, aiming to boost learning instead of proving that learning occurs (Crossouard & Pryor, 2012). Formative assessment not only has a positive influence on improving students' learning outcomes (Black & Wiliam, 1998; Kingston & Nash, 2011; Lee et al., 2020) but also it can boost students' performance on standardized assessments (Duckor et al., 2017; Reeves, 2001). While formative assessment and its implications have been examined (Atjonen, 2014; Elmahdi et al., 2018; Faber et al., 2016; Irving, 2015; Ramsey & Duffy, 2016), little is known about the relationship between formative and summative assessment in primary-grade mathematics classrooms.

Current Study

Considering formative and summative assessment are commonly used in educational settings and the conceptual difference in these two assessment paradigms, examining the relationship between formative and summative assessment became imperative due to multiple reasons. First, the relationship between formative and summative assessment could be an indication of effective formative assessment strategies. Second, this study could provide validity evidence for formative assessment tools. We used hierarchical linear modeling to examine if the relationship between formative and summative assessment change due to grade level and the average of students' achievement in a classroom.

The current study investigated the relationship between data from an internet-based formative assessment and data from a summative assessment focused on number sense for primary grade learners. The following research questions guided this study:

1. Is there a relationship between formative assessment scores and state summative assessment scores of students' mathematics number sense?

2. Is there a difference in the relationship between student's formative and summative assessment scores across kindergarten, first, and second grades?

3. Does the relationship between formative assessment scores and summative assessment scores vary by grade level and average students' achievement in a classroom?

Methods

Participants

Primary grade students' mathematics formative and summative assessment data came from a school district that included schools with urban,

suburban, and rural characteristics located in the southeastern United States. In this school district, 77 teachers participated in an 80-hours, one-year-long professional development experience, funded by the <state blinded> Mathematics Science Partnership grant program, to learn about formative assessment and students' number sense. Two groups of teachers with their students participated in this study. Group 1 consisted of 27 teachers and 258 students from Grade 1 (38%) and Grade 2 (62%). Group 2 consisted of 50 teachers and 477 students from Kindergarten (63%) and Grade 1 (37%). Group 1 and Group 2 took different parts of the online formative assessment tool (*AMC Anywhere*), which were hiding and counting, respectively.

Instruments

Internet-based Formative Assessment (AMC Anywhere)

The Internet-based formative assessment tool, AMC Anywhere, is used to collect data about students' mathematical understanding via diagnostic interviews in one-on-one settings (Figure 1). Based on the AMC Anywhere assessment tool, every student received a report with the letters A, P+, P, P-, I, and N (Figure 2). These letters, A, P, I, and N, stand for apply, practice, instruction, and needs prior skill, respectively. Please see Martin and Polly (2015) for a detailed description of the AMC Anywhere tool. In this project, teachers were expected to assess every student and use data to modify their classroom instruction. There are nine different assessments in the AMC Anywhere tool. Data from the Hiding and Counting Numbers Assessments were used in this study. The Hiding formative assessment provides data on students' ability to decompose numbers when they are given the total amount and one of the parts. For example, students are presented with a pile of 7 counters, they count them, and then the teacher hides some of them while the student looks away. The student sees the counters that remain and must determine how many counters are hiding and must orally explain their strategy. In the counting formative assessment, students count a set of objects put in front of them and determine how many counters there are and also determine how many would be in the pile if students added a counter or took away a counter. The Cronbach's alpha reliabilities for counting assessment scores and hiding assessment scores were .89 and .92, respectively, whereas the person reliability, which represents the probability of making the same separation between people over multiple measurements, was .92 for both of the assessments (Martin, Lambert et al., 2016). The consistent item location hierarchy provided evidence of the content aspect of the validity of the assessment scores with the developmental trajectory of children at these grade levels.

Figure 1

Hiding Assessment

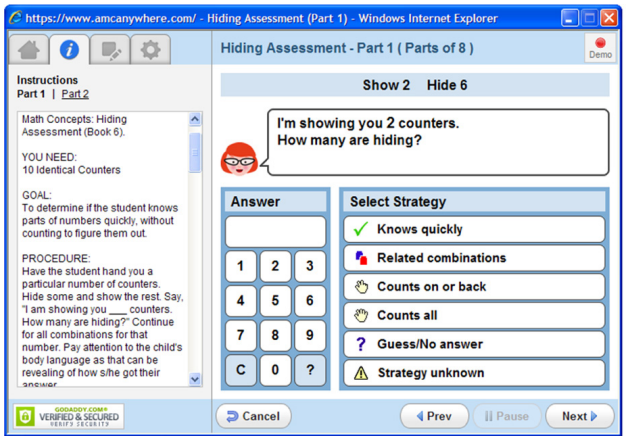


Figure 2

Hiding Assessment Scoring

Hiding Assessment - Part 1: Identifies Missing Parts of Numbers with Models								
Date	3	4	5	6	7	8	9	10
10/11/2013		A	P	I				
02/20/2014		A	P+	P				
05/22/2014			A	I				
Hiding Assessment - Part 2: Identifies Missing Parts of Numbers without Models								
Date		4	5	6	7	8	9	10
10/11/2013		N						
02/20/2014		P	P					
05/22/2014		P+	P	A	P	P	P	P

Summative Assessment

Teacher-leaders and state personnel created the summative assessment at the <state blinded> Department of Education. The assessment was designed to be given to an individual or small group of students in Kindergarten and Grade 1 and independently in Grade 2. Students' mathematics achievement was measured based on different tasks. The numbers of summative assessment tasks were 9, 12, and 11 in kindergarten, first grade, and second grade, respectively. Concepts that were assessed on those Kindergarten tasks included rote counting, counting objects, comparing numbers, addition, subtraction, and decomposing numbers. In first grade, summative assessment tasks included addition and subtraction, addition and subtraction word problems, solving for unknowns, extending the counting sequence, two-digit/place value, adding within 100, and subtracting multiples of 10. Lastly, second grade mathematics tasks included understanding place value, mentally adding 10 or 100, adding four two-digit numbers, addition and subtraction within 1000. The assessment included a rubric for each task. The rubrics described student performance on 3 possible levels: Level 1 (not yet meeting the standard), Level 2 (meeting the standards), and Level 3 (exceeding the standards). Students' summative assessment scores were the total percentage of tasks that students were grouped

at Level 2 or Level 3. Classroom achievement was measured as the percentage of proficient students in the classrooms.

Data Analysis

Item Response Theory was used to convert AMC Anywhere results into interval-level scale scores with a mean of 500 and a standard deviation of 100 with the Rasch Rating Scale Model (Andrich, 1978; Martin, Lambert et al., 2016). Pearson correlation was used to examine relationships between the two assessment scores by using .05 as the significance level. Before running the statistical analysis, the data were screened for outliers and normality. The multivariate outliers were checked based on Mahalanobis Distance, and the normality assumption was met.

For the first research questions, Pearson correlation coefficients were examined for the zero-order correlations between formative and summative test scores. The purpose of this analysis was that what percentage of the variance of the summative test scores was explained by the formative assessment scores. A one-way multivariate analysis of variance (MANOVA) was used to answer the second research question, which examined if there was a difference in students' formative and summative assessment scores between grade levels. Effect sizes were reported as eta squared (η^2), which is categorized as a small effect (0.01), medium effect (0.06), and large effect (0.15) (Cohen, 1988).

The third research question examined whether the relationship between formative and summative assessment data varied by the grade level and the average students' achievement in a classroom. We used a multi-level modeling procedure to examine the variance between classrooms relative to the variance within classrooms since students were nested in classrooms (Raudenbush & Bryk, 2002). Two-level hierarchical linear models (HLM) were used to understand the moderating effect of teachers on the relationship between the two student learning outcomes while grade level was controlled: formative assessment scores and state summative assessment scores. Unconditional models were run first to calculate the intraclass correlation coefficients (ICC), and random intercept models were run later to check the moderating effect of grade level and teachers on the relationships. Group-mean centering was used for independent variables of formative assessments so that the intercept of the HLM Level I represents the expected classroom mean score on the summative assessment for a student whose formative assessment score was at the classroom means. The hiding and summative assessment unconditional model revealed an ICC value of .204, which indicated that 20.4% of the variance of summative assessment was between classrooms. Similarly, the counting and summative assessment unconditional model revealed an ICC value of .062, which indicated that 6.2% of the variance of summative assessment was between classrooms. The HLM were represented as:

Level 1:

$$Summative_{ij} = \beta_{0j} + \beta_{1j} * (Formative_{ij}) + r_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * (Average\ Classroom\ Achivement_j) + \gamma_{02} * (Grade_{ij}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11} * (Average\ Classroom\ Achivement_j) + \gamma_{12} * (Grade_{ij})$$

The same HLM models were used for counting and hiding assessment scores. Grade 1 and Grade 2 students took the Hiding formative assessment, so the grade was dummy coded, and Grade 1 was the base group. Similarly, students that took the counting formative assessment were in kindergarten and Grade 1, and kindergarten was the base group in this analysis.

Results

The Relationship between Formative and Summative Assessments

Descriptive statistics for the formative assessments and summative assessments were presented in Table 1.

Table 1

Descriptive Statistics of Hiding, Counting and Summative Assessment Scores

	Hiding				Counting			
	Grade	M	SD	n	Grade	M	SD	n
Hiding	1st Grade	450.73	84.43	96	Kindergarten	288.18	40.18	302
	2nd Grade	469.91	65.62	162	1st Grade	315.59	11.73	169
	Total	462.77	73.61	258	Total	298.01	35.44	471
Summative	1st Grade	87.69	19.11	96	Kindergarten	97.00	9.69	302
	2nd Grade	77.04	24.06	162	1st Grade	92.05	14.65	169
	Total	81.00	22.90	258	Total	95.23	11.93	471

Hiding assessment

The correlation between state summative assessment scores and hiding assessment scores was statistically significantly different from zero, r = .44 (p < .01). This meant that 19.36% of the variance of hiding assessment scores was explained by state summative assessment.

Counting assessment

After the removal of six outliers based on Mahalanobis distance, all assumptions for linear regression were met. The correlation between the state summative assessment scores and counting assessment scores was statistically significantly different from zero, r = .29 (p < .01). It indicated that 8.41% of the variance of counting assessment scores was explained by the state summative assessment scores.

The Difference in Formative and Summative Assessment Scores between Grade Levels

Hiding formative assessment

A MANOVA was conducted to examine the difference in students' hiding and state summative assessment scores based on grade level. The dependent variables were hiding, and summative assessment scores and the independent variable was grade levels as first grade and second grade.

The assumption of homogeneity covariance matrices was not satisfied (Box's M= 18.32, F(3, 1413212) = 6.05, p < .001). Thus, Pillai's Trace criterion was used, and the combined dependent variables were statistically different based on grade level, Pillai's Trace = .113, F(2, 255) = 16.24, p < .001, partial η^2 =.11 (medium effect size). Follow-up univariate F statistics showed statistically significant differences in hiding scores, F(1, 256) = 4.14, p = .043, partial η^2 = .02 (small effect size) and summative assessment scores, F(1, 256) = 13.67, p < .001, partial η^2 = .05 (small effect size).

Counting formative assessment

A MANOVA was conducted to examine the difference in students' counting and summative assessment scores based on grade level. The dependent variables were counting, and summative assessment scores, and the independent variable was grade levels as kindergarten and first grade.

The assumption of homogeneity covariance matrices was not satisfied (Box's M= 311.55, F(3, 3735324) = 103, p < .001), so Pillai's Trace criterion was used. The combined dependent variables were statistically different based on grade levels, Pillai's Trace = .23, F(2, 468) = 70.31, p < .001, partial η^2 = .24 (large effect size). Follow-up using univariate statistics suggested statistically significant differences in counting, F(1, 469) = 75.05, p < .001, partial η^2 = .12 (medium effect size) and summative assessment scores, F(1, 469) = 19.42, p < .001, partial η^2 = .05 (small effect size).

Moderating Effects of Classroom Achievement and Grade Levels

Parameter estimates of the intercepts and slopes in the HLMs were presented in Table 2.

Hiding formative assessment

The parameter estimates in Table 2 suggested that first grade students, whose hiding score was at the classroom mean, were expected to receive 80.45 out of 100 in their summative assessment. Grade-level differences in the hiding assessment scores was not statistically significant (b = 3.73, p = .19). This result indicated that second grade students' performance on the summative assessment was the same as the first graders' performance in terms of standardized scores. Classroom mean performance on the formative assessment, however, contributed to the expected classroom mean summative scores (b = 0.81, p < .001). With one unit increase in average classroom score on formative assessment, the summative assessment score at the classroom mean was expected to increase by 0.81 unit.

Table 2
Parameter Estimates of the Fixed Effects with Summative Assessment as the Outcome

		Hiding			Counting		
	Level	Estimate	SE	df	Estimate	SE	df
Intercept	2	80.41	1.66***	24	92.73	1.07***	47
Class Achievement	2	0.81	0.08***	24	0.43	0.10***	47
Grade	2	3.73	2.78	24	1.53	2.01	47
Formative Assessment	1	0.17	0.02***	228	0.21	0.04***	424
Grade	1	-0.002	0.03	228	0.38	0.18*	424
Class Achievement	1	-0.005	0.002**	228	-0.01	0.01	424

*Note. *p < .05; *p < .01; ***p < .001*

The parameter estimates for the relationship between state summative assessment and hiding formative assessment at the individual level was statistically significant, b = 0.17, p < .001, which showed that with one unit increase in the student's hiding score from AMC Anywhere, the students' state summative assessment scores are expected to increase by 0.17. The parameter estimates for the moderating effect of classroom mean in formative assessment on this relationship was statistically significant, b = -0.005, p = .01, which demonstrated that with one unit increase in the average classroom assessment, the relationship between formative and summative assessments at the individual level was expected to decrease by 0.005 unit. The relationship was a bit weaker in classrooms with higher performance on hiding assessment. Grade level did not moderate this relationship, b = -0.002, p = .94, which meant that the relationship between formative assessment in hiding and summative assessment did not vary between first and second grade students. The effect size of this model was 30%, which indicated that independent variables included in the conditional model (hiding, class achievement, and grade) explained 30% of the individual differences in summative assessment. The conditional model also explained 94% of the between-classroom differences in summative assessment.

Counting formative assessment

The parameter estimates in Table 2 showed that kindergarten students whose counting scores were at the classroom mean were expected to receive 92.73 out of 100 in their summative assessment. Grade-level difference in counting assessment scores was not statistically significant (b = 1.53, p = .45). This result indicated that first grade students' performance on the summative assessment was the same as kindergarteners' performance in standardized scores. Classroom mean performance on formative assessment, however, contributed to the expected classroom mean summative scores (b = 0.43, p < .001). Data analysis indicated that a one-unit increase in the average classroom score on formative assessment was empirically associated with a 0.43 unit increase on the summative assessment score for the classroom mean.

The parameter estimates for the relationship between the summative assessment and the counting formative assessment at the individual level was statistically significant, b = 0.21, p < .001, which showed that with one unit increase in the student's counting score from AMC Anywhere, the students' state summative assessment scores were expected to increase by 0.21. Grade level moderated this relationship significantly, b = 0.18, p < .05, which means that the relationship between formative and summative assessment for counting is stronger among first-graders than among kindergarteners. Classroom mean performance on counting did not moderate this relationship significantly, b = -0.01, p = .19. The effect size of this model is 27%, which means that independent variables that we included in the conditional model (counting, class achievement, and grade) explained 27% of the within-group variance of summative assessment at the individual level. The conditional model also explained 93% of the between-group variance of summative assessment.

Discussion

This study contributes to the literature in that the findings indicate an empirical relationship between the internet-based formative assessment, AMC Anywhere, and the summative assessment for primary grade learners. Similarly, Guo and Yan (2019) found that students' attitude toward formative assessment is a predictor of students' attitudes toward summative assessment. While it was known that formative assessment data could be a significant predictor of summative assessment for upper elementary and middle school students in mathematics (Golden, 2019; Steward, 2016), this study focused on primary grade learners and used multi-level modeling. Considering the existing literature that formative assessment can support student learning (Black & Wiliam, 1998; Kingston & Nash, 2011; Lee et al., 2020; Rakoczy et al., 2016), this finding indicates the benefit of formative assessment practices in mathematics classrooms as well as the external validity of the formative assessment instrument, AMC Anywhere formative assessment tool. Besides, the result could indicate alignment between formative and summative assessment Golden, 2019). It is necessary to note that teachers should use the instructional tools correctly based on the principles for teaching to support student academic achievement (Chen et al., 2020)

Grade Level Difference in Formative Assessment and Summative Assessment

MANOVA results showed a significant difference between students' formative assessment and summative assessment results. Kindergarten students received higher formative assessment scores in hiding but lower summative assessment scores compared to first grade students. Similarly, the first grade students had higher formative assessment scores in counting but lower summative assessment scores compared to second grade students. In summary, lower grade students have higher formative assessment scores but lower summative assessment scores. This result echoed the Polly et al.'s (2018) finding that Kindergarten students outperformed First Grade students on formative assessment scores. Similarly, one explanation for increasing summative

assessment scores could be that students learn more mathematics content knowledge when they move up the grade levels (Martin, Polly et al., 2016; Martin, Lambert et al., 2016).

However, results from the multi-level model in this study indicated no statistically significant differences between Kindergarten and First Grade students in the formative assessments about counting and no statistically significant differences between first grade and second grade students in the formative assessment, hiding assessment, after moderating for classroom achievement. There could be multiple explanations of the different results from the MANOVA and the HLM analyses. First, the HLM did not compare the formative assessment and summative assessment between grade levels but instead used formative assessments to predict summative assessments. Second, HLM also used a different estimation approach (maximum likelihood estimation method) than that used in MANOVA (least squared estimation method). Third, as classroom achievement was included in the HLM model, it may explain the significant difference between formative and summative assessment between grade levels.

Moderating Effect of Classroom Achievement

The relationship between formative assessment in hiding and summative assessment is stronger in classrooms with lower average performance on formative assessment, which means that formative assessment may be more valuable for low achieving students. This result aligns with previous research as formative assessment was more effective for low-performing students (Polly et al., 2017; Bokhove & Drijvers, 2012; Koedinger et al., 2010). Students who were assessed with AMC Anywhere more frequently had a better understanding of number sense (Polly et al., 2017; 2018). Similarly, van den Berg et al. (2018) found that frequent use of formative assessment indicated higher achievement in fifth grades. The result of our study suggests that the frequency of formative assessment could be the reason for the difference between low performing and high performing students. It is important to interpret this result with caution because a possible explanation of this difference could be the faster growth of low achieving students (Polly et al., 2017).

Moderating Effect of Grade Level

The correlation between formative assessment in counting and summative assessment is higher in the first grade than in the kindergarten, which means that formative assessment could be more valuable for first grade students than for kindergarten students. This study aligned with findings from a previous study (e.g., Polly et al., 2018) where Kindergarten students received higher scores on the formative assessment. Although grade level was not a significant moderator of formative assessment, task complexity could be a moderator for formative assessment (Kingston & Nash, 2011). Besides, Kluger and DeNisi (1996) found that the effect of feedback increases with task complexity. Since task complexity increases as grade level go up, first grade students may benefit more from formative assessment than kindergarten students due to task complexity.

This study analyzed the relationship between formative and summative assessment in primary-grade mathematics classrooms, but there are some limitations. First, student and teacher characteristics were not included in the analysis because demographic data were not available to the researchers. Second, as we concluded that formative assessment is more beneficial to low performing students, low performing student achievements may increase due to the ceiling effect. Therefore, we recommended that the researchers interpret results with caution.

Implications

This research provides insights into the relationship between formative assessment and summative assessment in primary grades mathematics classrooms. The literature suggested that formative assessment and data-based instructional changes could improve students' mathematics achievement (Fennema et al., 1996; Kingston & Nash, 2011; Lee et al., 2020). However, this study is unique in adding classroom achievement to multi-level analyses and examining grade level differences, and focusing on primary grades' learners. The results suggest that formative assessment can be more beneficial to encourage low achieving students in primary-grade mathematics classrooms. Therefore, we recommend teachers to use formative assessment practices more frequently in low achieved primary grade classrooms, which includes the cycle of data collection, data analysis, planning future instruction, and examining the impact of that instruction through cycling back to data collection. For instance, the cycle of AMC Anywhere tool is that formative assessment, instructional practices, and formative assessment, and AMC Anywhere uses technology to adjusts formative assessment as students learn the concepts.

Teachers need to discover what aspect of number sense is challenging for low achieving students by using formative assessment. AMC Anywhere supports teachers in decision-making data-driven instructional decisions (Martin & Polly, 2015, p 376), and it collects data regarding students' strategies to solve the question. AMC Anywhere aims to reveal what students know or do not know about the number concepts rather

than whether students gave the right answer or not (Richardson, 2012). The positive relationship between formative and summative assessment may indicate the effectiveness of formative assessment strategies as the instruction quality improves student math achievement.

