Dear IEJEE Reader,

We are excited by presenting you a new issue of International Electronic Journal of Elementary Education (IEJEE). On behalf of our editorial board, as an Editor-in-Chief, I would like to share a message I received from one of our researchers who published a paper in IEJEE. His paper was downloaded by 64 persons within a week. We also noticed that IEJEE is reaching more and more researchers, teachers, students and policy makers, particularly after being indexed in ERIC - Education Resources Information Center, USA.

As its previous issues, this issue of IEJEE also includes papers addressing several important topics.

ERSOY & BOZKURT addresses the changes, challenges and opportunities that the new technologies represent for elementary school teachers in their work. The authors use the metaphor of journey from sand table to interactive whiteboard for the changes that elementary teachers are going through in our time.

NURLU addresses the importance and the consequences of the teachers' self-efficacy in mathematics teaching. Her findings suggest that teachers with high self-efficacy demonstrate higher level of effort and persistence with students, are more open to new ideas and new methods. They believe in students' achievements and take responsibility for students' success. These teachers use to place more importance on building a warm relationship with their students rather than with the parents.

BEDİR investigated perception of teaching efficacy by primary and secondary school teachers. She found significant differences among teachers' perception concerning teaching efficacy across different variables such as the faculty they graduated, gender, course match, in-service training, branch, and seniority. An interesting finding seems to be the high level of self-efficacy among teachers with regard to class management and low level of self-efficacy with regard to choosing instructional methods/strategies.

ÖZYÜREK & AYDIN investigated the impact of computer-animated concept cartoons and outdoor science activities on creating awareness among seventh graders about light pollution. The findings show that both strategies can be effective in creating awareness about light pollution.

ÇAKIR investigated the instructional materials commonly employed by foreign language teachers at elementary schools. On the basis of his study ÇAKIR argue for utilization of variety of instructional materials to motivate learners. At the same time he wish to see instructional materials that can help teachers to create an interactive foreign language teaching atmosphere.

ÖZERK & ÖZERK has conducted a single-case study with a bilingual student with Autism Spectrum Disorders (ASD). The aim was to teach the student social-communications skills through Video Modeling. Their study reveals that children with ASD can learn desirable behavioral skills as