This study contributed to the literature as it examined the relationship between formative assessment and state summative assessment scores with both zero-order correlation coefficients and parameters estimated in a multi-level model by considering the nesting nature of students within classrooms. The significantly positive relationship between formative and summative assessment was noted in both methods. This relationship was stronger among first grade students than among kindergarteners. Further, low performing classrooms on formative assessment in hiding benefited more from formative assessment than high performing classrooms.

This study indicates the grade level difference between formative assessment and summative assessment in primary-grade mathematics classrooms. Thus, future studies should examine the grade level differences regarding formative and summative assessment for higher grades while including students' demographic information and teacher' background information. For instance, self-efficacy is a significant predictor of teachers' intention to use formative assessment (Karaman & Sahin, 2017). Further examination is also warranted to examine the moderating effect of grade level and students' proficiency level on the relationship between formative assessment and summative assessment. Results from these studies would be helpful for policymakers and educational practitioners who are interested in the use of formative assessment to guide instructions.

References

American Educational Research Association, American Psychological Association and National Council on Measurement in Education (2014). *Standards for educational and psychological testing.* Washington, DC: American Educational Research Association, American Psychological Association and National Council on Measurement in Education.

Andrich, D. (1978). A rating formulation for ordered response categories. *Psychometrika, 43,* 561–573.

Atjonen, P. (2014). Teachers' views of their assessment practice. *Curriculum Journal, 25*(2), 238-259. Retrieved from http://dx.doi.org/10.1080/09585176.2013.874952

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*(1), 7-74. doi:10.1080/0969595980050102

Bokhove, C., & Drijvers, P. (2012). Effects of feedback in an online algebra intervention. *Technology, Knowledge and Learning, 17*(1-2), 43-59.

Box, C., Skoog, G., & Dabbs, J. M. (2015). A case study of teacher personal practice assessment theories and complexities of implementing formative assessment. *American Educational Research Journal, 52*(5), 956–983. doi: 10.3102/0002831215587754

Burke, K. (2010). *Balanced assessment: From formative to summative.* Bloomington, IN: Solution Tree Press.

Carpenter, T., & Franke, M. (2004). Cognitively Guided Instruction: Challenging the Core of Educational Practice. In Glennan T., Bodilly S., Galegher J., & Kerr K. (Authors), *Expanding the Reach of Education Reforms: Perspectives from Leaders in the Scale-Up of Educational Interventions* (pp. 41-80). Santa Monica, CA; Arlington, VA; Pittsburgh, PA: RAND Corporation. Retrieved September 11, 2020, from http://www.jstor.org/stable/10.7249/mg248ff.10

Chapman, O. (2012). Challenges in mathematics teacher education. *Journal of Mathematics Teacher Education, 15,* 263-270.

Chen, I. H., Gamble, J. H., Lee, Z. H., & Fu, Q. L. (2020). Formative assessment with interactive whiteboards: A one-year longitudinal study of primary students' mathematical performance. *Computers & Education, 150,* 103833. https://doi.org/10.1016/j.compedu.2020.103833

Cizek, G. J. (2010). An introduction to formative assessment: History, Characteristics, and Challenges. In H. L. Andrade & G. J. Cizek (Eds.), *Handbook of formative assessment* (pp. 3-17). New York, NY: Routledge.

Clark, I. (2010). Formative assessment: There is nothing so practical as a good theory. *Australian Journal of Education, 54*(3), 341-352. Retrieved from http://dx.doi.org/10.1177/000494411005400308

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates Publishers.

Connor, C. M., Mazzocco, M. M., Kurz, T., Crowe, E. C., Tighe, E. L., Wood, T. S., & Morrison, F. J. (2018). Using assessment to individualize early mathematics instruction. *Journal of School Psychology, 66*, 97-113.

Crossouard, B., & Pryor, J. (2012). How theory matters: Formative assessment theory and practices and their different relations to education. *Studies in Philosophy and Education, 31*(3), 251-263. doi: 10.1007/s11217-012-9296-5

Dixson, D. D. & Worrell, F. C. (2016). Formative and summative assessment in the classroom. *Theory Into Practice, 55*(2), 153-159, DOI: 10.1080/00405841.2016.1148989

Duckor, B., Holmberg, C., & Becker, J. R. (2017). Making moves: Formative assessment in mathematics. *Mathematics Teaching in the Middle School, 22,* 334-342. Retrieved from http://about.jstor.org

Elmahdi, I., Al-Hattami, A., & Fawzi, H. (2018). Using technology for formative assessment to improve students' learning. *Turkish Online Journal of Educational Technology-TOJET, 17*(2), 182-188.

Faber, J. M., Luyten, H., & Visscher, A. J. (2016). The effects of a digital formative assessment tool on mathematics achievement and student motivation: Results of a randomized experiment. *Computers & Education, 106*, 83-96.

Fennema, E., Franke, M. L., Carpenter, T. P., & Carey, D. A. (1993). Using children's mathematical knowledge in instruction. *American educational research journal, 30*(3), 555-583.

Fennema, E., Carpenter, T. P., Franke, M. L., Levi, L., Jacobs, V. R., & Empson, S. B. (1996). A longitudinal study of learning to use children's thinking in mathematics instruction. *Journal for research in mathematics education,* 403-434.

Gersten, R., & Chard, D. (1999). Number sense: Rethinking arithmetic instruction for students with mathematical disabilities. *Journal of Special Education, 33*(1),18–28.

Golden, J. B. (2019). *The Relationship between Formative Math Assessments and the State Summative Assessment for Middle School Students in Alabama* (Doctoral dissertation, University of South Alabama). (Order No. 27544015). Available from ProQuest Dissertations & Theses Global. (2316839127).

Govender, P. (2019). Formative assessment as 'formative pedagogy' in grade 3 mathematics. *South African Journal of Childhood Education, 9*(1), 1-12.

Guo, W. Y., & Yan, Z. (2019). Formative and summative assessment in Hong Kong primary schools: students' attitudes matter. *Assessment in Education: Principles, Policy & Practice, 26*(6), 675-699. DOI: 10.1080/0969594X.2019.1571993

Hattie, J. (2003). Formative and summative interpretations of assessment information. *Retrieved September 28,* 2011.

Heritage, M. (2007). Formative assessment: What do teachers need to know and do? *Phi Delta Kappan, 89*(2), 140-145.

Heritage, M. (2013). *Formative assessment in practice: A process of inquiry and action.* Boston: Harvard Education Press.

Irving, K. (2015). Technology-assisted formative assessment. In M. J. Urban & D. A. Falvo (Eds.), *Improving K-12 STEM education outcomes through technological integration* (380 – 398). http://doi.org/10.4018/978-1-4666-9616-7.ch017

Jordan, N. C., & Levine, S. C. (2009). Socioeconomic variation, number competence, and mathematics learning difficulties in young children. *Developmental Disabilities Research Reviews, 15*(1), 60-68.

Kanjee, A., & Sayed, Y. (2013). Assessment policy in post-apartheid South Africa: Challenges for improving education quality and learning. *Assessment in Education: Principles, Policy & Practice, 20*(4), 442-469.

Karaman, P., & Şahin, Ç. (2017). Adaptation of Teachers' Conceptions and Practices of Formative Assessment Scale into Turkish Culture and a Structural Equation Modeling. *International Electronic Journal of Elementary Education, 10*(2), 185-194. DOI: 10.26822/iejee.2017236114

Kingston, N., & Nash, B. (2011). Formative assessment: A meta-analysis and a call for research. *Educational Measurement: Issues and Practice, 30*(4), 28-37.

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119*(2), 254– 284.

Koedinger, K. R., McLaughlin, E. A., & Heffernan, N. T. (2010). A quasi-experimental evaluation of an online formative assessment and tutoring system. *Journal of Educational Computing Research, 43*(4), 489-510.

Lee, H., Chung, H. Q., Zhang, Y., Abedi, J., & Warschauer, M. (2020). The Effectiveness and Features of Formative Assessment in US K-12 Education: A Systematic Review. *Applied Measurement in Education, 33*(2), 124-140. DOI: 10.1080/08957347.2020.1732383

Martin, C., Lambert, R., Polly, D., Wang, C., & Pugalee, D. (2016). The measurement properties of the assessing math concept's assessments of primary students' number sense skills. Journal of *Applied Measurement, 17*, 354-364.

Martin, C. S., & Polly, D. (2015). Using the AMC Anywhere web-based assessment system to examine primary students' understanding of number sense. In Cases on technology integration in mathematics education (pp. 365-377). IGI Global.

Martin, C. S., Polly, D., Wang, C., Lambert, R. G., & Pugalee, D. K. (2016). Perspectives and practices of elementary teachers using an Internet-based formative assessment tool: The case of assessing mathematics concepts. *International Journal for Technology in Mathematics Education, 23*(1), 3–13.

Mason, B. J., & Bruning, R. (2001). Providing feedback in computer-based instruction: What the research tells us. Retrieved February 19, 2019.

McMillan, J. H. (2010). The practical implications of educational aims and contexts for formative assessment. In H. L. Andrade & G. J. Cizek (Eds.), *Handbook of formative assessment* (pp. 41-58). New York, NY: Routledge.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA.

National Council of Teachers of Mathematics (NCTM). (2014). Principles to actions: Ensuring mathematical success for all.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards for Mathematics.* Washington, DC: Authors.

North Carolina Department of Public Instruction. (2017). Standards for mathematical practice. Retrieved from https://files.nc.gov/dpi/documents/curriculum/mathematics/scos/current/k-2.pdf

Pachler, N., Daly, C., Mor, Y., & Mellar, H. (2010). Formative e-assessment: Practitioner cases. *Computers & Education, 54*(3), 715-721.

Perie, M., Marion, S., & Gong, B. (2009). Moving toward a comprehensive assessment system: A framework for considering interim assessments. *Educational Measurement: Issues and Practice, 28*(3), 5-13.

Polly, D., Martin, C. S., Wang, C., Lambert, R. G., & Pugalee, D. K. (2016). Primary grades teachers' instructional decisions during online mathematics professional development activities. *Early Childhood Education Journal, 44*, 275–287. doi: 10.1007/s10643-015-0711-8

Polly, D., Wang, C., Martin, C., Lambert, R., Pugalee, D., & Middleton, C. (2018). The influence of Mathematics professional development, school-level, and teacher-level variables on primary students' Mathematics achievement. *Early Childhood Education Journal, 46*, 31-45. doi: 10.1007/s10643-017-0837-y

Polly, D., Wang, C., Martin, C., Lambert, R. G., Pugalee, D. K., & Middleton, C. W. (2017). The influence of an internet-based formative assessment tool on primary grades students' number sense achievement. *School Science and Mathematics, 117*(3-4), 127-136.

Rakoczy, K., Pinger, P., Hochweber, J., Klieme, E., Schütze, B., & Besser, M. (2019). Formative assessment in mathematics: Mediated by feedback's perceived usefulness and students' self-efficacy. *Learning and Instruction, 60,* 154-165.

Ramsey, B., & Duffy, A. (2016). *Formative assessment in the classroom: Findings from three districts. Michael and Susan Dell Foundation and Education, 1.* Retrieved from https://education-first.com/wp-content/uploads/2016/05/MSDF-Formative-Assessment-Study-Final-Report.pdf

Randel, B., Apthorp, H., Beesley, A. D., Clark, T. F., & Wang, X. (2016). Impacts of professional development in classroom assessment on teacher and student outcomes. *The Journal of Educational Research, 109*(5), 491-502. doi:10.1080/00220671.2014.992581

Raudenbush, S., & Bryk, A. (2002). *Hierarchical linear models: Applications and data analysis methods.* Thousand Oaks, CA: Sage.

Reeves, D. B. (2001). Standards make a difference: The influence of standards on classroom assessment. *NASSP Bulletin, 85*(621), 5-12.

Richardson, K. (2012). *How children learn number concepts: A guide to the critical learning phases.* Bellingham, WA: Math Perspectives.

Riggan, M., & Olah, L. N. (2011). Locating interim assessments within teachers' assessment practice. *Educational Assessment, 16*(1), 1-14.

Shepard, L. A. (2008). Formative assessment: Caveat emptor. In C. A. Dwyer (Ed.). *The future of assessment: Shaping teaching and learning.* New York, NY: Erlbaum.

Shepard, L. A., Penuel, W. R., & Pellegrino, J. W. (2018). Using learning and motivation theories to coherently link formative assessment, grading practices, and large-scale assessment. *Educational Measurement: Issues and Practice, 37*(1), 21–34.

Stewart, A. B. B. (2016). *An analysis of the predictive validity of curriculum-based mathematics assessments on student performance on state standardized tests.* Available from ProQuest Dissertations & Theses Global. (AAI3704816) Retrieved from https://search.proquest.com

Thames, M. H., & Ball, D. L. (2010). What math knowledge does teaching require? *Teaching Children Mathematics, 17,* 220-229.

van den Berg, M., Bosker, R. J., & Suhre, C. J. (2018). Testing the effectiveness of classroom formative assessment in Dutch primary mathematics education. *School Effectiveness and School Improvement, 29*(3), 339-361. https://doi.org/10.1080/09243453.2017.1406376

Veldhuis, M., & van den Heuvel-Panhuizen, M. (2019). Supporting primary school teachers' classroom assessment in mathematics education: Effects on student achievement. *Mathematics Education Research Journal,* 1-23.

Yılmaz, Z. (2017). Young children's number sense development: Age related complexity across cases of three children. *International Electronic Journal of Elementary Education, 9*(4), 891-902.

This page is intentionally left blank.

www.iejee.com

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 687-697

STEM in Transition from Primary School to Middle School: Primary School Students' Attitudes

Halit Karalar[*,a], Sabri Sidekli[b], Bekir Yıldırım[c]

Received : 27 January 2021
Revised : 27 April 2021
Accepted : 15 June 2021
DOI : 10.26822/iejee.2021.221

[*,a]**Corresponding Author:** Halit Karalar, Muğla Sıtkı Koçman University
E-mail: khalit@mu.edu.tr
ORCID: https://orcid.org/0000-0001-9344-9672

[b]Sabri Sidekli, Muğla Sıtkı Koçman University
E-mail: ssidekli@mu.edu.tr
ORCID: https://orcid.org/0000-0003-3202-6451

[c]Bekir Yıldırım, Muş Alparslan University
E-mail: b.yildirim@alparslan.edu.tr
ORCID: https://orcid.org/0000-0002-5374-4025

Abstract

This study aims to examine the STEM attitudes of primary school fourth-grade students who are in the transition period from primary school to middle school. More specifically, this study examines whether the students' attitudes towards STEM significantly differ according to gender, parents' educational background, science achievement, and mathematics achievement. The data obtained from 221 fourth-grade students through the STEM Attitude Scale were analyzed by independent sample t-test and one-way analysis of variance (ANOVA). The research results revealed that students move from primary school to middle school with a high STEM attitude. In this transition, girls' attitudes towards mathematics and boys' towards engineering and technology were higher. The tendency in engineering and technology attitudes differs only in favor of male students but does not differ significantly in parents' educational background, science, and mathematics achievement. While there was no significant difference in general STEM attitudes of the students in terms of gender and mother's education, there was a difference in father's education, mathematics, and science achievement. Following, the research results were discussed, and recommendations for policymakers and practitioners were presented.

Keywords:

STEM Attitude, The Transition From Primary School To Middle School, Fourth-Grade Students, STEM, Attitude, Primary School.

Introduction

In today's 5.0 society, the rapid change in science and technology has enabled countries to change in many areas as health, industry, agriculture, technology (Murphy et al., 2018). In parallel with this change, professions in science, technology, engineering, and mathematics (STEM) fields, which are the sources of innovation of today's digital economies, are predicted to increase visibly compared to other professions. The demand for professions in STEM fields in the USA, for instance, will grow as 8% until 2029 (U.S. Bureau of Labor Statistics, 2021). While the need for experts in STEM fields is constantly increasing, interest in these fields

is gradually decreasing in developed and developing countries; and preference for these fields as a profession loses popularity (Brophy et al., 2008; Lavonen et al., 2008; National Research Council [NRC], 2011). According to Turkish Industry and Business Association (TUSIAD) estimation, requirement for the STEM-related employment for 2023 will be approximately 1 million in Turkey, and about 31% of this need will not be met (TUSIAD, 2017).

Concerning change in education systems has also become inevitable to meet the increasing professional needs of STEM fields and prepare students for an uncertain future. The uncertainty for today's students requires them to be prepared for and equipped with 21st-century skills such as communication, collaboration, critical thinking, innovation, creativity, and problem-solving. This requirement has led to the adaptation of new and different approaches into education systems. One of these approaches is the STEM education approach (Bybee, 2013). STEM education approach is an educational approach in which the fields of Science, Technology, Engineering, and Mathematics are integrated with daily-life skills (Stohlmann et al., 2012).

The STEM approach has attracted educators as it provides individuals with the skills and competencies necessary for the 21st-century business world (Walton & Johnson, 2015). Also, this approach is preferred to increase students' interest in STEM fields, teach the STEM-related concepts, and improve students' literacy and awareness towards these fields (Sarı et al., 2018). During the period from preschool to higher education, students can decide which fields they like, which fields they are good at, and which professions they will choose (Yıldırım, 2021). Consequently, it is recommended to integrate STEM education in classrooms starting from an early age (NRC, 2011; Yıldırım, 2021) to ensure that students have a positive attitude towards STEM fields (Gonzalez, & Freyer, 2014). STEM education approach is practiced in formal and informal learning environments in many countries such as South Korea, England, and the USA (Smith & White, 2019). There are many important reasons explaining why STEM education is practiced through formal and informal learning. To name a few, STEM education (1) enables school-industry connection, (2) improves 21st century skills (Partnership for 21st Century Skills [P21], (3) attaches importance to vocational high schools and (4) connects acquired knowledge with daily life (Guzey et al., 2020).

Previous researches have shown that there is a positive relationship between interest in STEM fields and STEM career intention (Christensen & Knezek, 2017). Also, there is a positive relationship between early career interest in STEM fields and career choice (Crisp et al., 2009). Besides, there is a positive relationship between attitude towards STEM fields and interest in STEM careers (Ciftci et al., 2020; Wiebe et al., 2018). Ciftci et al. (2020) indicated that approximately 43% of the total variance of interest towards STEM careers derived from attitudes towards STEM fields. They reported that attitude towards STEM was an important factor in determining interest in STEM careers. Therefore, it is important to examine students' attitudes towards STEM fields which have an influence on their choices for future careers.

The literature shows that students' attitudes towards STEM careers are not stable in primary and middle schools (Wiebe et al., 2018), and half of the students lose their high attitudes and interest in STEM fields when they reach the 8th grade (Allen, 2016). In this context, studies conducted in recent years (Akif Bircan & Köksal, 2020; Christensen & Knezek, 2017; Ciftci et al., 2020; Karakaya & Avgın, 2016; Koyunlu et al., 2020; Özcan & Koca, 2019; Yerdelen et al., 2016; Yıldırım & Selvi, 2017) have focused on determining the attitudes of middle school students towards STEM fields and their career interests in these fields. However, little is known about what the students' attitudes towards STEM are during the transition from primary to middle school. Particularly, determining the attitudes of primary school 4th-grade students towards STEM fields and examining these attitudes according to different variables can give important clues to policymakers, curriculum developers, teachers, and researchers on STEM education. Relatively, this study aimed to determine the primary school students' attitudes towards STEM, and the following questions are attempted to be answered:

- What are the attitudes of primary school fourth-grade students towards STEM?

- Is there any significant difference in the attitudes of primary school fourth-grade students towards STEM in terms of gender, parents' educational background, mathematics achievement, and science achievement?

Method

Research model

Aiming to determine the attitudes of fourth-grade students towards STEM, the survey model was used in this study. A survey model can be used to analyze the opinions of the participants about an issue or event or their interests, skills, abilities, attitudes, etc. It is used in cases where certain features are desired to be identified (Büyüköztürk et al., 2009).

Participants

Participants were selected according to the purposeful sampling method of non-probability sampling methods. In this sampling, the researcher decides on the sample to be conducted, and in this way, the most suitable sample is selected with the purpose of the study (Balcı, 2016). Choosing the most suitable sample in the research provides time and convenience for the people doing the research (Patton, 2002). While determining the participants, we focused on the students with family profiles from lower levels of socioeconomic status and educational background. The convenience sampling method was applied while reaching the participants. The total number of participants is 221 fourth-grade students from one of Turkey's western provinces. Table 1 shows the demographic information of fourth-grade students who voluntarily participated in the study.

Table 1

Demographic Information of Participants

		f	%
Gender	Girl	125	55.6
	Boy	96	43.4
	Total	221	100
Mother's educational background	Primary school	68	30.7
	Middle school	102	46.2
	High school	51	23.1
	Total	221	100
Father's educational background	Primary school	74	33.5
	Middle school	77	34.8
	High school	70	31.7
	Total	221	100
Mathematics achievement	Low	10	4.5
	Middle	72	32.6
	High	139	62.9
	Total	221	100
Science achievement	Low	17	7.7
	Middle	71	32.1
	High	133	60.2
	Total	221	100

Data Collection Tools

Demographic information form and "STEM Attitude Scale" were used as data collection tools in the study. The demographic information form developed by the researchers consisted of students' gender, parents' educational background, mathematics achievement, and science achievement.

"STEM Attitude Scale" was developed by Faber et al. (2013) and adapted into Turkish for primary schools by Özyurt et al. (2018). The construct validity of the scale was tested by the researchers with confirmatory factor analysis (Özyurt et al., 2018). The scale has 37-items as 5-point Likert-type with 4 sub-dimensions, namely: Mathematics (8), Science (9), Engineering-technology (9), and 21st century skills (11). In the scale adaptation study, the Cronbach Alpha reliability coefficients of Mathematics, Science, Engineering-technology, 21st century skills, and Attitude towards STEM were calculated as .78, .82, .82, .90, and .93 respectively (Özyurt et al., 2018). For this study, Cronbach Alpha reliability coefficients were calculated as .82, .84, .88, .90, and .92, respectively.

Data Collection

The data collection was carried out in 4 stages. Firstly, possible primary schools to conduct the study were decided. Following, fourth-grade classroom teachers working in these schools were determined. Secondly, teachers were contacted by telephone and informed about the research. Eight teachers were willing to support the research. Thirdly, measurement tools were digitized with a Google Form, and the form's URL address was sent to volunteer teachers. Finally, the URL address of the form was shared with the students in virtual classrooms by the teachers. Since the data collection process was in the pandemic period, no face-to-face interviews were held with the teachers, and the data were not collected in the classroom. With the help of teachers, fourth-grade students anonymously filled out the form within two weeks. When the given responses to the form stopped, the data collection was completed and the data analysis was started. Since the form was digital and each question had to be answered, the data were obtained without any errors and losses.

Data Analysis

To determine the statistical tests to be used in the analysis of the data, it was examined whether the data showed a normal distribution or not. Kurtosis and Skewness values of the scores obtained from the subscales and the scale were in the range of -1 +1 (see Table 2), indicating the scores do not deviate excessively from the normal distribution (Hair et al., 2019). With the assumption of normality and homogeneity of variances regarding group scores, data analysis was conducted through independent sample t-test and the one-way analysis of variance (ANOVA) test. In determining the source of the significant difference between the group averages as a result of ANOVA test, Scheffe test was used, since the groups did not have an equal number of participants.

Obtaining significant differences in the data analysis, Cohen's d was used to report the effect sizes of these

differences. As Cohen (1992) guided, Cohen's d effect sizes were interpreted as small (0.20), medium (0.50), and large (0.80). Eta square (η^2) was used to report the effect sizes related to the significant differences found as a result of ANOVA test, and the values were interpreted as small (0.01), medium (0.06), and large (0.14) effect sizes (Büyüköztürk, 2015). Data analysis was proceeded via SPSS 23 statistical software, taking the significance level as .05.

Results

Students' Attitudes towards STEM

Table 2 shows the descriptive statistics obtained from the STEM Attitude Scale and its subscales. The average scores on the STEM attitude scale were, respectively, "Mathematics" (*M* = 32.63, *SD* = 5.36, out of 40), "Science" (*M* = 36.11, *SD* = 5.36, out of 45), "Engineering-technology" (*M* = 35.51, *SD* = 6.13, out of 45), "21st century skills" (M = 46.78, *SD* = 6.15, out of 55), and "Total" (*M* = 151.02, *SD* = 17.33, out of 185). All of them were high, indicating that students had a positive learning attitude towards STEM.

STEM Attitude and Gender

Table 3 presents independent t-test results examined if there was any gender difference in the primary school 4th-grade students' STEM attitudes.

As shown in Table 3, a statistically significant difference was identified in "Mathematics" (t = 2.02, p < .05) and "Engineering-technology" (t = 3.48, p < .01). While the female students' scores (*M* = 33.30, *SD* = 5.35) on the "Mathematics" were significantly higher than the male (*M* = 31.80, *SD* = 5.29), the male students' scores (*M* = 37.10, *SD* = 4.87) on the "Engineering-technology" were significantly higher than the female (*M* = 34.3, *SD* = 6.71). The Cohen's d effect sizes were, respectively, 0.27 and 0.47, suggesting a small and medium effect size. Except for the "Mathematics" and "Engineering-technology" subscales, no other subscales and total scale scores revealed significant differences between the male and female students.

STEM Attitude and Mother's Educational Background

Table 4 shows the descriptive findings and one-way analysis of variance (ANOVA) results of the STEM

Table 2
Descriptive Findings

	N	*M*	*SD*	Min	Max	Skewness	Kurtosis
Mathematics	221	32.63	5.36	18	40	-.61	-.26
Science	221	36.11	5.36	20	45	-.32	-.26
Engineering-technology	221	35.51	6.13	18	45	-.36	-.28
21st century skills	221	46.78	6.15	28	55	-.43	-.24
Total	221	151.02	17.33	100	185	-.21	-.18

Table 3
T-Test Results of Attitude Scale Towards STEM According to Gender

		N	*M*	*SD*	*df*	*t*	*p*	Cohen's *d*
Mathematics	Girl	125	33.3	5.35	219	2.02	0.04	0.27
	Boy	96	31.8	5.29				
Science	Girl	125	36.3	5.42	219	0.72	0.47	0.09
	Boy	96	35.8	5.30				
Engineering-technology	Girl	125	34.3	6.71	219	3.48	0.00	0.47
	Boy	96	37.1	4.87				
21st century skills	Girl	125	47.2	6.20	219	1.16	0.25	0.15
	Boy	96	46.2	6.07				
Total	Girl	125	151.1	18.30	219	0.06	0.96	0.00
	Boy	96	150.9	16.08				

attitude scale and its subscales, according to the mother's educational background. There was no significant difference in scale and its subscales in terms of mother's educational background. This indicated that mother's educational background did not play a role in STEM attitudes of the students.

Stem Attitude and Father's Educational Background

Table 5 shows the descriptive findings and one-way analysis of variance (ANOVA) results of the STEM attitude scale and its subscales, according to the father's educational background. As seen in Table 5, significant differences were found in "Science" (F = 9.51, p < .01) and "Total" (F = 3.71, p < .05). The eta-square (η^2) effect sizes were, respectively, 0.08 and 0.03, suggesting a medium and small effect size. No significant father's educational background differences were found in other subscales. This indicated that father's educational background did play a role in STEM attitudes of the students.

The Scheffe test results showed that the difference between the mean scores of the students in "Science" was due to the significant difference among students whose fathers were high school graduates and primary school graduates (t = 3.93, p <.01), and among students whose fathers were high school and middle school graduates (t = 3.66, p <.01). Students whose fathers were high school graduates had statistically significantly higher attitudes than students whose fathers were primary (M = 34.90, SD = 4.73) and middle (M = 35.20, SD = 5.53) school graduates. The Cohen's d effect sizes were, respectively, 0.66 and 0.60, suggesting a medium effect size.

In terms of the difference between the scores obtained from the scale total, the Scheffe test results showed that this difference was due to the difference between the students whose fathers were high school and middle school graduates (t = 2.48, p <.05). On the other hand, there was no significant difference between students whose fathers were high school graduates and primary school graduates (t = 2.25, p > .05). However, due to the absence of zero value in the 95% CI [-0.71, -0.04], regarding the effect size, it could be accepted that there was a significant difference among these groups in favor of the students whose fathers were high school graduates. Students (M = 156.00, SD = 17.60) whose fathers were high school

Table 4

An Analysis of STEM Attitude and Mothers' Educational Background

	(1) Primary School (n = 68)		(2) Middle School (n = 102)		(3) High School (n = 51)			
	Mean	*SD*	Mean	*SD*	Mean	*SD*	*F*	*p*
Mathematics	32.0	5.75	32.5	5.22	33.7	5.03	1.49	0.22
Science	35.7	5.32	35.6	5.41	37.6	5.12	2.79	0.06
Engineering-technology	36.0	5.22	34.6	6.72	36.7	5.83	2.46	0.08
21st century skills	47.9	5.57	46.0	6.58	46.7	5.88	1.86	0.16
Total	152.0	16.9	149.0	17.7	155.0	16.7	2.11	0.12

Table 5

An Analysis of STEM Attitude and Fathers' Educational Background

	(1) Primary School (n = 74)		(2) Middle School (n = 77)		(3) High School (n = 70)				
	Mean	*SD*	Mean	*SD*	Mean	*SD*	*F*	*p*	Scheffe test
Mathematics	32.10	5.37	32.20	5.55	33.60	5.07	1.75	0.18	-
Science	34.90	4.73	35.20	5.53	38.30	5.19	9.51	0.00	3>1 3>2
Engineering-technology	35.40	5.30	34.80	7.19	36.40	5.62	1.36	0.25	-
21st century skills	46.70	5.36	46.40	6.79	47.30	6.24	0.36	0.70	-
Total	149.00	14.20	149.0	19.20	156.00	17.60	3.71	0.03	3>1 3>2

graduates had statistically significantly higher STEM attitudes than students whose fathers were primary (M = 149.00, SD = 14.20) and middle (M = 149.00, SD = 19.20) school graduates. The Cohen's d effect sizes were, respectively, 0.41 and 0.37, suggesting about medium and small effect size.

STEM Attitude and Science Achievement

This study also examined the role of science achievement in primary school 4th-grade students' STEM attitudes dispositions. Students' science achievement was categorized into three groups; low is within less than 50 points, middle is 50 to 75 points, and high is more than 70 points. Table 6 shows the results of the one-way variance analyses (ANOVA). As shown in Table 6, except for "Engineering-technology" (F = 1.06, p > .05), statistically significant differences were identified in "Mathematics" (F = 13.00, p < .01), "Science" (F = 21.90, p < .01), and "21st century skills" (F = 12.00, p< .01), and "Total" (F = 15.6, p< .01). The eta-square (η^2) effect sizes were, respectively, 0.11, 0.17, 0.10, and 0.13, suggesting a large effect size. That is, students' science achievement did play a role in STEM attitudes except for the "Engineering-technology" subscale. This also shows that the science and engineering-technology disciplines could not be adequately dealt with in the context of Turkey.

Scheffe test results showed students with high science achievement on the "Mathematics" was statistically higher than those of middle level (t = 3.96, p < .01) and low level (t = 3.93, p < .01). The Cohen's d effect sizes were, respectively, 0.92 and 0.87, suggesting a large effect size. Similarly, students with high science achievement on the "Science" was statistically higher than those of middle (t = 6.24, p < .01) and low (t = 3.40, p < .01). The Cohen's d effect sizes were, respectively, 0.92 and 0.87, suggesting a large effect size. In terms of "21st century skills", attitudes of students with high science achievement were statistically higher than the middle (t = 4.66, p < .01), and attitudes of students with middle science achievement were statistically higher than low (t = 3.14, p < .01). The Cohen's d effect sizes were, respectively, 1.20 and 0.85, suggesting a large effect size. These findings mean that students with high science achievement have higher "Mathematics" and "Science" attitudes than those of middle and low, and as their success in science increases, their attitudes towards the "21st century skills" also increase.

Attitudes of students with high science achievement on the total scale was statistically higher than those of middle (t = 4.53, p < .01) and low (t = 4.10, p < .01). The Cohen's d effect sizes were, respectively, 0.67 and 1.57, suggesting a medium and large effect size. This means that students with high science achievement have higher STEM attitudes than those of middle and low ones.

STEM Attitude and Mathematics Achievement

This study also examined the role of students' mathematics achievement in primary school 4th-grade students' STEM attitudes dispositions. Students' mathematics achievement was categorized into three groups; low is within less than 50 points, middle is 50 to 75 points, and high is more than 70 points. Table 7 shows the results of the one-way variance analyses (ANOVA). As shown in Table 7, except for "Engineering-technology" (F = 0.07, p > .05), statistically significant differences were identified in "Mathematics" (F = 5.40, p < .01), "Science" (F = 4.24, p < .01), and "21st century skills" (F = 6.61, p < .01), and "Total" (F = 15.9, p < .01). The eta-square (η^2) effect sizes were, respectively, 0.25, 0.04, 0.06, and 0.12, suggesting a large, small, medium,

Table 6

An Analysis of STEM Attitude and Science Achievement

	(1) Low (n = 17)		(2) Middle (n = 71)		(3) High (n = 133)				
	Mean	*SD*	Mean	*SD*	Mean	*SD*	*F*	*p*	Scheffe test
Mathematics	28.80	5.10	31.00	5.46	34.00	4.88	13.00	0.00	3 > 1 3 > 2
Science	33.60	4.64	33.40	4.97	37.90	4.92	21.90	0.00	3 > 1 3 > 2
Engineering-technology	35.30	4.66	34.70	5.36	36.00	6.64	1.06	0.35	-
21st century skills	40.90	6.25	45.90	5.15	48.00	6.16	12.00	0.00	3 > 1 2 > 1
Total	139.00	16.8	145.0	14.20	156.00	17.2	15.6	0.00	3 > 1 3 > 2

Note. Low = less than 50 points; Middle = 50 to 75 points; High = more than 75 points

and large effect size. That is, students' mathematics achievement did play a role in STEM attitudes except for the "Engineering-technology" subscale. This also shows that the mathematics and engineering-technology disciplines could not be adequately dealt with in the context of Turkey.

Scheffe test results showed that attitudes of students with high mathematics achievement on the "Mathematics" were statistically higher than those of middle (t = 5.79, p < .01) and low (t = 6.92, p < .01). There was also a significant difference in attitudes of students with middle mathematics achievement on the "Mathematics" compared to those of low (t = 4.22, p < .01). The Cohen's d effect sizes were, respectively, 0.84, 2.26, and 1.42, suggesting a large effect size. Similarly, attitudes of students with high mathematics achievement on the "21st century skills" were statistically higher than those of middle (t = 2.72, p < .05) and low (t = 2.80, p < .05). The Cohen's d effect sizes were, respectively, 0.40 and 0.92, suggesting about medium and large effect sizes. On the other hand, there were no significant differences in students' "Science" attitudes (p > .05). However, due to the absence of zero value in the 95% CI [-1.34, -0.04] and [-0.62, -0.05], regarding the effect sizes, it could be accepted that attitudes of students with high science achievement on the "Science" subscale were statistically higher than those of middle and low achievement. The Cohen's d effect sizes were, respectively, 0.33 and 0.69, suggesting a small and medium effect size. This means that students with high mathematics have higher "21st century skills" and "Science" attitudes than those of middle and low, and as their success in mathematics increases, their attitudes towards the "Mathematics" subscale also increase.

Attitudes of students with high mathematics achievement on the total scale were statistically higher than those of middle (t = 3.98, p < .01) and low (t = 4.41, p < .01). There was also a difference in attitudes of students with middle mathematics achievement compared to ones with low achievement (t = 2.57, p < .05). The Cohen's d effect sizes were, respectively, 0.59, 1.44, and 0.89, suggesting a medium, large and large effect size. These findings mean that as their mathematics success increases, their STEM attitude also increases.

Discussion

This study aimed to examine the STEM attitudes of primary school 4th-grade students. Particularly, this descriptive study aimed to reveal whether students' attitudes towards STEM significantly differ according to gender, parents' educational background, science, and mathematics achievements.

In terms of general STEM attitudes, results show that students have high STEM attitudes. This finding is in parallel with many studies in the literature (Karakaya & Avgın, 2016; Özcan & Koca, 2019; Yıldırım & Selvi, 2017; Yerdelen et al., 2016). Students' STEM attitudes and interests are high at an early age, but they may decrease over time (Allen, 2016). Since students' attitudes towards STEM affect their early career choices in STEM fields (Brophy et al., 2008), determining it from an early age is necessary.

The results show no significant difference in STEM attitudes of the students in terms of gender. This finding is parallel to many studies (Aydın et al., 2017; Balçın et al., 2018; Brown et al., 2016; Ciftci et al.,

Table 7

An Analysis of STEM Attitude and Mathematics Achievement

	(1) Low (n = 10)		(2) Medium (n = 72)		(3) High (n = 139)				
	Mean	*SD*	Mean	*SD*	Mean	*SD*	*F*	*p*	Scheffe test
Mathematics	23.80	4.13	30.50	4.25	34.40	4.91	5.40	0.00	3 > 2 3 > 1 2 > 1
Science	33.20	5.35	35.10	5.11	36.80	5.37	4.24	0.02	3 > 2 3 > 1
Engineering-technology	32.30	5.31	34.80	6.20	36.10	6.07	2.64	0.07	-
21st century skills	42.30	7.12	45.40	5.65	47.80	6.09	6.61	0.00	3 > 2 3 > 1
Total	132.00	15.50	146.0	17.10	155.00	15.9	15.40	0.00	3 > 2 3 > 1 2 > 1

Note. Low = less than 50 points; Middle = 50 to 75 points; High = more than 75 points

2020; Özyurt et al., 2018). Özyurt et al. (2018) found no significant difference between primary school student's attitudes towards STEM and gender. On the other hand, in this study, it was found that girls' attitudes towards mathematics were higher than boys', while boys' attitudes were higher than girls' in engineering and technology. This finding coincides with the results of the research conducted by Ciftci et al. (2020) and Koyunlu Ünlü & Döküm (2020). Similarly, there are studies showing boys are more interested in engineering than girls and the perception that engineering is a more suitable profession for men (Capobianco et al.2011; Ketenci et al., 2020; Knight & Cunningham, 2004; Yıldırım & Türk, 2018). There are also studies indicating that student's attitudes towards STEM change depending on gender (Christensen & Knezek 2017; Karakaya et al., 2018). These studies show that boys' attitudes towards STEM are higher than girls' (Reinking & Martin, 2018; Legewie & DiPrete, 2014). Gender pressure can be the major rationale for this conclusion (National Science Foundation [NSF], 2003).

When STEM attitudes of the students are examined in terms of parents' educational background, the findings show that students' STEM attitudes do not differ according to their mothers' educational background, but they do in terms of their fathers' educational background. Students whose fathers are high school graduates have higher Science and STEM attitudes than students whose fathers are middle and primary school graduates. Sivrikaya (2019) also has reached a similar finding. Similarly, Fan (2003) has indicated that students' STEM attitudes differ according to parents' educational background. As opposed to these findings, Aydın et al. (2017) have stated no difference in the students' attitudes towards STEM regarding parents' educational background. Families, mothers in particular, with low socio-economic and education level generally work in agriculture and service sectors, so it may have effect on these results.

In terms of students' science and mathematics achievement, the results show that students' mathematics, science, 21st century skills, and STEM attitudes significantly differ, except for engineering and technology. Also, the findings show that as students' science achievement increases, their 21st century skills attitudes increase; as students' mathematics achievement increases, mathematics and STEM attitudes increase significantly. Previous studies show that students' academic achievements positively affect their attitudes towards STEM (Karakaya et al., 2018; Olivarez 2012). There is a positive relationship between students' science and mathematics achievements and their attitudes towards these courses (Liu et al., 2011). Previous research results are consistent with the results of the study.

Conclusion

The research reveals that students move from primary school to middle school with a high STEM attitude. In this transition, girls' attitudes towards mathematics and boys' towards engineering and technology are seemingly higher. The tendency in engineering and technology attitudes differs only in favor of male students but does not differ significantly in parents' educational background, science and mathematics achievement. While there is no significant difference in STEM attitudes of the students according to gender and mothers' educational background, there is a difference in fathers' educational background, mathematics and science achievement.

Implications for Policy and Practice

If the high level of attitude in the transition to middle school can maintain during the secondary school period, students' career preferences towards STEM fields may increase. For this reason, it is recommended to make changes in middle school curricula. Instructional interventions depending on the curriculum changes may include STEM-based design-oriented activities in which knowledge turns into products.

It is striking that although the girls have high attitudes towards mathematics; their attitudes towards engineering and technology are low. If there is no intervention in the primary school period, it may continue during the middle and high school periods (Ketenci et al., 2020). Therefore, instructional activities can be organized to increase girls' engineering and technology attitudes. With after-school and summer camp activities for girls, their design and production skills can be improved. Raising girls' engineering and technology attitudes at this age can positively affect career choices in forward-looking engineering and computer science fields.

Another important result of the study is that there is no significant difference in engineering and technology attitudes of students with high mathematics and science achievements from other levels of education. It may indicate that STEM applications are not sufficiently implemented in primary school. Updating primary school curricula to include STEM activities can both increase students' existing STEM attitudes and make it easier to increase girls' positive attitudes towards engineering and technology.

Limitations

This study has some limitations. The first limitation of the study is that the number of fourth-grade primary school students is limited; therefore, the generalizability

is low. This means that findings cannot be interpreted to reflect all fourth-grade primary school students in Turkey. However, research findings will make a sense in understanding fourth-grade primary school students' attitudes towards STEM. The second limitation of the study is that when examining the students' attitudes towards STEM, the variables were gender, parents' educational background, science achievements, and mathematics achievements. Different variables can be used in future studies. The third limitation of the study is that it is a quantitative study, and STEM attitudes of students can be investigated in more depth with qualitative studies.

References

Akif Bircan, M., & Köksal, Ç. (2020). Investigation of STEM attitudes and STEM career interests of gifted students. *Turkish Journal of Primary Education, 5*(1), 16–32.

Allen, A. (2016). *Don't fear STEM-you already teach it.* School Age/ After School Exchange, September/October 56–59.

Aydın, G., Saka, M., & Guzey, S. (2017). Science, technology, engineering, mathematic (STEM) attitude levels in grades 4th- 8th. *Mersin University Journal of the Faculty of Education, 13*(2), 787-802. http://dx.doi.org/10.17860/mersinefd.290319

Balcı, A. (2016). *Sosyal bilimlerde araştırma yöntem teknik ve ilkeleri*[Research methods, techniques and principles in social sciences]. Pegem Akademi.

Balçın, M., Çavuş, R.,& Yavuz Topaloğlu, M. (2018). Investigation of secondary school students' attitudes towards STEM and their ınterest towards professions in STEM fields. *Asian Journal of Instruction, 6*(2), 40-62.

Brophy, S., Klein, S., Portsmore, M., & Rogers, C. (2008). Advancing engineering education in P-12 classrooms. *Journal of Engineering Education, 97*(3), 369–387. https://doi.org/10.1002/j.2168-9830.2008.tb00985.x.

Brown, P. L., Concannon, J. P., Marx, D., Donaldson, C. W., & Black, A. (2016). An examination of middle school students' stem self-efficacy with relation to interest and perceptions of STEM. *Journal of STEM Education: Innovations and Research, 17*(3), 27-38.

Bybee, R. W. (2013). *The case for STEM education: Challenges and opportunities.* NSTA Press.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2009). *Bilimsel araştırma yöntemleri* [Scientific research methods] (3rd ed.). Ankara: Pegem Akademi.

Büyüköztürk, Ş. (2015). *Sosyal bilimler için veri analizi el kitabı* [Handbook of data analysis for social sciences] (21st ed.). Pegem Akademi.

Capobianco, B. M., Diefes-Dux, H. A., Mena, I., & Weller, J. (2011). "What is an engineer? Implications of elementary school student conceptions for engineering education." *Journal of Engineering Education, 100*(2): 304-328.

Christensen, R., & Knezek, G. (2017). Relationship of middle school student STEM interest to career intent. *Journal of Education in Science, Environment and Health (JESEH), 3*(1), 1-13. https://doi.org/10.21891/jeseh.45721

Ciftci, A., Topcu, M. S., & Erdogan, I. (2020). Gender gap and career choices in STEM education: Turkey sample. *International Journal of Progressive Education, 16*(3), 53–66. https://doi.org/10.29329/ijpe.2020.248.4

Crisp, G., Nora, A., & Taggart, A. (2009). Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a hispanic serving institution. *American Educational Research Journal, 46*(4), 924–942. https://doi.org/10.3102/0002831209349460

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Faber, M., Unfried, A., Corn, J., & Townsend, L. W. (2013). Student attitudes toward STEM: The development of upper elementary school and middle/high school student surveys. *120th ASEE Annual Conference & Exposition.* https://peer.asee.org/student-attitudes-toward-stem-the-development-of-upper-elementary-school-and-middle-high-school-student-surveys.pdf

Fan, C. (2013). Rural-urban migration and gender division of labor in transitional China. *International Journal of Urban and Regional Research, 27*(1), 24-47.

Gonzalez, M., & Freyer, C. (2014). A collaborative initiative: STEM and universally designed curriculum for at-risk preschoolers. *National Teacher Education Journal, 7*(3), 21–29.

Guzey, S. S., Caskurlu, S., & Kozan, K. (2020). Integrated STEM pedagogies and student learning. In C. C. Johnson, M. J. Mohr-Schroeder, T. J. Moore & L. D. English (Eds.), *Handbook of research on STEM education* (pp. 65-75). Routledge. https://doi.org/10.4324/9780429021381

Hair, J. F., Blacks, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.

Karakaya, F. ve Avgın, S. S. (2016). Effect of demographic features to middle school students' attitude towards FeTeMM (STEM). *Journal of Human Sciences, 13*(3), 4188-4198.

Karakaya, F., Avgın, S. S., & Yılmaz, M. (2018). Middle school students' interest in science-technology, engineering and mathematics (STEM) professions. *Ihlara Journal of Educational Research, 3*(1), 36-53.

Ketenci, T., Leroux, A., & Renken, M. (2020). Beyond student factors: A study of the impact on STEM career attainment. *Journal for STEM Education Research, 3*(3), 368–386. https://doi.org/10.1007/s41979-020-00037-9

Knight, M., & Cunningham, C. (2004). *Draw an engineer test (DAET): Development of a tool to investigate students' ideas about engineers and engineering.* Paper presented at the ASEE Annual Conference and Exposition, 19 June, Utah.

Koyunlu Ünlü, Z., & Dökme, İ. (2020). Multivariate assessment of middle school students' interest in STEM career: a profile from Turkey. *Research in Science Education, 50*(3), 1217–1231. https://doi.org/10.1007/s11165-018-9729-4

Lavonen, J., Gedrovics, J., Byman, R., Meisalo, V., Juuti, K., & Uitto, A. (2008). Students' motivational orientations and career choice in science and technology: A comparative investigation in Finland and Latvia. *Journal of Baltic Science Education, 7*(2), 86–102.

Legewie, J., & DiPrete, T. (2014). The high school environment and the gender gap in science and engineering. *Sociology of Education, 87*(4), 259-280.

Liu, M., Horton, L., Olmanson, J., & Toprac, P. (2011). A study of learning and motivation in a new media enriched environment for middle school science. *Educational Technology Research and Development, 59*(2), 249-265.

Murphy, S., MacDonald, A., Danaia, L., & Wang, C. (2018). An analysis of Australian STEM education strategies. *Policy Futures in Education, 17*(2), 122–139.

National Research Council. (2011). *Successful STEM education: A workshop summary.* National Academies Press.

National Science Foundation. (2003). *New formulas for America's workforce: Girls in science and engineering.* https://www.nsf.gov/pubs/2003/nsf03207/nsf03207.pdf.

Olivarez, N. (2012). *The Impact of a STEM program on academic achievement of eighth grade students in a south texas middle school.* (Unpublished doctoral thesis). Texas A & M University: Texas. https://www.proquest.com

Özcan,, H., & Koca, E. (2019). The Impact of teaching the subject "pressure" with STEM approach on the academic achievements of the secondary school 7th grade students and their attitudes towards STEM. *Education and Science, 44*(198), 201-227.

Özyurt, M., Kuşdemir-Kayıran, B., & Başaran, M. (2018). Analysis of primary school students' attitudes towards stem in terms of various variables. *Turkish Studies, 13*(4), 65-82. http://dx.doi.org/10.7827/TurkishStudies.12700

Partnership for 21st Century Skills (P21). (2006). *Framework for 21st century learning.* https://www.imls.gov/assets/1/AssetManager/Bishop%20Pre-Con%202.pdf

Patton, M. (2002). *Qualitative evaluation and research methods.* Sage.

Reinking, A., & Martin, B. (2018). The gender gap in STEM fields: Theories, movements, and ideas to engage girls in STEM. *Journal of New Approaches in Educational Research, 7*(2), 148-153.

Sarı, U., Alıcı, M., & Şen, Ö. F. (2018). The effect of STEM instruction on attitude, career perception and career interest in a problem-based learning environment and student opinions. *Electronic Journal of Science Education, 22*(1), 1-21.

Sivrikaya, Ö. S. (2019). Research of high school students' attitudes of STEM. *International Journal of Society Researches, 11*(18), 914-934. https://doi.org/10.26466/opus.547459

Smith, E., & White, P. (2019). Where do all the STEM graduates go? Higher education, the labor market and career trajectories in the UK. *Journal of Science Education and Technology, 28,* 26–40. https://doi.org/10.1007/s10956-018-9741-5

Stohlmann, M., Moore, T. J., & Roehrig, G. H. (2012). Considerations for teaching integrated STEM education. *Journal of Pre-College Engineering Education Research, 2*(1), 28–34. https://doi.org/10.5703/12882 84314 653.

TUSIAD. (2017). *2023'edoğru Türkiye'de STEM gereksinimi* [STEM requirements in Turkey towards to 2023]. https://www.pwc.com.tr/tr/gundem/dijital/2023e-dogru-turkiyede-stem-gereksinimi.html

U.S. Bureau of Labor Statistics. (2021). *Employment in STEM occupations.* https://www.bls.gov/emp/tables/stem-employment.htm

Walton, J. B., & Johnson, C. C. (2015). Examining the leaky STEM talent pipeline: Need for further research. Editorial. *School Science and Mathematics, 115*(8), 379–380. https://doi.org/10.1111/ssm.12148

Wiebe, E., Unfried, A., & Faber, M. (2018). The relationship of STEM attitudes and career interest. *EURASIA Journal of Mathematics, Science and Technology Education, 14*(10), 1–17. https://doi.org/10.29333/ejmste/92286

Yerdelen, S., Kahraman, N., & Taş, Y. (2016). Low socioeconomic status students' STEM career interest in relation to gender, grade level, and STEM attitude. *Journal of Turkish Science Education, 13* (Special Issue), 59-74.

Yıldırım, B. (2021). Preschool STEM activities: preschool teachers' preparation and views. *Early Childhood Education Journal, 49,* 149–162. https://doi.org/10.1007/s10643-020-01056-2

Yıldırım, B., & Selvi, M. (2017). An experimental research on effects of STEM applications and mastery learning. *Journal of Theory and Practice in Education, 13*(2), 183-210.

Yıldırım, B., & Türk, C. (2018). The effect of STEM applications on girls' STEM attitude and engineerıng perception. *Adıyaman Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 10*(30), 842-884.

This page is intentionally left blank.

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 699-711

Multi-Layered Language Policy and Translanguaging Space a Mother Tongue Classroom in Primary School in Sweden

Åsa Wedin[*,a], Jenny Rosén[b], Boglárka Straszer[c]

Received : 14 June 2020
Revised : 23 March 2021
Accepted : 15 June 2021
DOI : 10.26822/iejee.2021.222

[*,a]**Corresponding Author:** Åsa Wedin, Dalarna University, SE-791 88 Falun, Sweden,
E-mail: awe@du.se
ORCID: https://orcid.org/0000-0002-2992-0818

[b]Jenny Rosén, Stockholm University, Stockholm, Sweden
E-mail: jenny.rosen@isd.se
ORCID: https://orcid.org/0000-0001-7937-3325

[c]Boglárka Straszer; Dalarna University, Sweden
E-mail: bsr@du.se
ORCID: https://orcid.org/0000-0002-0011-1689

Abstract

This article is aimed to demonstrate how language policy at the local school level may create space for translanguaging. Focus is on a Mother Tongue (MT) classroom for Somali in a primary school in Sweden by way of an analysis of layers of language policy, with focus on spatial aspects. The empirical material consists of policy documents, interviews and observations documented through field notes and photographs from an MT Somali classroom with grade six students. Through the use of a framework of language policy as layered and linguistic landscaping with a focus on aspects of time, place and social factors, the analysis shows how the mother tongue classroom may constitute a demarcated room, while simultaneously interacting with other spaces both inside and outside school. The understanding of policy as layered made power relations visible in terms of language that moves between layers. It also made visible how school discourses shift between micro/macro, management/practice and inside/outside in the creation of space dominated by Somali and Swedish. It became apparent that an environment that supports the use of Somali *inside* the MT classroom may increase the likelihood of the pupils using Somali *outside* the classroom.

Keywords:

Language Policy, Mother Tongue Education, Sweden, Primary School

Introduction

In the 1960s, Sweden has mandated Mother Tongue Tuition (MTT), previously called home language instruction, to students in compulsory school who use another language than Swedish at home. The overall objective, as described in the national curriculum for compulsory school, is to support pupils in the development of their mother tongue (SNAE, 2018: 86). The common language of instruction in Swedish primary school is Swedish, with English being a core subject. MTT is offered for students who use another language than Swedish in their home setting but is not an

obligatory subject (SFS, 2010:800; see also Hyltenstam & Milani 2012). The aim of the subject is according to the national curriculum to help students to "develop knowledge in and about the mother tongue" (SNAE, 2018: 86). The concept mother tongue (MT) may be problematic for several reasons, but we will use it in this article to refer to the specific school subject in the Swedish national curriculum.

Despite its long tradition and the strong support it receives in both official contexts and research, reports (SI, 2012; Spetz, 2014) and research relating to MT (Avery, 2016; Ganuza & Hedman, 2015; Lainio, 2013; Reath Warren, 2013;) show deficiencies in the implementation of MT policy. Previous studies have highlighted the often marginalised role of MT teachers in the Swedish school context in terms of the ambivalent position of the school subject, lack of MT teacher education, employment status and relation to other teachers categories (Ganuza & Hedman, 2015; Jonsson-Lilja, 1999; Reath-Warren, 2013; Wigerfelt, 2004). There is a clear gap between the ambitions expressed in official policy and the reality of MT, as described in research and reports on the organisation of MT classes (see, for example, Norberg Brorsson & Lainio, 2015; SI, 2012). Reports point towards extensive structural problems (for example, Spetz, 2014) and the impossibility of achieving the ambitious goals relating to MT as stated in the Swedish Education Act, the national curriculum and syllabi for the MT, when the limited number of allotted teaching hours is considered. (See also Rosén, Straszer, & Wedin 2019a.)

Research by, for example, Baker (2011), Cummins (2017) and García (2009) emphasize the importance of opening spaces for students with a migrant background to use and develop their linguistic repertoire by creating what (Wei, 2011) termed *translanguaging* spaces, that is arenas for translanguaging practices created through processes of translanguaging. Earlier studies (Straszer, Rosén, & Wedin, 2020) positioned MT classrooms as spaces where complex diaspora situations and nationalities may be negotiated and where language hierarchies and issues of language policy are made more visible (Straszer, Rosén, & Wedin, submitted). In this article we direct our focus towards local language policy and its influence on spatial aspects of MT in a primary school in Sweden. The aim of the article is to study how language policy at the local school level may create space for translanguaging, and we do this by focussing on a selected MT classroom.

Theoretical basis

The theoretical framework of this study includes a critical and post-structural perspective on education and language that highlights questions of power, such as voice, agency and investment (Block, 2007; Norton, 2013; Pavlenko & Blackledge, 2004). Considering the marginalised role of MT identified in previous studies, aspects of power and empowerment are important when trying to understand its marginalised role in school. An important requirement for successful spatial integration of MT is local school policy, where physical, temporal and social space is created for MT. We aim to analyse how local school policy may create space for translanguaging, with focus on one specific MT classroom. Here we will build on Li Wei's use of the concept *translangauging* space described as being both an arena for translanguaging practices and a space created through the process of translanguaging. Moreover, translanguaging "creates a social space for the multilingual language user by bringing together different dimensions of their personal history, experience and environment, their attitudes, beliefs and ideology, as well as their cognitive and physical capacity into one coordinated and meaningful performance, which then becomes a lived experience" (Wei, 2011, p. 1223). For the analysis of spatial aspects of language policy, linguistic landscaping (see Blommaert, 2013; Straszer, 2017; Straszer et al., 2020) will be used, where issues relating to space in terms of i) physical/material, ii) temporal and iii) social aspects are considered. We will first present the theoretical ground used here for the study of language policy and then the basis for translanguaging space.

Understanding language policy at the local school level through layers

Based on a critical theoretical framework, social power relations and their mirroring in educational structures and interaction patterns for students' learning and identity processes depend on how language policy is implemented explicitly as well as implicitly (Hornberger & Johnson 2017). Building on Cummins (2005) and Spolsky (2004), we thus consider language policy as both official documents as well as implicit language norms and perceptions. Ricento and Hornberger (1996) used the metaphor of an onion to create an understanding of policy as layered, and Hornberger and Johnson (2017) developed the metaphor further by talking about policy as opening or closing spaces for multilingual practices.

Bonacina-Pugh (2012) described the relation between policy and practice as comprised by three closely intertwined elements: 1) management, 2) ideology and 3) practised language policy. Language policy is constructed and negotiated in and between these layers. In our case the declared language policy, such as the Swedish Education Act (SFS 2010:800), and the perceived policy among school leaders, teachers and students, as well as their perceptions about language, affect the opportunities students have to use and develop their linguistic repertoire on a daily basis,

both inside and outside the classroom. Thus, language policy influences spaces for multilingualism through interaction between these layers. Understanding policy as consisting of multiple layers (see Blommaert & Maly, 2014) enables an analysis of agentive powers influencing and intersecting each other in complex ways (Ricento & Hornberger, 1996). Thus, in this article we follow Hornberger and Johnson (2017) by creating understanding of how space for multilingual practices such as translanguaging may be opened and closed, with focus on the importance of how actors act and move between policy layers is in focus.

The three layers illustrate the close relation between practice, an explicit language policy and attitudes in relation to practised language policy, while the importance of understanding the role of language policy in educational settings is emphasized. Here we will use Bonacina-Pugh's model to analyse the influence of language policy on the MT classroom as space for multilingual practices, focusing the management level and practices at the classroom level. Thus, Bonacina-Pugh's third element, the perceptions of those involved, will not be analysed in depth here as our focus is on the relation between managed and practised language policy at the local school level.

Space for translanguaging

Several scholars (García, 2017) emphasise the importance of creating spaces for students' multiple language resources. In particular, they highlight the importance of supporting students diverse linguistic repertoires that may differ from the language of instruction– languages that are often invisible and considered less important in the educational setting. With our focus on spatial aspects of the MT classroom, we see physical, temporal and social aspects as valuable for an understanding of how spaces are opened and closed for students' diverse linguistic repertoires.

According to Rönnlund and Tollefsen (2016), schools and classrooms may be perceived as public spaces, that is as ideologically and institutionally designed to "do something" (Rönnlund & Tollefsen, 2019, p. 163, our translation). When people appropriate these rooms, it becomes interesting to distinguish between on the one hand a dominant and on the other hand an appropriated space (Lefebvre, 1991). According to Lefebvre, there are clear power relations between dominant and appropriated rooms where the dominant is superior to the appropriated. At the same time, appropriated rooms are continuously created and have an important role in society. One example is graffiti, which may be perceived to be an example of appropriated space that persists despite thwarting authorities (see Straszer & Wedin, 2018).

The classroom constitutes a social space, where the particular place, the physical classroom at a certain point in time, displays a specific mix of social relations, including a particular sense of belonging (cf. Wei, 2011, pp. 1222-1223). Li Wei (2011, p. 1223) uses translanguaging space both for a social space that is open for translanguaging as a social practice as well as for the space created through translanguaging practices. Translanguaging space in educational settings may thus be understood to be a space where students' linguistic repertoires are acknowledged and valued. This means that translanguaging spaces are physical, timely and social spaces and, according to Zhu, Li and Lyons (2017), express the dynamic, complex and interconnected nature of multilingual interaction where new meanings are co-produced. (See also Straszer et al. submitted)

To develop knowledge about spatial aspects of MT classrooms, linguistic landscaping as theory and method is relevant (Landry & Bourhis, 1997). The concept has been used principally to show how public spaces are symbolically constructed, by the description and interpretation of how language is visually used in multilingual settings (Ben-Rafael et al., 2006; Shohamy & Gorter, 2009; Blommaert, 2013). Linguistic landscaping as a research method may contribute to an understanding of linguistic hierarchies. It may also make visible what languages are perceived to be relevant and/or are given status in a certain space so that conclusions can be drawn as to how it is influenced by local language policies. Lately, there has been increased interest in landscaping within the context of school, schoolscaping (e.g. Szabó, 2015; Straszer, 2017; Straszer et al. 2020; Straszer & Kroik, in press). The concept schoolscape is defined by Brown (2012, p. 282) as being a "school-based environment where place and text, both written (graphic) and oral, constitute, reproduce, and transform language ideologies".

Using schoolscaping as an analytical tool, we do not approach multilingualism as something that individuals have or do not have; rather, it is perceived as something that the environment can make possible by way of organisational structures and interactional patterns. This implies the perception that the classroom does something to those who inhabit it, namely students and teachers, and vice versa as these in interaction semiotically create and modify the room. As emphasized by Blommaert et al. (2005), the space is there before any activity starts and it triggers certain activities and actions. At the same time, the space is inhabited and appropriated by people, who may be teachers and students whose goals may differ. The room may also have restrictions concerning

participation and repertoire, such as which language should be used, and may have various time-related restrictions, which actualises issues of language policy, such as issues regarding who may enter the room, who is given voice and what spaces for diverse language resources are opened and closed.

The analysis of language policy at the local school level with a focus on space enables the study of conditions and processes at the micro level as contingent resources in relation to the macro level.

To study how language policy at the local school level may create space for translanguaging in one specific MT classroom, the following research questions will guide the analysis:

1. What language policies at the management level become visible in relation to the MT classroom?
2. What practised language policy becomes visible through physical, temporal and social aspects of the specific MT classroom?

The answers to these questions will then allow for an analysis of how the multilayered language policy at this particular primary school in Sweden facilitates the MT classroom as a translanguaging space.

Method and data

The empirical material that was analysed was produced in two research projects[i]. The first project was an action research project in a primary school, which is here called Forest School[ii]. The second project focused on MT and Study Guidance through the Mother Tongue (SGMT) and was carried out in two municipalities and at five schools, of which Forest School was one. The data analysed here is from Forest School. Other development projects were carried out at Forest School at the same time, and these were led by the school's head teacher and teachers of Swedish as a second language (see Wedin, 2017; Wedin & Wessman, 2017). These development projects were not explicitly part of the two research projects; however, because they focused on developing local school policy, which was monolingual Swedish-only, into becoming a multilingual policy that incorporated students' linguistic diversity, they influenced the research and, in particular, the classroom chosen here, that being the MT classroom for Somali.

The two projects were inspired by linguistic ethnography because of their focus on relations between language use and the social, cultural, economic and sociopolitical contexts that surround the linguistic practice (Creese, 2008; Copland & Creese, 2015). Linguistic Ethnography enables an analysis of language policy as multilayered (Canagarajah, 2006; Hornberger & Johnsson, 2017; Zeichner, 2001). In the two projects, data was collected by way of observations in classrooms and the school setting, as well as by way of interviews. Local policy documents were used, such as 1) Policy for Newly Arrived Students' Learning 2) Action Plan for the Reception of Newly Arrived Students with Another Mother Tongue than Swedish, 3) International Development Plan 2014-2016, and 4) Policy on Swedish as a Second Language[iii].

Besides the local policy documents, the main data used is from observations in the school, its classrooms (140 hours) and the school yard (70 hours). For this article, in particular observations from one MT classroom will be used, that being the classroom for Somali with students in grade six, aged 12-13 years. Observations of five lessons, 60 minutes each, were documented using field notes and photographs. One lesson was video-recorded. Analyses of policy documents, interviews with teachers and observations on school premises, including the school yard, formed part of the first project. The MT teacher, students and the specific classroom were included in both research projects despite the projects having different aims and focus.

In this linguistic, ethnography-inspired piece of research and not least in the action research project, questions concerning vicinity and respect were crucial. The study was approved by the regional ethics review board. The participating MT teacher, the students and their guardians were informed about the aim of the study, and written consent was given for participation. Because school activities may present challenges, particular regard was shown to ensure that nobody was harmed during the study. Furthermore, material is presented in such a way as to prevent the identification of participants.

Table 1.
Material used

	Classroom observations with field notes	Video-recordings	Photographs	Policy documents	Interviews	Observations on school premises, including the school yard
Project 1	About140 hours in total		School premises	Four documents	MT teacher and three class teachers	About 40 hours
Project 2	5 lessons, 60 mins each, from the Somali classroom	1 lesson	MT classroom		MT teacher and two head teachers	About 30 hours

The analysis of the selected MT classroom, a classroom for Somali, is based on Bonacina-Pugh's (2012) three layers focusing on the specific sociocultural context. In the analysis, space for multilingualism has been analysed by identifying physical, temporal and social aspects of space. As a first step, language policy at the management level in Forest School was analysed using policy documents, interviews and field notes from observations at school level. The second step involved the analysis of practised language policy in the Somali MT classroom using schoolscaping, the material used being photographs, fieldnotes from observations and video-recordings in the classroom. In this step, physical, temporal and social aspects of language policy were analysed in relation to the specific room. We approached the material with a focus on i) the location of the classroom within the school, ii) when it is used and iii) by whom the classroom was used. This step also involved the analysis of who has a voice and which language has a place. During the third step the analysis was oriented towards practised language policy using field notes from observations of practices inside and outside the classroom. Here, special interest was directed at temporal and social aspects of spatiality and language norms.

Findings

To study how language policy at the local school level may create a space for translanguaging in Mother Tongue Tuition, we begin by using Bonacina-Pugh's layers (2012), which focus on the management level and practice level. These we discuss under separate headings below. The analysis of practised language policy starts with physical aspects of the Somali MT classroom, followed by temporal and social aspects.

Language policy at the management level in the selected school

Forest School is located in an area with high relocation and mobility among inhabitants, and many households can be described as low socio-economic. Due to a large number of people with a Somali background locating there in recent years, the number of students studying Somali in MT was high: in some classes, more than 50% of students. Access to qualified teachers at the school was limited, but despite this challenge, the school administration, with its head teachers and teachers of Swedish as a second language (SSL), had consciously developed school policy by way of collaboration in study circles, in-service training and team discussions. Here it can be mentioned that not only class teachers but also recreational teachers, MT teachers and Study Guidance Assistants in the Mother Tongue (SGMT assistants, see Rosén, Straszer, & Wedin, 2019b) took part in at least some of the activities. Also involved were lunchroom and janitorial staff. As evident, work with local school policy involved every staff member, and the focus of activities was to increase their knowledge about the conditions for learning of newly arrived students who did not have Swedish as their mother tongue. The explicit aim of such efforts was to create opportunities for students to develop their language skills, which in turn would increase their ability to learn.

The development work resulted in a local policy for multilingualism and the integration of MT in other school activities. The policy was expressed in formal school documents and could be observed in the school premises as well, through posters, pictures and booklets displayed on the walls of the school and boards where diverse languages were made visible.
The school documents that were developed included a Policy on Swedish as a Second language , including issues about assessment and organization of the education. Other policy documents that were developed were an International Development Plan (2014-2016); an Action Plan for the Reception of Newly Arrived Students with Another Mother Tongue than Swedish and Policy for Newly Arrived Students' Learning.

The international development plan identified three areas to prioritise: i) internationalisation, ii) multilingual students' learning and iii) reception and education of newly arrived students. Through various activities, all school staff were expected to find ways to adapt their instruction, and to increase their knowledge and understanding of other languages and cultures from an international perspective. The policy for Newly Arrived Students' Learning stated, with a manifest intertextuality to popular research in the field of multilingualism and intercultural learning, that the school needed to make visible multilingualism by:

- Reading and producing bilingual texts and books
- Cooperating with SGMT assistants and MT teachers
- Including bilingual teaching during the language workshop
- Allowing newly arrived students to write in their MT
- Displaying multilingual posters on the walls
- Displaying students work in their MT
- Using the school blog to inform students and parents about activities in different languages
- Creating teacher exchanges with schools in the UK and Canada
- Corresponding with students in the UK in English and in the MT
- Writing tests in Swedish and English for students to complete, the results of which are then compared

The policy further states that there MT teachers, SGMT assistants and teachers in Swedish as a second language teachers should work together to organise a language workshop for newly arrived students where instruction is in both Swedish and the MT. The Action Plan for the Reception of Newly Arrived Students with Another Mother Tongue than Swedish has a section about MT, stating that MT teachers for Somali and Kurmanji are employed at the school and that having multilingual staff is very important for interculturalism. The policy further states that the presence of MT teachers at school throughout the day, not only after regular school hours, increases opportunities for planning and working together in relation to multilingual students. MT teachers are positioned as "key individuals" in the school setting, as they are able to support other colleagues.

To sum up, the analysis of language policy development at the management level shows that MT teachers are positioned as important because they can support both students and teachers. Previous research (Ganuza & Hedman, 2015; Jonsson-Lilja, 1999; Svensson & Torpsten, 2013) highlights the marginalised position of MT teachers; however our analysis shows how the local documents, with explicit reference to popular research in the area of multilingualism, formulate a policy whereby MT teachers are positioned as "key individuals" and where students' MT are to be given space not just in MT but also in the entire school setting.

Practised language policy: physical aspects of the Somali MT classroom

Our analysis of practised language policy begins with the physical aspects. As part of the analysis, we will first present the physical context of the Somali MT classroom.

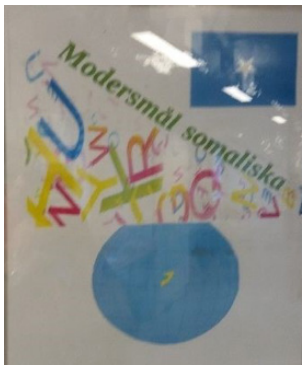
At this school, the female staff who had a Somali background wore clothes that could be immediately associated with perceptions of Somalia – what we here term Somaliness. With Somaliness we mean features at the school that made identities relating to the geopolitical place of Somalia visible, as well as perceptions about Somalia,[iv] thus Somaliness as dynamic and negotiated in the local context. One example is a particular type of shawl. Other students also wore shawls, but a specific design became indexical for Somaliness and the use of Somali. Thus, a particular type of shawl was attributed to Somaliness in this particular context, and girls and women who had a Somali background made Somaliness particularly visible by their presence. Somali was also one of several languages that was audible in the school yard, Swedish being the most prominent.

A sign in Swedish at the outside doors stated "Take off your shoes". To the right, a large digital screen provided information in both Swedish and some of the more common languages used in the school: at the time of observations, these were (apart from Somali) Kurdish (Kurmanji), Arabic and Finnish. Inside the school, posters and pictures on walls displayed languages, festivals and feasts from different cultures and teachers visiting schools in other countries. To the left in the corridor was the staff room and beyond that the library. The linguistic diversity of the school was apparent in the staff room because of the various language used, notably Somali and Kurdish besides Swedish. The MT teachers, SGMT assistants and teacher assistants at the school also served to increase the visibility of Somali. Class teachers, special needs teachers and school administrators did not have Somali communication skills; however, for one school term, the school did appoint a female class teacher with a Somali background (she had previously worked as an SGMT assistant).

In the library, multilingual material was less prominent than Swedish material. The number of books on the shelves was markedly low considering the number of students. There were some books in some of the language represented at the school, for example Somali, but these were few, and thus Swedish dominated.

The MT classroom was on the first floor, in one of two corridors: it was a former group room between regular[v] classrooms. The door to the classroom had a window on which there was a sign with the text "Modersmål somaliska" [Mother Tongue Somali], together with a map of Somalia[vi], the Somali flag and some decorations (see picture 1) (see Straszer et al. 2020 for a more in-depth analysis of the construction of home land). The principal's office, the school nurse's room and the staff office were also located on the first floor. There all regular staff, including MT teachers, each had a desk, while SGMT assistants shared their desks.

Picture 1.
The sign on the Somali classroom door



Because of the small size of the classrooms, the school felt crowded. This was also the case with the Somali classroom, as there were as many as 17 students

sitting close together in groups of three at desks. The classroom had one tall shelving cabinet for student binders and a row of short cabinets. On the walls there were posters and pictures with reference to Somalia and there was a whiteboard on each of two of the walls. During the year of classroom observation, the furnishing did not change; this compares with the placement of students' desks in the regular classroom, which changed frequently during the same period. Pencils and rubbers lay on the desks in the classroom, and students only brought their homework, often in a notebook or photocopied papers. The teacher remained in the room from class to class, with groups of students coming for their lessons but otherwise spending most of their time in the regular classroom. It could therefore be said that the teacher dominated the classroom for Somali to a higher extent in terms of the physical space than teachers in the regular classrooms did. In the regular classrooms, the students spent most of their time and had a permanent desk and drawers for their things.

On the walls were the two aforementioned whiteboards, as well as texts in Swedish with information about the school – for example, a timetable for the for the MT, an excerpt from the curriculum on school values, the code of conduct – for the school in general and football specifically, evacuation points and the school term times. There were also posters and pictures in Somali showing words for parts of the body, seasons and handicrafts, as well as maps of Somalia depicting, for example, crops, fruits and regions.

Due to the high number of Somali-speaking students at the school, students from different classes and streams attended MT one class at a time. During the observation period, there were ten groups. The teacher used the two white boards for both long-term information, such as weekly planning, display of curriculum goals (see Picture 2) and information for individual lessons. Somali dominated the room, but certain expressions and words in Swedish were used, both written on the white board and spoken (what the teacher said). The teacher often used Swedish words and expressions relating to the curricula and grading, such as "reading comprehension", "goals to reach" and "assessment", and relating to education, such as essay. Sometimes the teacher used everyday Swedish expressions, such as those meaning "great" and "fantastic question", and for instructions "you are not allowed to write; today, we only only be talking and discussing things". During the observed lessons, students mainly used Somali between themselves. Occasionally, they addressed the teacher in Swedish with questions such as, "May we start to read now?"

Students competence in Somali varied, with some Somali-speaking students relatively new to Sweden and others having been born in Sweden and being therefore less competent in Somali; the consequence of this was that they used both Swedish and Somali during individual work. Sometimes, the students with less Somali used Swedish to ask their classmates for help. English was never observed being used in writing but it was in oral communication: for example, a student leaving the classroom one day said: "Bye bye, malim, see you" ("malim" is teacher in Arabic); on another occasion, the teacher said to a student: "Ok well done". It may be the case that the way in which Swedish and English were used was affected by the presence of the researcher. Worth noticing is that students were not asked by either a teacher or another student to consider their choice of language, and this may be perceived to be an acceptance of translanguaging practices, whereby students move freely between languages. In the school, beyond the Somali classroom, Swedish dominated both talking and writing, while expressions of Somali identity were identifiable through students' clothing and language. These expressions were particularly visible because those students attributed a Somali background formed the majority at the school. Overall, however, a Swedish-speaking discourse was reproduced at the school even though school administrators and class teachers as a result of their presence represented to a high extent various types of Swedishness. Despite the display of posters and displays in other languages, the dominant position of Swedish was never challenged during the observations. This became clear as a result of the physical room reserved for MTT in Somali. Meanwhile, the Somali classroom was to a great extent appropriated by the teacher and students. The Somali classroom was made possible as a result of policy decisions at the management level, with the Somali teacher being involved in the policy-making process. The analysis of the MT classroom and its surroundings illustrates the importance of physical space as part of a practised language policy at the school. The Somali room within the context of a Swedish school is a place where the Somali language dominates; in other parts of the school, it has a subordinate position. The students' relation with and sense of belonging to Somalia were evidenced by their use of Somali within the classroom as well as by the cultural artefacts to be found there. However, cultural manifestations of Somalia were not static; rather, they were negotiated and transformed as they intersected within the classroom, while the room also interacted with other spaces within the school. It may, for example, be the case that what was perceived to relate to Somalia here may not signal the same in other settings, such as in Somalia. Thus, one may understand various layers of policy that intersected in this classroom.

Practised language policy: temporal aspects of the Somali MT classroom

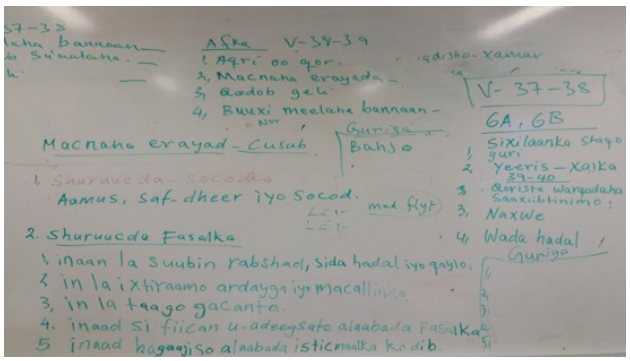
To further understand created norms, we continue to analyze temporal aspects of practised policy in the MT classroom. In this school, MT was scheduled during regular school hours, with 40 minutes per week for young students and 60 minutes for other students. MT teachers for Somali, Arabic and Kurdish/Kurmanji had permanent employment at the school and were included in work teams with other teachers, class teachers, special needs teachers and SSL teachers. The MT teacher for other languages worked at both Forest School and other schools, but as far as possible maintained the scheduled time for MT. For class 6b, the class selected for this study, MT was on Fridays 10 –11, and all students in the class studied MT. Of the 21 students in the class, 12 studied Somali.

The limited time for MT is one factor that is relevant for what happens within this temporal space and that also mirrors attitudes on the side of the school administration regarding the status of MT. During her interview, one of the school principals put great emphasis on explaining how work hade been done to integrate MT into the regular school day rather than it being an after-school activity.

An example of this is the fact that the students in 6b had recess before coming directly to the classroom for their lesson. If they had homework, they went to the corridor outside their regular classroom, fetching what they needed, usually a notebook. Sometimes the notebooks were in the classroom, and the teacher handed them out at the beginning of the lesson. When students entered the classroom, they sat down often in the same places where they normally sat. No discussions about seating were observed. The observed lessons began with checking attendance and handing out corrected assignments. This was followed by a short review of the previous lesson and a presentation of the current lesson. During the lesson, the teacher had his own laptop on a desk and a folder where he noted student performance. He referred to what was written on the whiteboard and wrote things about the current lesson on the whiteboard. Thus, the lesson was temporally placed in the MT classroom thanks to the weekly planning on the board. Further, the lesson related to curricula and policy documents because the goals were written on the board.

Picture 2.

One of the two whiteboards.



The temporal limitation affects the language norm that appears here, with Somali as the unmarked language, the neutral, and Swedish and English as additional languages. The languages were physically represented by, for example, the teacher's timetable on the wall, which was also the timetable for the classroom, and the weekly plan on the whiteboard (see Picture 2). The sign on the door, the room as physical space, the timetable, the activity plan in weeks as well as the physical presence of the teacher may in the classroom orient the language use of students towards both Somali and Swedish.

Thus, the MT classroom is temporally related to the local school policy by the timetable for all students and, in the classroom, by the teacher's reference to weekly planning on the board. In this case entering the MT classroom may for a newly arrived student mean a space where he/she is perceived as competent student rather than students that lacks Swedish skills and needs extra support. Thus, the existence of the temporal space widens students' space for translanguaging in the school context.

Practised language policy: social aspects of the Somali MT classroom

The physical and temporal aspects of the MT classroom interact with the social aspects of the space. To analyse social aspects of space as part of a practised language policy, we will present examples of classroom interaction from the observations.

Not once during the observations did students challenge the authority of the teacher. One exception to this may be the occasion when some girls ran giggling from the classroom without first asking the teacher's permission (they wanted to correct one of their shawls in the toilets). After they had been absent for some time, the teacher told the other students that he wanted to go and bring them back. One girl

objected, saying that they were in the toilets, which mean that he, the teacher, would not be able to. Unlike what might happen in a regular classroom, this teacher did not raise his voice nor reprimand the students by telling them to return to their places, be quiet, listen better and concentrate. On the whole, the classroom was quiet, with students small talking during their work and listening attentively when the teacher talked. Norms and behaviour were not discussed except on a few occasions when the teacher in a low voice asked students to return to their work. In the observed lessons, it was the teacher who initiated and directed the work, and students were not invited to discuss what should be done or how.

The relation between the classroom and students' home environments became apparent when parents visited the MT specifically. On one occasion, the mother of one of the boys came to the lesson. She arrived at the beginning of the lesson with her newborn baby in a stroller and left the school after the lesson. The boy was clearly proud when he went up to the stroller to hug and talk to his sibling. The visit and the boy's action may be interpreted here as being a bridge between the MT classroom and the home.

Thus, the social practices observed in this MT classroom showed that relations both between students and the teacher, and between the school and students' homes followed patterns that differed from those of the regular classroom.

The Somali classroom as a space for translangauging?

While language policy at the management level appeared to position MT teachers as important actors and MT classrooms as important spaces for students language learning and identity work, the analysis of physical, temporal and social aspects show that the Somali MT classroom is separated from and, at the same time, interacts with other spaces in the school. Thus the classroom constructs as space were Somali and Swedish school discourses intersect and transform. The practised school policy is expressed through the language norms in the separate classroom. An example of this is a newly arrived student, during the lesson in Somali, appearing competent in Somali when, for example, the teacher asked such a student to read a new, more difficult text out loud to the class. Meanwhile, a student who is less competent in Somali can receive support for his or her language development from the classmates and the teacher. Here aspects of power become visible because of the opportunities that the MT classroom creates where the Somali language is perceived as the norm, and where competence and lack of competence in Somali is made visible. This may then be countered by the school as space in the form of time students spend outside MT, where Swedish language competence/ lack of competence becomes apparent for example, when the grading of students' Swedish competence forms part of the assessment.

The analysis of layers of language policy focusing on spatial aspects of this MT classroom made visible how the managed and practised policy intersect each other and their influence on spatial, temporal and social aspects of the MT classroom as translanguaging space. At the same time, the transformation of school and language norms in relation to space was revealed. In terms of the physical room, the MT classroom (as one of many spaces within the school context), and the temporal aspect (60 minutes per school week), the MT classroom constituted a limited translanguaging space with borders, a space where the Somali language was dominant, while outside this space, Swedish was dominant. A Swedish school discourse was apparent in the Somali classroom (the curricula, timetables and values) and was also explicitly referred to, often in Swedish. A Swedish school discourse was also visible in the physical room with the display of texts such as rules of conduct, evacuation plans and other common documents for the school. At the same time, the room was characterised by temporal and social aspects regulating both entrance to and exit from the room, and what took place *inside* and *outside*.

At the local management level, the development work at the school involving a multilingual policy and strategies for inclusion of, for example, MT in other school activities was clearly apparent in the form of the physical and temporal room created for the MT classroom in Somali. Although Swedish dominated education outside the MT classroom, it is reasonable to assume that the creation of a specific room for Somali contributed to raising the status of the language while widening students' space to use Somali outside the specific classroom as well.

Discussion

The analysis of the multilayered language policy at the school shows how the MT classroom was constructed as a space for Somali as well as for other languages. The managed language policy at the school recognised and made visible the linguistic diversity at the school and as a result the Somali language was given status not only within the MT classroom but in the school as a whole as well. Thus, the practised language policy in the MT classroom became more inclusive, as students used both English and Swedish there; it was not a protected space for Somali only. The MT teacher did not perceive the use of Swedish and English in the MT classroom as undermining (perceived language policy) and thus different languages were made visible and audible both inside and outside

the MT classroom (practised language policy). When linguistic diversity is given space rather than being treated as a threat, translanguaging spaces open for students to develop multilingual identities (Creese & Blackledge, 2015). Unlike earlier studies, which made visible the marginalised characteristics of MT (Lainio, 2012; Wigerfelt, 2004) and its exclusionary practices (Nilsson & Bunar, 2016), this study shows how processes of inclusion and exclusion are not fixed but are situated and dynamic.

Based on social aspects, the Somali MT classroom appears to be a translanguaging space since it offers opportunities for varied language use (García, 2009; Zhu et al, 2017), with Somali as the dominant language. At the same time, this classroom differs from the regular classroom (see Wedin, 2017; Wedin, forthcoming) in that students when in it showed more engagement and worked more intensively with given tasks.

With the room physically and temporally within a Swedish school context, the teacher and the students appear to be agents interpreting school policy in different layers (Bonacina-Pugh, 2012; Hornberger & Johnson, 2017). Here the door may be understood as the boundary between the inside, the context where Somali dominates, and the outside, that being the school context where Swedish dominates. However, as the analysis demonstrates, this boundary is not fixed. The door is admittedly closed but may be opened, for example by the girl adjusting her shawl (who thus appropriates the toilet as a room for that) and by a visiting parent or by students asking for help. Also, temporally the timetable may change, for example, when a school-wide activity, such as a field day, is to take place or when the MT teacher is involved in planning and implementation. Thus, the room should not be understood as being isolated from other rooms but rather as a space for transformation and negotiation of language. This room may therefore be understood to be a translanguaging space where Somali dominates, while it is physically, temporally and socially included in, and to a certain extent secluded from (even if there is some interaction with), the Swedish dominant room of the Forest School, where individual agents may move between layers of power.

The understanding of policy as layered (Blommaert et al., 2005; Hornberger & Johnson, 2017; Ricento & Hornberger, 1996) makes visible how language norms transform as they move between layers. It also makes visible how school discourses shift between micro/macro, management/practice and inside/outside in the creation of space dominated by Somali and Swedish. As Cummins et al. (2015) argue, an environment that promotes the use of Somali inside may increase the opportunity to use Somali outside.

Footnotes

i. Flerspråkiga resurser (2013-2017), and Modersmålsundervisning och studiehandledning i grundskolan – undervisningens praktik, villkor och pedagogik (2015-2017). The latter was financed by The School Research Fund, Dalarna.
ii. For ethical reasons, all names are fictive.
iii. To safeguard anonymity, no detailed references are provided.
iv. In this text, "Somalia" is used to refer to the geographical area formally called "The Federal Republic of Somalia" formed by rival areas. As the individuals in the text come from different areas, which is not something we deal with here, we simply call this area Somalia and refer to individuals as having a "Somali background". Many of the students referred to in this text have never been to Somalia but have grown up in countries such as Kenya, Ethiopia, Italy and Denmark.
v. "Regular classroom" is used here to refer to the classrooms where students spent most of their classtime, in this case the classroom for 6 b, where they worked with their class teacher.

References

Avery, H. (2016). Moving Together: *Conditions for Intercultural Development at a Highly Diverse Swedish school.* PhD diss. Jönköping University, School of Education and Communication.

Baker, C. (2011). *Foundations of Bilingual Education and Bilingualism.* (5th ed.) Bristol: Multilingual Matters

Ben-Rafael, E., Shohamy, E., Amara, M.H., & Trumper-Hecht, N. (2006). Linguistic landscape as symbolic construction of the public space: The case of Israel. *International Journal of Multilingualism 3*(1), 7-30.

Block, D. (2007). *Second Language Identities.* London: Continuum.

Blommaert, J. (2013). *Ethnography, Superdiversity and Linguistic Landscape: Chronicles of Complexity.* Bristol: Multilingual Matters.

Blommaert, J., Collins, J., & Slembrouck, S. (2005). Spaces of multilingualism. *Language & Communication, 25,* 197–216.

Blommaert, J., & Maly, I. (2014). Ethnographic linguistic landscape analysis and social change: A case study. *Working Papers in Urban Language & Literacies.* 133.

Bonacina-Pugh, F. (2012). Researching 'practiced language policies': Insights from conversation analysis. *Language Policy, 11*(3), 213–234. DOI: 10.1007/s10993-012-9243-x.

Brown, K. D. (2012). The linguistic landscape of educational spaces: Language revitalization in southeastern Estonia. In D. Gorter, H. F. Marten & L. Mensel. (Eds.) *Minority Languages in the Linguistic Landscape.* 281-298. England: Palgrave McMillan.

Canagarajah, A. S. (2006). Ethnographic methods in language policy. In T. Ricento, (ed.) *An Introduction to Language policy: Theory and Method.* 153-169. Maiden, MA: Blackwell.

Copland, F. & Creese, A. (2015). *Linguistic Ethnography Collecting, Analysing and Presenting Data.* Los Angeles: SAGE.

Creese, A. (2008). Linguistic ethnography. In K. King & N. Hornberger (Eds.) *Encyclopedia of Language and Education.* (2nd ed) 229–241. New York: Springer.

Creese, A. & Blackledge, A. (2015). Translanguaging and identity in educational settings. *Annual Review of Applied Linguistics 35*, 20–35.

Cummins, J. (2005). A proposal for action: Strategies for recognizing heritage language competence as a learning resource within the mainstream classroom. *The Modern Language Journal, 89*(4), 585-592.

Cummins, J. (2017). *Flerspråkiga elever: Effektiv undervisning i en utmanande tid.* [Multilingual Students: Effective Education in a Challenging Time] Stockholm: Natur och kultur.

Cummins, J., Hu, S., Markus, P., & Montero, K. (2015). Identity texts and academic achievement: Connecting the dots in multilingual school contexts. *TESOL Quarterly, 49*(3), 555-581. DOI: 10.1002/tesq.241

Ganuza, N., & Hedman, C. (2015). Struggles for legitimacy in mother tongue instruction in Sweden. *Language and Education, 29*(2), 125-139.

García, O. (2009). *Bilingual Education in the 21st century: A Global Perspective*. Oxford: Wiley-Blackwell.

Hornberger, N., & Johnson, D. C. (2017). Slicing the onion ethnographically: Layers and spaces in multilingual language education policy and practice. *TESOL Quarterly, 41*(3), 509-532.

Hyltenstam, K. & Milani, T. (2012). Modersmålsundervisning och tvåspråkig undervisning. In K. Hyltenstam, M. Axelsson & I. Lindberg. (Eds) *Flerspråkighet: En forskningsöversikt.* [Multilingualism: A Research Overview] 17-152. Vetenskapsrådets rapportserie 5: 2012. Stockholm: Vetenskapsrådet.

Jonsson-Lilja, S. (1999). *Den mångkulturella skolan: Ideal kontra verklighet. Modersmålslärarnas arbetsvillkor i Göteborg i ett sociologiskt perspektiv.* IPG-rapporter, Nr 1999:12. Institutionen för pedagogik och didaktik, Göteborgs universitet. Göteborg.

Lainio, J. (2012). "Modersmåls erkända och negligerade roller" [The acknowledged and neglected roles of mother tongues]. In M. Olofsson (Ed.) *Symposium 2012: Lärarrollen i svenska som andraspråk*. [Symposium 2012: The Teacher Role in Swedish as a Second Language] 66-96. Stockholm: Stockholms universitets förlag.

Landry, R. & Bourhis, R. Y. (1997). Linguistic landscape and ethnolinguistic vitality: An empirical study. *Journal of Language and Social Psychology, 16*(1), 23-49.

Lefebvre, H. (1991). *The Production of Space.* Oxford: Blackwell.

Manyak, P. C. (2004). "What did he say?" Translation in a primary-grade English immersion class. *Multicultural Perspectives, 137*(2), 12-18. DOI: 10.1207/S15327892mcp0601_3

Nilsson, J., & Bunar, N. (2016). Educational responses to newly arrived students in Sweden: Understanding the structure and influence of post-migration ecology. *Scandinavian Journal of Educational Research, 60*(4) 399-416.

Norberg Brorsson, B., & Lainio, J. (2015). *Litteratur och språk: Flerspråkiga elever och deras tillgång till utbildning och spark i skolan: Implikationer för lärarutbildningen.* Uppföljningsrapport till EUCIM-TE-projektet. Nr: 10, 2015. Mälardalens högskola. Eskilstuna.

Norton, B. (2013). *Identity and Language Learning: Extending the Conversation.* Bristol: Multilingual Matters.

Paulsrud, B., Rosén, J., Straszer, B. & Wedin, Å. (Eds.) (2017). *New Perspectives on Translanguaging and Education.* Bristol: Multilingual Matters.

Pavlenko, A. & Blackledge, A. (2004). Introduction: New Theoretical Approaches to the Study of Negotiation of Identities in Multilingual Contexts. I A. Pavlenko & A. Blackledge, (Eds.) *Negotiations of Identities in Multilingual Contexts.* 1-33. Clevedon: Multilingual Matters.

Reath Warren, A. (2013). Mother tongue tuition in Sweden: Curriculum analysis and classroom experience. *International Electronic Journal of Elementary Education, 6* (1), 115-142.

Ricento, T. & Hornberger, N. H. (1996). Unpeeling the onion: Language planning and policy and the ELT professional. *TESOL Quarterly, 30*(3), 401-427.

Rosén, J., Straszer, B. & Wedin, Å. (2019a). Maintaining, developing and revitalizing: Language ideologies in national education policy and home language instruction in compulsory school in Sweden. In C. Seals & V. Olsen-Reeder. (Eds.) *Embracing Multilingualism across Educational Contexts.* 182-211. New Zealand: Victoria University of Wellington.

Rosén, J., Straszer, B. & Wedin, Å. (2019b). Studiehandledning på modersmål: Studiehandledares positionering och yrkesroll. [Study Guidance assistance in the Mother Tongue: SGMT Assistants' positioning and professional role] *Educare – Vetenskapliga Skrifter* (3), 49-61. https://doi.org/10.24834/educare. 2019.3.4

Rönnlund, M., & Tollefsen, A. (2016). *Rum: Samhällsvetenskapliga perspektiv.* [Space: Perspectives from Social Sciences] Stockholm: Liber.

SFS 2010:800 *Skollag*. [Education Act]. Swedish Code of Statutes. Stockholm: Ministry of Education and Research.

Shohamy, E., & Gorter, D. (2009). *Linguistic Landscape: Expanding the Scenery.* New York and London: Routledge.

SI (2012). *I marginalen: En granskning av modersmålsundervisning och tvåspråkig undervisning i de nationella minoritetsspråken.* [In the Margain: Examination of Mother Tongue Education and Bilingual Education in the national Minority Languages] Kvalitetsgranskning. Rapport 2012: 2. The Swedish Schools Inspectorate: Stockholm: Skolinspektionen.

Skolverket (2008). *Med annat modersmål: Elever i grundskolan och skolans verksamhet.* [With other Mother Tongue: Students in Primary school and School Activities] Rapport 321. Stockholm: Skolverket.

SNAE (2018). *Läroplan för grundskolan, förskoleklassen och fritidshemmet.* [Curriculum for the Compulsory School, Preschool Class and the Recreation Centre]. Revised 2018. Stockholm: Swedish National Agency for Education.

Spetz, J. (2014). *Debatterad och marginaliserad: Perspektiv på modersmålsundervisningen.* [Debated and Marginalised: Perspectives on Mother Tongue Education] Rapporter från Språkrådet 6. Språkrådet. Stockholm.

Spolsky, B. (2004). *Language Policy.* Cambridge: Cambridge University Press.

Straszer, B. (2017). Translanguaging space and spaces for translanguaging: A case study of a Finnish-language pre-school in Sweden. In B. Paulsrud, J. Rosén, B. Straszer & Å. Wedin, (Eds.) *New Perspectives on Translanguaging and Education.* 129–147.Bristol: Multilingual Matters.

Straszer. B. & Kroik, D. (in press). Promoting indigenous language rights in Saami educational spaces: Findings from a preschool in southern Saepmie. In E. Krompák, Edina; V. Fernández-Mallat & S. Meyer (Eds.) *Linguistic Landscape and Educational Spaces.* Bristol: Multilingual Matters.

Straszer, B., Rosén, J. & Wedin, Å. (2020). Imagining the homeland. Transnational spaces in mother tongue tuition in Sweden. *Journal of Multicultural Discourse.* DOI:10.1080/17447143.2020.1726932

Straszer, B., Rosén, J. & Wedin, Å. (submitted). Spaces for translanguaging in mother tongue tuition.

Straszer, B. & Wedin, Å. (2018). Rum för transspråkande i modersmålsundervisning. [Space for translanguaging in mother tongue tuition.] In B. Paulsrud, J. Rosén, B. Straszer & Å. Wedin. (Eds.) *Transspråkande i svenska utbildningssammanhang.* [Translanguaging in Swedish Educational Settings] 217-241. Lund: Studentlitteratur.

Svensson, G. & Torpsten, A.-K. (2013). Makt och litteracitet: Modersmålslärare skriver om modersmålsundervisning. In D. Skjelbred & A. Veum (Eds.) *Literacy i læringskontekster.* 170-179. Oslo, Cappelen Damm AS.

Szabó, T. P. (2015). The management of diversity in schoolscapes: An analysis of Hungarian practices. *Apples – Journal of Applied Language Studies, 9* (1), 23–51.

Wedin, Å. (2017). Arbete med identitetstexter – Flerspråkigt skrivande för identitetsförhandling och engagemang. [Working with Identity Texts – Multilingual Writing for Negotiation of Identity and Engagement] *Nordisk tidskrift för andraspråksforskning. 13*(1), 45-61.

Wedin, Å. & Wessman, A. (2017). Multilingualism as policy and practices in elementary school: Powerful tools for inclusion of newly arrived pupils. *International Electronic Journal of Elementary Education, 9*(4), 873-890.

Wedin, Å. (In press). Construction of identities in diverse classrooms: Writing identity texts in grade five. In E.O. Breuer, E. Lindgren, A. Stavans & E. Van Steendam, (Eds.) *Multilingual Literacy.* Bristol: Multilingual Matters.

Wei, Li (2011). Moment analysis and translanguaging space: Discursive construction of identities by multilingual Chinese youth in Britain. *Journal of Pragmatics, 43*(5), 1222-1235.

Wigerfelt, B. (2004). Modersmålslärare: En yrkesgrupp mellan retorik och realitet. [Mother Tounge Tutors: A Professional Group between Rhetoric and Reality] In M. Greiff, A. Persson & H. Viggósson (Eds.) *Nära gränsen? Perspektiv på skolans arbetsliv.* [Close to the Border? Perspectives on Working Life in School] 221-255.) Malmö: Arbetslivsinstitutet.

Zeichner, K. (2001). Educational action research. In P. Reason & H. Bradbury. (Eds.) *Handbook of Action Research: Participative Inquiry and Practice.* 273–283. London: Sage.

Zhu, H., Li, W. & Lyons, A. (2017). Polish shop(ping) as translanguaging space. *Social Semiotics, 27* (4), 411-433. doi-org.www.bibproxy.du.se/10.1080/10350330.2017.1334390

This page is intentionally left blank.

www.iejee.com

iejee

International Electronic Journal of Elementary Education
June 2021, Volume 13, Issue 5, 713-725

Class Teachers, Subject Teachers and Double Qualified: Conceptions of Teachers' Skills in Early Foreign Language Learning in Finland

Kaisa Hahl[*,a], Maija Pietarila[b]

Received : 12 February 2021
Revised : 18 May 2021
Accepted : 21 June 2021
DOI : 10.26822/iejee.2021.223

[*,a]**Corresponding Author:** Kaisa Hahl,
Faculty of Educational Sciences,
Department of Education,
University of Helsinki, Helsinki, Finland.
E-mail: kaisa.hahl@helsinki.fi
ORCID: https://orcid.org/0000-0002-8703-4558

[b]Maija Pietarila
E-mail: maija.pietarila@helsinki.fi
ORCID: https://orcid.org/0000-0002-0733-8405

Abstract

The shift to an earlier start in foreign language teaching in Finland took place nationwide in 2020. Both class teachers and subject teachers faced a new situation. They would be teaching children younger than before, or they would be teaching a completely new subject for them. This article examines teachers' conceptions of the skills and competencies, including required language skills, that are important for a teacher in early foreign language teaching. The data for this study were gathered through essays that teachers (n=44, subject teachers, class teachers, and double qualified teachers) turned in as tasks during an in-service teacher training for early teaching of foreign languages. The essays were analyzed with content analysis. The findings show that teachers found it the most essential that early foreign language teachers have enthusiasm for the job and are able to inspire learners. They also considered it important that teachers focus on learners and the learning environment, as well as have skills for early years pedagogy. The teachers did not consider foreign language education or language skills as important as the other skills but yet wished for teachers to be able to communicate in the target language in the class.

Keywords:

Early Foreign Language Teaching, Class Teachers, Subject Teachers, Finland

Introduction

There has been a trend to an ever-earlier start to foreign language teaching and learning in Europe since the 1990's (Enever, 2016). The decisions for lowering the starting age have often been made on the assumption that younger learners learn a new language better (e.g., Luz Celaya, 2012). However, currently there is little proof that an earlier start will provide the learner with better language skills than starting later (Muñoz & Singleton, 2011; Pfenninger & Singleton, 2017). The reasons are many. Among the reasons are that

young learners are usually offered a minimal amount of teaching in the foreign language (Enever, 2015), the level of language skills by teachers varies (Unsworth et al., 2015), and teachers' skills to implement age-appropriate pedagogical solutions are sometimes lacking (Nikolov & Mihaljević Djigunović, 2011)).

The shift to an earlier start in foreign language teaching in Finland, the context of this study, took place nationwide in the beginning of 2020 (Inha & Kähärä, 2018). Before the change, both subject teachers (specialized in the language) and class teachers (generalists who teach at the elementary level) were offered in-service teacher training to enhance their competencies in teaching a foreign (or second) language to young children. Both groups of teachers faced a new situation. They would be teaching children younger than before, or they would be teaching a completely new subject for them. This article examines subject teachers' and class teachers' conceptions of the skills and competencies that are necessary for a teacher in early foreign language teaching, including teacher's language skills.

Early Teaching of Foreign Languages

Early foreign language teaching sets partly different requirements for language teachers when compared to teaching foreign languages to older students. When learners are so young that they do not yet read and write, the main input is through listening to the teacher using the language or hearing language from other sources, such as videos or audio files. Many researchers thus encourage teachers to use solely or mostly the target language in order to maximize learners' exposure to it (Enever, 2016; Mezzi, 2012).

One of the reasons why the Finnish government pushed for the early teaching of foreign languages was the understanding that young children learn languages very easily due to the so-called sensitivity period (Finnish Ministry for Education and Culture, 2018). The same reason has also been behind the decision to start earlier in many other countries (Enever, 2015). However, research on the sensitivity period does not explicitly support the claims of success, particularly when the question is about learning foreign languages in a school context instead of learning a second language in a home or daycare setting (e.g., Luz Celaya, 2012; Nikolov, 2009). It is rare that there is more than minimal exposure to a foreign language at school where the language is usually taught for only one or two lesson hours per week (Enever, 2015). Furthermore, prior research shows that sometimes any advantage that earlier starters gain is caught up by older starters — even within a few months (Dolean, 2015; Huhta & Leontjev, 2020; Muñoz & Singleton, 2011; Pfenninger & Singleton, 2017).

However, there are advantages that young children may have over older learners; namely motivation, positive attitude and the willingness to engage in activities (Johnstone, 2009; Nikolov, 2009). These are aspects that can be capitalized on in teaching. In her research, Enever (2015) brings up five elements that are essential for successful early foreign language learning and that warrant particular attention. These are teacher expertise, learners' sustained motivation, continuity of learning, setting realistic aims, and out-of-school learning.

Being exposed to a foreign language outside of school is known to have a positive influence on learning the foreign language. However, pinpointing the exact benefits has been difficult to prove with research (Enever, 2015; Pfenninger & Singleton, 2017). Nevertheless, being exposed to the language through various channels and using it also outside the classroom will grant learners precious practice time. Out-of-school learning may take place without learners even realizing it or considering it studying. Thus, a pleasant and stress-free environment may be well suited to language acquisition. A study by de Wolf et al. (2017) even suggests that early foreign language learning is not beneficial without the support of out-of-school exposure to the language.

Setting realistic aims for foreign language learning is important so that both teachers, learners and guardians know what (kind of) learning outcomes can be expected. It must be kept in mind that in minimal input instruction (such as 1–2 lesson hours weekly), the expected results must be reasonable and feasible within the limited exposure and learning time (Enever, 2015; Dolean, 2015). Continuity of learning a foreign language should be ensured so that students moving from one school or one school level to the next would be able to continue their language learning path at the right level (Enever, 2015).

Some skills that are not easily measurable or comparable in statistics might be overlooked when learners' progress is tested (Enever, 2015). Such skills are, for example, affective aspects including attitude, motivation and intercultural learning. These are skills that early foreign language teaching seems to affect positively. The provision of teaching a foreign language to young learners also differs from context to context, with different implementations of teaching and different numbers of weekly lessons (de Wolf et al., 2017). Thus, it is difficult to compare students' language attainment between contexts. A Dutch study showed that early starters (age 4) outperformed later starters (age 8–9) with "a marginal advantage" in oral fluency (de Wolf et al., 2017, p. 341). However, in many school contexts, such as in this study, starting the first foreign language is later than at the age of 4.

The elements that are the most central in terms of this article are teacher expertise and learners' sustained motivation. Teachers often have different educational backgrounds and competencies, and their language skills vary (Unsworth et al., 2015). Teachers do not always receive sufficient professional development before they start teaching a foreign language to young learners (Zhetpisbayeva et al., 2016). Teacher expertise for early foreign language teaching consists of both strong language skills and the ability to use age-appropriate teaching techniques and tasks (Enever, 2015). Teacher expertise can also be considered to include teachers' personal qualities, such as an ability to create rapport with students (Edelenbos et al., 2006). Nguyen (2016) calls this a mother or a caregiver role that teachers adopt to show affection and care to children. Teachers also need an ability to create a pleasant and invigorating classroom atmosphere (Edelenbos et al., 2006). Teachers can inspire learners with their artistic and creative abilities when they use movement, singing and facial expressions, and act out different roles (Nguyen, 2016).

Unsworth et al. (2015) found that young children who had teachers with a high language proficiency (above B2 in CEFR) scored better in vocabulary and grammar tests after two years of learning than those children whose teachers had a lower level of language proficiency (B2 or below). In fluent speech, we retrieve and combine various readymade 'lexical chunks' — language that consists of short phrases including words and structure (Mezzi, 2012). Teachers can teach actual language structures and grammatical constructions to older learners, whereas young learners do not yet possess sufficient cognitive skills to receive such instruction. Teachers need to provide young learners with plenty of opportunities to repeatedly hear and use correct forms of lexical chunks (Mezzi, 2012). That is why students should be exposed to authentic language that results from real acts of communication. Young learners learn the meaning of a new language more holistically by listening, imitating, and repeating (Pinter, 2017). In order to enhance young children's learning, teachers are advised to use their tone of voice, facial expressions, gestures, and movement to encourage the learners to guess the meaning of new words (Mezzi, 2012; Meriläinen & Piispanen, 2019). Teachers who are fluent speakers of the target language will likely speak more target language in the classroom than teachers with a lower level of language skills. Teachers also need to know how to make their speech comprehensible and not too complicated so that it is at the appropriate level for the student group (Graham et al., 2017).

Learners' motivation and engagement are influenced, for example, by the kind of activities that the teacher selects and the nature of learner involvement in the activities (Edelenbos et al., 2006; Mezzi, 2012). Earlier studies show that young children are initially very motivated and have a positive attitude towards language learning (Enever, 2016). They are easily excited and engage willingly in various activities (Johnstone, 2009; Nikolov, 2009). In the beginning, young children are often introduced to language learning by games, storytelling, role-playing, drama and different sketches (Mezzi, 2012). It is important that the chosen methods are interactive, engaging and encouraging (Enever, 2015; Johnstone, 2009; Luz Celaya, 2012). However, learner motivation declines with age. The reasons are that the early years of using the fun approaches of singing and games are gradually changed to more demanding tasks of studying by reading, writing and memorizing vocabulary (Enever, 2016). Learners' attitudes to songs and games change with age, too, and thus teachers need to adapt to what fun and meaningful activities mean for different age groups.

Foreign Language Teaching in Basic Education in Finland

Teaching of foreign languages starts now in grade 1 (age 7) in Finland. Previously, the starting of the first foreign language was not until grade 3 (age 9) in most schools. This change became effective in January 2020 and from then on, all first graders start the first foreign language at the latest in the spring term of the first school year. The change in the starting age of the first foreign language was historical as it was through an addition of lesson hours without taking any away from other subjects. However, it is only one 45-minute lesson that all students are given in a week unless a municipality gives extra resources for it (e.g., the capital of Finland). One of the goals of lowering the starting age was also that students would be given opportunities to choose languages other than English and that the overall scope of Finnish people's language reserve would widen. However, it seems that those goals may not be realized as English is most often the only language that is offered for first graders. Students may have an opportunity (if schools offer it and if enough students choose it) to start their second foreign language in grade 4 or 5. In grade 6, all students in Finnish-language schools start Swedish, the second national language in Finland, as another "foreign" language. In grade 8, students have their next opportunity to add another foreign language to their repertoire (Finnish National Board of Education, 2016). The statistics show that the number of students learning additional languages has dropped dramatically in the last two decades except for Spanish that has gained popularity as a new foreign language in Finland (Education Statistics Finland, 2020).

According to the core curriculum (Finnish National Board of Education, 2016), the objective of foreign language teaching in Finland is to strengthen students' multilingual competence that comprises all the different language competence levels of students' home language(s), second, and additional languages. It aims to strengthen students' parallel use of different languages and increase their language awareness and understanding of themselves as multilingual speakers. Language education should support the development of students' cultural identities and increase their appreciation for linguistic and cultural diversity. Teachers are supposed to utilize diverse teaching methods and make room for joy, playfulness and creativity in learning (Finnish National Board of Education, 2016). The additions done to the Finnish core curriculum in relation to early foreign language learning emphasize the use of oral skills in everyday situations and the handling of topics in multifaceted ways (Finnish National Agency for Education, 2020).

The Finnish government started a Government Key Project for Languages in 2017, which focused on increasing and diversifying language teaching by offering resources to municipalities to organize regional experiments for early teaching of foreign languages. The aims of the key project have been simplified to three main focal points: integrating early foreign language learning into Finnish basic education at a much larger scale than before, providing students access to a wider language repertoire, and introducing students to a positive and encouraging attitude and approach to language learning (Inha, 2018a).

In Finland, foreign languages have usually been taught by subject teachers specialized in one to three languages. However, a class teacher, as a generalist teacher and qualified to teach any subject offered in the elementary school (first six grades of basic education), is also qualified to teach a foreign language. They are qualified even if they have no prior knowledge or education in the language subject. Class teachers may have other subjects as minors that they are qualified to teach also at the lower secondary level (the last three grades of basic education). These teachers (with a language as a minor) are referred to in this article as double qualified teachers. When early teaching of foreign languages was introduced through various projects funded by the government (Inha, 2018a; Inha & Kähärä, 2018), different schools opted for different implementations, usually based on teachers' own interest. Sometimes it was a subject teacher, sometimes a class teacher who would teach a foreign language in the early grades, or sometimes lessons would be co-taught by a subject teacher and a class teacher (Hahl, Savijärvi, & Wallinheimo, 2020). In general, all teachers faced a new situation. On the one hand, subject teachers were not used to teaching such young children who were not able to read and write yet. On the other hand, class teachers might not have taught a foreign language ever before. Thus, there was need for further training for all teachers.

So far there is limited research about early teaching of foreign languages in Finland, or about teachers' conceptions of teaching a foreign language to younger students than before. This qualitative study thus aims to fill this gap by examining teachers' conceptions of teacher's skills and competencies, including required language skills, in order to gain an understanding about the following questions:

1. What skills and competencies do subject teachers, class teachers and double qualified teachers consider important for a teacher in early foreign language teaching?
2. What (kind of) language skills do subject teachers, class teachers and double qualified teachers consider important in early foreign language teaching?

Data and method

The data for this qualitative study were gathered through essays that teachers turned in as assignments during an in-service teacher training for early teaching of foreign languages. The same in-service teacher training was offered to two groups of teachers, the first in autumn 2019 and the second in spring 2020, lasting about 5–6 months. The implementation of the second training had to be modified due to the worldwide Covid-19 pandemic, but the assignments remained the same. The assignments were completed in between full training days that were carried out as contact teaching (two out of four in the spring term as remote teaching) as well as shorter one-hour-long webinars. Each teacher turned in four separate essays. The participants read selected literature and watched short videos where an invited specialist shared her expertise and research done by scholars in early foreign language learning. The assignments also included questions that the participants answered in essay-type writing. The questions posed to the teachers related to the teachers' conceptions and approaches to supporting student learning and the use of various games and activities; what they considered important in teachers' language skills, and how they felt about their own language skills; what they considered the most essential skills and competencies for teachers to possess in early foreign language teaching; and what they wanted to develop in their own skills.

The participants were in total 44 teachers, of whom 18 were subject teachers (ST), 10 class teachers (CT), and 16 teachers who were double qualified as both class and subject teachers (CST). All of them signed a

written consent to use their assignments for research. The majority of the teachers had already participated in early foreign language teaching, either through a program that their school had had in place for a longer period, or through a project that had been funded by the government since 2017 (Inha, 2018b). The essays were analyzed with thematic analysis (Braun & Clarke, 2006) and coded with the Atlas.ti program. The analysis was carried out as an iterative process where the data were read through multiple times while looking for repetitive content that was labelled with themes. The similar themes and content were then grouped into larger categories. We present the findings in the next section as the final categories that we formed based on the themes raised from the data.

Findings

The findings of this study are presented here according to the research questions. First, we present the skills and competencies that the in-service teacher training participants considered important for a teacher to possess in early foreign language teaching, before moving on to the question about language skills.

Important Skills and Competencies for a Teacher in Early Foreign Language Teaching

The teachers of the in-service teacher training brought up many different professional skills and personal qualities that are important for a teacher to have when teaching a foreign language to young children. These skills and competencies are presented and discussed in the following, starting from those that were considered the most important by the teachers. We have divided the skills and competencies into the following categories:

- Enthusiasm and ability to inspire
- Focus on children and the learning environment
- Skills for early years pedagogy
- Skills for foreign language education
- Willingness to develop one's skills
- Ability to throw oneself in the job
- Using one's strengths

Enthusiasm and ability to inspire

The participants were overwhelmingly in agreement about the most important skills and competencies that a teacher should possess for early foreign language teaching. We have named the first of these categories as Enthusiasm and ability to inspire, and almost all teachers mentioned these competencies (100% of ST, 94% of CST, 100% of CT). The participants emphasized it as the most essential that the teacher is enthusiastic and willing to teach a foreign language to young students. Simultaneously, the teacher should be able to inspire and motivate students to language learning through awakening a curiosity and excitement for learning a new language.

> *I think the most important skill, or an area of emphasis, is teachers' own inspiration and will to teach the early language. I feel that teachers' most important task is to motivate students and create a safe learning environment.*[1] *(Double qualified teacher 28)*

These aspects were most often mentioned at the same time. Teachers' inspiration was seen contagious and necessary for promoting and maintaining students' motivation and interest at the same time. However, as the teacher below mentions, a teacher's own inspiration is not something stable, but it may need to be nurtured and reignited at certain intervals.

> *I think it would be ideal for each teacher that their own attitude to the taught subject and subject area would be as positive as possible. It can be assumed that a subject teacher, who has chosen to study a particular subject, possesses motivation and knowhow to acquire and teach it. Motivation and inspiration are not stable states, however, and sometimes they might disappear and to find them again and strengthen them needs self-orientation and one's own development. (Subject teacher 29)*

The teacher in the above quote also addresses the difference in the situation for subject teachers and class teachers. A subject teacher is an expert in the particular subject, but a class teacher has maybe never taught the subject before.

Focus on children and the learning environment

The second category combines several aspects of teachers' skills and competencies that are related to learners and the learning environment. The teachers mentioned that teaching must start from the young students and the teacher must be able to create a safe learning environment that also feeds students' courage as language users. Teachers need to know their students and their world and include children's ideas and their points of interest into teaching. All the subject teachers, double qualified teachers and class teachers mentioned at least some of these aspects as essential to teacher's skills and competencies.

> *I think the most important thing in early foreign language teaching is to get students inspired about foreign languages and cultures and arouse their own curiosity and motivation towards languages. For this to succeed, the teacher must be able to create a safe environment for understanding and speaking the language so that it does not cause fear for the future. Here the teacher has a big role so that s/he can provide the students with experiences of success even just from the courage of trying before they have necessarily even learned it yet. (Double qualified teacher 42)*

Group management skills are important in creating a safe and peaceful learning environment. These skills enable teachers to set limits and maintain order as well as carry out transitions in between tasks. A peaceful learning environment provides students with an opportunity to concentrate on the given tasks. Subject teachers have most often taught older children who are already used to being in school and who know the rules for behavior. On the contrary, class teachers teaching in grades 1 and 2 have the responsibility and experience of teaching young children the basic skills of being in school. This is perhaps the reason why class teachers were the ones to emphasize group management skills. As the teacher below expresses, classroom management skills are all the more important when group sizes are big and students diverse in their development levels.

> *Classroom management and organization skills are extremely essential with large student groups and different students (of very different levels). (Class teacher 06)*

Subject teachers also brought up teachers' ability to be flexible according to the specific group of children. This competency was only seldom mentioned by class teachers or double qualified teachers. Flexibility was associated with teachers' ability to read different situations and, when necessary, adjust plans and activities on the go according to the needs of the learners.

A safe learning environment is also important so that students feel comfortable and encouraged to try speaking the new language without being afraid of making mistakes. Encouraging students to become confident language users was considered important by especially the double qualified teachers and subject teachers while half of the class teachers mentioned this. The encouragement to language use included urging students to become active in using and functioning in the foreign language from the start as well as offering them experiences that enabled the use of the language.

> *A good teacher encourages students and urges them to use even their small language skills bravely. In addition, the teacher helps to notice strengths and makes the learning objectives and their attainment explicit. This means, too, that self and peer assessment are practiced regularly with students. (Double qualified teacher 02)*

A safe learning environment should also support students' sense of capacity to function in the foreign language. It was considered important that teachers both acknowledge students' strengths and provide them with plenty of opportunities for feelings of success.

Skills for early years pedagogy

All the class teachers and double qualified teachers (100%) specified that it was important for early foreign language teachers to possess skills for early years pedagogy and be able to select age-appropriate and varied tasks. Almost all of the subject teachers (89%) mentioned these skills as well. Being familiar with early years pedagogy includes possessing knowledge about young children's developmental stages and how they learn.

> *All teachers, despite their educational background, must know age-appropriate pedagogy. Understanding age-appropriate matters is important. Teachers' own understanding and will to make teaching of high quality, plan diverse and motivating lessons and obtain necessary knowledge and skills are essential. (Subject teacher 36)*

Teachers also mentioned practical solutions such as short and clear instructions and scheduling and alternating more peaceful and more active tasks in lessons. They talked about creating routines and selecting content with "less is more" understanding.

> *Right now I believe that my prejudice about class teachers was wrong. It might have been a better option to choose 'less is more' thinking in an English lesson and group management by a class teacher than subject teachers jumping into the deep end for the first time who had no previous experience of action-based tasks and young children's energy. (Subject teacher 07)*

Some teachers also admitted (as above) that, before the training, they had been biased against teachers with a different educational background. Thus, the training had also helped teachers to become more open and receptive to other teachers' skills and talent. Although subject teachers often have a stronger command of the foreign language, some yet lack skills and experience of dealing with very young children and selecting suitable teaching activities and tasks.

Skills in foreign language education

It was notable that the number of teachers (50% of ST, 50% of CST, 20% of CT) who considered skills specifically in foreign language education important in early foreign language teaching was much lower than in the earlier categories. However, some teachers, as the one in the quote below, emphasized that it is essential that language teachers also have knowledge of how to best teach foreign languages to young children.

> *I think it is very important in early foreign language teaching that the teacher masters both foreign language and early years pedagogies. [...] The teacher should be able to speak fluently so that children get proper exposure to the language and have knowledge of foreign language pedagogy so that s/he can plan teaching as an efficient and*

> *beneficial entity. However, it is also important that the teacher can take into account her/his learners' age and developmental stage. (Subject teacher 35)*

This teacher highlighted the importance of knowledge in both foreign language education and early years pedagogy, but also strong language skills. It was also recommended by many of the teachers that initial class teacher education would have studies in foreign language education (which may be optional but are not compulsory at the moment).

Willingness to develop one's skills

Almost three quarters of the subject teachers (72%) mentioned that it was important that a teacher is willing to develop her/his skills and is open to new ideas. Meanwhile, a little over a third of double qualified teachers (37%) and class teachers (40%) mentioned this aspect as important. This aspect included teachers' will to develop their teacherhood and/or language skills, for example, through in-service teacher training. The will to develop oneself consisted also of being open, possessing a preparedness to challenge used practices and to try something new..

> *It is worth for a teacher to aim to develop continuously through peer support and self-studying. Peer support, support by conversation, and interaction based on brainstorming can be found in social media groups in addition to one's own colleagues. There is plenty of in-service training available, too, and it is worth it to challenge oneself to step outside of one's comfort zone. That is when new opportunities open up to widen one's own image of being a teacher and a perspective to one's own teacherhood. (Subject teacher 29)*

As the teacher in the above quote mentions, development can be gained through formal in-service teacher education, but also more informally from colleagues in one's own school or online, through discussions, sharing of ideas and material, and peer support. Some teachers also called for more co-teaching or joint planning sessions between teachers. They mentioned that if there were more collaboration between teachers in the schools, each type of teacher could share their expertise and educate the others.

Some teachers also mentioned the necessity to have inspiration for teaching a foreign language to young learners in order to be willing to develop – especially if early foreign language teaching is new for them.

> *I [think] that students can certainly see it if a teacher is not excited about teaching the language. I think schools should pay attention to this. If a class teacher says that s/he is not willing to teach a foreign language, it would be important to listen to the teacher and, in particular, to the reasons why the teacher does not want to teach and take it seriously... Students can sense it quickly if a teacher is not interested in teaching the language. I would be personally more worried of a situation where a teacher is forced to teach a foreign language than, for example, if the teacher's pronunciation is lacking. A motivated teacher is willing to learn new things and find ways to go around her/his shortcomings. (Subject teacher 18)*

The above quote brings up an issue that worried some teachers: sometimes a (class) teacher is made to teach a foreign language without having competence for it or without having a desire to teach it. It was considered essential that teachers could choose themselves whether they wanted to teach a foreign language in the early grades or not. This is, after all, a new subject for many teachers. It was felt that if teachers are motivated to take on a new challenge, they will also be motivated to develop themselves to do the job well.

Ability to throw oneself in the job

Half of the subject teachers (50%), and more than a third of double qualified teachers (44%) and class teachers (40%) mentioned teacher's ability to throw themselves in bravely in early foreign language teaching. This category includes an ability and courage to throw oneself in plays, games and action, and act silly and have fun without being constrained by the fear of acting foolish. It is a way to meet students at their age level.

> *Early foreign language teaching is by nature functional and consists of a lot of plays and songs, which requires a whole-hearted attitude to throw oneself into teaching and often functioning outside of one's own comfort zone. A good teacher gives their students an important model that one does not need to be flawless, and you can view yourself with kind humor. (Double qualified teacher 40)*

One of the class teachers wrote that being able to throw oneself in bravely can also help if a teacher does not possess strong language skills.

> *When tutoring other teachers, I have noticed that several teachers are ready to throw themselves in the job and many have a great amount of courage although their language skills are not at the level of an English teacher. I think being a good teacher includes in fact one's ability to throw oneself in and even if things do not always go perfectly right, you can still speak English. (Class teacher 09)*

Starting early foreign language teaching has also influenced some subject teachers' other language teaching in a positive way. Some mentioned how they have now more courage to try out new things with older learners as well.

> *I enjoy early foreign language teaching and its planning. With small children, you must be genuinely engaged and present in the lesson. Your every cell is engaged in the early teaching. Furthermore,*

> *teaching a foreign language to small children has enriched my teaching, because I am much braver to include action-based tasks in every lesson, even with older students. (Subject teacher 04)*

Starting to use action-based tasks in language learning might be a substantial change from normal practices for subject teachers. Teaching foreign languages in Finland is often book-based with limited communicative activities (Harjanne et al., 2017).

Using one's strengths

The last of the categories and another quality considered important by half of the subject teachers (50%) and about a third of double qualified teachers (37%), but rarely mentioned by class teachers (20%), was teacher's own strengths. Using one's strengths was associated with the understanding that it depends on each teacher on what makes her/him a good teacher for early foreign language teaching.

> *Nowadays a teacher is met repeatedly with external requirements and may, under continuous pressures for development and change, doubt the adequacy of their own skills. It is important to remember that there is not only one "right" way to teach but each teacher works with their own personality and brings in their own strengths and experiences. I am sure that every teacher aims to be a good teacher in their own way. (Subject teacher 38)*

As the teacher above writes, there are many right ways to implement good teaching. It was considered important for teachers to use their own personality in teaching and reflect on the strengths they have that can be harnessed in teaching.

Language Skills for a Teacher in Early Foreign Language Teaching

The participants were asked specifically to consider what kind of language skills are necessary for a teacher to possess in order to teach a foreign language to young children. We have divided the different skill areas raised from the teachers' essays into the following categories:

- Communication in target language
- Courage to speak and trust in one's language skills
- Basic grammar and pronunciation
- Correctness and development of language skills

Communication in target language

The majority of the teachers (83% of ST, 88% of CST and 90% of CT) felt that communication in general in the target language and communicativeness were the most important when considering teacher's language skills for early foreign language teaching. The participants felt that if teachers are too focused on error-free language, it hinders the naturalness of the language and even scares teachers away from communicating in the target language.

> *Of course, teacher's language skills matter, but native speakers do not either always speak the language perfectly or know how to pronounce all the words correctly. So, communicativeness goes before grammatical correctness. Of course, teachers should aim at good and right language, but it must not be a hindrance or cause fear of teaching a foreign language. Each one of us can learn new things and no one is so perfect in their language skills that they don't make any mistakes. Children might in fact feel braver and safer to also make mistakes, if the teacher dares to be fallible and sometimes makes mistakes. (Double qualified teacher 08)*

Some of the teachers, as the one above, also mentioned that the teacher can set a right example to the students if they use the target language despite some weaknesses in their language skills. They can show to the students that one does not need to be a "perfect" speaker to use the new language (as we all make mistakes even in our first language) and that it is natural and acceptable to make mistakes or to not always find the right word. However, the teachers considered it important that a language teacher would use as much of target language as possible.

Courage to speak and trust in own language skills

Many of the teachers mentioned that it is important to trust in one's own language skills in order to have the courage to speak the language in the class. Two thirds of the double qualified teachers and half of the subject teachers mentioned this as essential. Only three class teachers (30%) mentioned this aspect.

> *As a language teacher I find all language competence utmost important, and I think in a language class the teachers should use the target language as much as possible. I have often encouraged my colleagues to speak the foreign language. (Subject teacher 35)*

Some of the teachers brought up the fact that in some schools, a teacher who has not previously taught the language and does not speak the language well, would yet be made to teach it. These teachers were encouraged to start learning and speaking the language alongside with the students.

> *I think a teacher can throw herself into the role of a student and learn pronunciation together with the children. For example, a puppet, who speaks in the voice of the recording, could be in the role of the teacher. I still hope, however, that every language teacher would find the courage to speak the language themselves. (Double qualified teacher 03)*

For those teachers, who have not studied the foreign language, used their English (or other language skills) in years, or do not possess good language skills, having to start to teach it anyway might feel insurmountable. Thus, the teachers felt that support from the school community and participation in in-service training are highly needed.

Basic grammar and pronunciation

Most of the teachers felt that basic language skills were important. They thought a language teacher should have good pronunciation of the language and/or knowledge of at least basic grammar (72% of ST, 69% of CST, 50% of CT). Young students do not yet read and thus their language input comes either through different audio or video material, but also relies largely on the teacher to be a model for them in pronunciation.

> *It would be good for a language teacher [in early language teaching] to know how to pronounce the language correctly at least in general. One can cope with a smaller vocabulary, but wrong models of pronunciation get easily stuck in the child's mind. (Double qualified teacher 17)*

However, some teachers commented that a teacher can supplement her/his lack of language skills with widely available recordings of native speaker speech

> .
> *Fortunately, it is extremely easy to offer children good models of pronunciation and error-free speech with native speaker recordings. (Subject teacher 11)*

Many of the teachers also discussed English as a lingua franca and its multiple variations. Although different Englishes and all languages should be appreciated, some teachers yet worried about what non-standard models of pronunciation would do to the children. There was also a concern that not all children are exposed to the foreign language outside of school and at home. Therefore, there would be a greater need for exposure and support in the school.

> *Nowadays there are so many speakers of different Englishes in the world that different kinds of "rally English" are allowed. I think this is all in all a slightly difficult question in relation to the early teaching of languages, because children should learn right pronunciation from the start. All children do not necessarily have models for English around them through the media or their homes. (Subject teacher 01)*

Traditionally, the teaching of foreign languages has started from grade 3 in Finland and usually the languages have been taught by subject teachers specialized in the particular language. There was a worry among some teachers that early foreign language teaching is not valued in the same way as foreign language teaching from grade 3 on, if it is taught by a class teacher who does not have sufficient language competence.

> *Class teachers, sometimes regardless of their skills, might have to teach a foreign language in the early grades. I still wish that in the future, students would be given the "best possible" teaching. It is wrong to think that the language subject in grades 1 and 2 is less valuable than from grade 3 on. Because in early foreign language teaching the focus is largely on listening to and speaking the language, it should be "quite right". I mean by this that if the teacher lacks the articles or is missing simple grammar, the situation is challenging. Students learn by listening to the language the first couple of years. If it has a lot of errors, I can imagine that students will experience fossilisation. (Double qualified teacher 31)*

Fossilization refers to a process in which a learner is not able to attain target language accuracy in a foreign language but learns a deviant form of, for example, pronunciation or grammar. Incorrect language forms become a habit and cannot be easily corrected (e.g., Han, 2013). Some teachers were particularly worried about repetitive grave errors that students might be exposed to if teachers lack good pronunciation and basic grammar. They worried that it would be challenging for other teachers later to try help the learners rid themselves of the wrong forms and learn correct language forms.

Correctness and development of language skills

Although the teachers were mostly very lenient about the level of language skills needed for early foreign language teaching and considered communication in general more important, a third of the teachers (of each teacher type) yet mentioned that a language teacher should aim at as good and error-free language as possible.

> *It is good to aim at the correct pronunciation and grammar as exactly as possible, but communicativeness is yet more important. (Subject teacher 34)*

The participants mentioned that teachers should also upkeep and develop their language skills – in the same way as they should any other skills and competencies that are part of their work. A class teacher (below in the quote) discusses her perspective to English accents. Although she wants to work on improving her English pronunciation and lose her "Finnish accent," she does not think her foreign accent should deter her from teaching English.

> *In my own English teaching, I would still like to develop my pronunciation to be better and phonetically more correct, and get rid of my Finnish accent. Although I don't feel like the accent is a hindrance to teaching English. In fact, I believe that it is good for children to hear as many different kinds of speakers as possible.*
>
> *(Class teacher 06)*

For many, strong language skills were not as important as other aspects of teachers' skills and competencies.

> *I think a teacher's strong language skills are not enough if teaching does not start from the young learners. If the teacher has a sufficiently good command of the language to feel her/himself confident in using it, then experience from early years teaching is more important. Every teacher needs to take care of maintaining and updating their language skills. I also hope there will be funding for such in-service education. (Class teacher 33)*

In general, teachers considered their own motivation and eagerness to teach a foreign language to young students and focusing on the students more important than strong language skills.

Another aspect important to teaching foreign languages, but seldom mentioned by the teachers in their essays, was the knowledge of cultural content associated with the foreign language.

Discussion and conclusions

In this article, we examined teachers' conceptions of the necessary skills and competencies that a teacher should have in early foreign language teaching. The participants of this study were subject teachers (specialized in the foreign language), class teachers (generalists without studies in the foreign language or language education), or teachers with a dual qualification as class teacher and subject teacher. The participants emphasized several different skills and competencies that are important for an early foreign language teacher to have, but only some of the skills were such that all or almost all teachers brought up. We identified seven different categories of skills and competencies, but the different types of teachers were in agreement in only three of them. These were: Enthusiam and ability to inspire; Focus on children and the learning environment; and Skills for early years pedagogy. Thus, the most important aspects were teachers' personal qualities before skills for pedagogy.

The teachers in this study considered it the most essential that early foreign language teachers have enthusiasm and a will to teach a foreign language to young students, and that they are able to inspire and motivate students to language learning. These competencies have been found central in other studies as well (e.g., Edelenbos et al., 2006; Nguyen, 2016). Young children can be easily excited to get involved in different activities, and it is important that teachers capitalize on this quality (Johnstone, 2009; Nikolov, 2009). Focusing on the young learners and creating a safe learning environment were also considered important by the teachers. These findings are also similar to ones in earlier literature (e.g., Edelenbos et al., 2006; Tragant Mestres & Lundberg, 2011). When teachers are able to connect to their students' life worlds, they can create a more suitable and invigorating classroom climate for the students (Edelenbos et al., 2006). A safe learning environment can also provide better opportunities for students to become confident language users. Almost all the teachers in this study considered skills in early years pedagogy important, as teaching of young children new to school life is different from teaching older children and those who can already read and write. However, although teachers considered skills for early years pedagogy important, less than half of them also mentioned skills for foreign language education. Many studies emphasize the need for foreign language methodology (e.g., Zhetpisbayeva et al., 2016). It is essential that teachers know how to select various age-appropriate and action-based activities to guide and encourage students to use the new language repeatedly in meaningful and engaging ways (Enever, 2015; Mezzi, 2012; Nikolov & Mihaljević Djigunović, 2011).

All teachers participating in our in-service training were exemplars of active teachers who want to commit to life-long learning. Willingness to develop one's skills was mentioned as an important competency for language teachers, in particular by the majority of the subject teachers. Earlier studies show, however, that not all teachers are interested in investing time and effort into further training even when it is offered (Zhetpisbayeva et al., 2016). Another important competency mentioned by many of teachers was teachers' ability to throw oneself in the job. Nguyen (2016) has found in his study that teachers often capitalize on their creative and artistic skills when they use movement, singing or facial expressions to engage learners. We consider this competency to throw oneself in the job, act silly and have fun in early foreign language teaching related to these creative and artistic abilities.

In relation to the second research question, the teachers were not as unanimous about the necessary language skills for teachers in early foreign language teaching as they were about the other skills and competencies. In general, they felt that it was more important to be motivated about teaching a foreign language and being learner-centered than to possess a high level of language competence. Prior research recommends that teachers should have a sufficiently high command of the foreign language being taught (e.g., Enever, 2015; Graham et al., 2017). However, the majority of the respondents (about 90%) mentioned that communication in general in the target language is the most important about language skills in early foreign language teaching. The second most important aspect about language skills was possessing competence in basic grammar

and pronunciation. The participants were in general quite lenient about teachers' language skills and opposing views were also expressed. While some teachers felt that teachers should possess a high level of language skills, some yet mentioned that a teacher new to early foreign language learning could learn the language alongside with the students. The responses show that the participants knew what the reality is. Many class teachers in Finland may have to teach a foreign language in the first grades without prior experience in language education or strong foreign language competence. It is positive to see this kind of a supportive approach towards colleagues. Nevertheless, it raises a concern about educational equality in foreign language learning for all children, which is a core value in Finnish education (Niemi et al., 2016).

It may be contradictory that the teachers in this study want teachers to be able to communicate in the foreign language but only require basic grammar and pronunciation from them. In order for a teacher to use the target language for most of the lessons, it requires communicative competence in the language. It is also important for language teachers to use target language at the right level for students. With young learners it means simplified and uncomplicated language (Graham et al., 2017). If teachers only have knowledge about the basics of the foreign language, communicating fluently in the language may be impossible. Moreover, cultural aspects should be integrated to teaching a foreign language, but these might be left out if a teacher is not knowledgeable about them. Cultural aspects received little attention in our data as well. It is also necessary to keep in mind that prior research shows that students whose teachers have a high language proficiency in the foreign language will benefit from it and learn the new language better (Graham et al., 2017; Unsworth et al., 2015). Finland prides on ensuring equal opportunities and equal access to high-quality education to all students (Niemi et al., 2016). In order for it to be realized in early foreign language teaching, further education should be guaranteed for and required of all those teachers who are made to teach a foreign language without sufficient language and cultural skills or knowledge of appropriate language learning activities for young learners. Language skills are not something that a person can acquire from a single in-service teacher training course, though, but they take years of practice to learn.

The findings of this study suggest that the subject teachers were the most active in considering the necessary skills and competencies for an early foreign language teacher, while the class teachers had the least requirements. This is also understandable as subject teachers are the ones whose job it has been to teach foreign languages, while class teachers are new at it. However, no clear differences between the different types of teachers could be determined based on our data. Furthermore, the purpose of this study was not to find generalizable results, but to gain an understanding of the skills and competencies that teachers in Finland should have for foreign language teaching in the early grades. The data used for the study consisted of essays completed during in-service teaching training. Had the data collection methods been different, for example, a questionnaire or an interview, slightly different results might have been obtained.

This study also showed that an in-service teacher training for teachers of different educational backgrounds is beneficial as they get a closer look into each other's skills and competencies and learn to appreciate them better. Collaboration between teachers is becoming more necessary to fulfill the objectives of the core curriculum (Finnish National Board of Education, 2016), so joint workshops and trainings can be a springboard to it as well. As early foreign language teaching in Finland is a new phenomenon, there is need to conduct in-class research to learn about the different activities and strategies that class teachers and subject teachers employ to create learner-centered and engaging environments. In addition, it is important to study what methods and techniques help learners to learn the best in order to give them a sound foundation for foreign language learning.

Footnotes

1. These extracts are quotes from the data and they have been translated from Finnish by the authors.

Acknowledgements

Open access funded by Helsinki University Library.

References

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oade Wolf, S. Smit, N., & Lowie, W. (2017). Influences of early English language teaching on oral fluency. ELT Journal Volume, 71(3), 341–353. https://doi.org/10.1093/elt/ccw115

Dolean, D. D. (2015) How early can we efficiently start teaching a foreign language?, European Early Childhood Education Research Journal, 23:5, 706-719, https://doi.org/10.1080/1350293X.2015.1104047

Edelenbos, P., R. Johnstone, & A. Kubanek. (2006). *The Main Pedagogical Principles Underlying the Teaching of Languages to Very Young Learners. Languages for the Children of Europe: Published Research, Good Practice and Main Principles.* European Commission. https://ec.europa.eu/assets/eac/languages/policy/language-policy/documents/young_en.pdf

Education Statistics Finland (2020a). Perusopetuksen 1–6 luokkien A-kielivalinnat. [Selection of A-languages in grades 1-6 in basic education.] Vipunen. Statistics Finland, the Ministry of Culture and Education and the Finnish National Agency for Education.

Education Statistics Finland (2020b). Perusopetuksen 7–9 luokkien B2-kielivalinnat. [Selection of B2-languages in grades 7-9 in basic education.] Vipunen. Statistics Finland, the Ministry of Culture and Education and the Finnish National Agency for Education.

Enever, J. (2015). The Advantages and Disadvantages of English as a Foreign Language with Young Learners. In J. Bland (Ed.), *Teaching English to Young Learners: Critical Issues in Language Teaching with 3–12 Year Olds* (pp. 13–29). Bloomsbury Academic. https://doi.org/10.5040/9781474257145

Enever, J. (2016). What can we expect of an early start to foreign language learning in Europe today? *Gyermeknevelés, 4*(1), 2–10.

Finnish Ministry for Education and Culture. (2018). Valtioneuvosto päätti peruskoulun tuntimäärän kasvattamisesta - kieltenopetus alkaa jatkossa jo ensimmäiseltä luokalta [The government decided about the increase of lesson hours in basic education – language learning will start in grade 1.]. Website of the Ministry for Education and Culture. https://minedu.fi/-/valtioneuvosto-paatti-peruskoulun-tuntimaaran-kasvattamisesta-kieltenopetus-alkaa-jatkossa-jo-ensimmaiselta-luokalta

Finnish National Board of Education. (2016). *Finnish National Core Curriculum for Basic Education 2014.* Publications 2016:5.

Finnish National Board of Education. (2020). *Amendments and additions to the National Core Curriculum for Basic Education 2014 regarding the instruction of the A1 language in grades 1–2.* Regulations and guidelines 2019:1c.

Graham, S., Courtney, L., Marinis, T., & Tonkyn, A. (2017). Early Language Learning: The Impact of Teaching and Teacher Factors. *Language Learning, 67*(4), 922–958. https://doi.org/10.1111/lang.12251

Hahl, K., Savijärvi, M. & Wallinheimo, K. (2020). Varhennetun kieltenopetuksen käytäntöjä: opettajien kokemuksia onnistumisista ja haasteista [Practices in early language teaching: Teacher's experiences of success and challenges]. In R. Hilden & K. Hahl (Eds.), *Kielididaktiikan katse tulevaisuuteen: Haasteita, mahdollisuuksia ja uusia avauksia kielten opetukseen* [Language didactics looking into the future: Challenges, opportunities and new perspectives to language teaching] (pp. 77–103). Ainedidaktisen tutkimusseuran julkaisuja. University of Helsinki.

Han, Z.H. (2013). Forty years later: Updating the Fossilization Hypothesis. *Language Teaching, 46*(2), 133–171. https://doi.org/10.1017/S0261444812000511

Harjanne, P., Díaz Larenas, C., & Tella, S. (2017). Foreign-language teaching and studying in Chilean and Finnish classrooms as seen by teachers. *Journal of Language and Cultural Education, 5*(3), 1–21. https://doi.org/10.1515/jolace-2017-0025

Huhta, A. & Leontjev, D. (2019). Kieltenopetuksen varhentamisen kärkihankkeen loppuraportti [The final report for the key project in early foreign language teaching]. Centre for Applied Sciences. University of Jyväskylä, Finland. https://www.jyu.fi/hytk/fi/laitokset/solki/tutkimus/julkai-sut/pdf-julkaisut/kieltenopetuksen-varhentamisen-karkihankkeen-seu-rantapilotti-loppuraportti.pdf

Inha, K. (2018a). Finland invests in early language learning. Retrieved 20 April, 2021 from: https://www.oph.fi/sites/default/files/documents/finland_invests_in_early_language_learning.pdf

Inha, K. (2018b). Vuosi kärkihanketta takana [A year of key project behind]. Kieli, koulutus ja yhteiskunta, 9(4). https://www.kieliverkosto.fi/fi/journals/kieli-koulutus-ja-yhteiskunta-kesakuu-2018/vuosi-karkihanketta-takana

Inha, K., & Kähärä, T. (2018). Introducing an earlier start in language teaching: Language learning to start as early as in kindergarten. Retrieved 20 April, 2021 from: https://www.oph.fi/sites/default/files/documents/introducing_an_earlier_start_in_language_teaching.pdf

Johnstone, R. (2009). An early start: What are the key conditions for generalized success? In Enever, J. Moon & U. Raman (Eds.), *Young Learner English Language Policy and Implementation: International Perspectives* (pp. 31–41). IATEFL Young Learner Special Interest Group.

Luz Celaya, M. (2012). "I wish I were Three!": Learning EFL at an early age. In M. G. Davies & A. Taronna (Eds.), *New Trends in Early Foreign Language Learning: The Age Factor, CLIL and Languages in Contact. Bridging Research and Good Practices* (pp. 2–11). Cambridge Scholars Publishing.

Mezzi, T. (2012). Being young, being adult: The age factor issue for vocabulary in FL education. In M. G. Davies & A. Taronna (Eds.), *New Trends in Early Foreign Language Learning: The Age Factor, CLIL and Languages in Contact. Bridging Research and Good Practices* (pp. 12–23). Cambridge Scholars Publishing.

Meriläinen, M., & Piispanen, M. (2019). The Early Bird Gets the Word. *International Electronic Journal of Elementary Education, 12*(1), 11–17. https://doi.org/10.26822/iejee.2019155332

Muñoz, C. & Singleton, D. (2018). Lecture 8: Age and multilingualism. In L. Aronin & D. Singleton (Eds.), *Twelve lectures on multilingualism* (pp. 213–230). Multilingual Matters.

Niemi, H., Toom, A., & Kallioniemi, A. (Eds.) (2016). *Miracle of Education: The Principles and Practices of Teaching and Learning in Finnish Schools.* (2nd revised edition). Sense Publishers.

Nikolov, M. (2009). The age factor in context. In M. Nikolov (Ed.), *The Age Factor and Early Language Learning* (pp. 1–37). De Gruyter. https://doi.org/10.1515/9783110218282

Nikolov, M., & Mihaljević Djigunović, J. (2011). All shades of every colour: an overview of early teaching and learning of foreign languages. *Annual Review of Applied Linguistics, 31,* 95–119.

Nguyen, C. D. (2016). Metaphors as a window into identity: a study of teachers of English to young learners in Vietnam. *System 60,* 66–78. https://doi.org/10.1016/j.system.2016.06.004.

Pfenninger, S. E. & Singleton, D. (2017). *Beyond age effects in instructional L2 learning: Revisiting the age factor.* Multilingual Matters.

Pinter, A. (2017). *Teaching young learners.* Oxford University Press.

Tragant Mestres, E., & Lundberg, G. (2011). The teacher's role: what is its significance in early language learning? In Enever, J. (Ed.), *Early Language Learning: Evidence from the ELLiE study* (pp. 81–100). British Council. https://www.teachingenglish.org.uk/sites/teacheng/files/B309%20ELLiE%20Book%202011%20FINAL.pdf

Unsworth, S., Persson, L., Prins, T., & De Bot, K. (2015). An investigation of factors affecting early foreign language learning in the Netherlands. *Applied Linguistics, 36*(5), 527–48. https://doi.org/10.1093/applin/amt052

Zhetpisbayeva, B. A., Shelestova, T. Y., & Abildina, S. K. (2016). Examining teachers' views on the implementation of English as L3 into primary schools: A case of Kazakhstan. *International Electronic Journal of Elementary Education, 8*(4), 659–674.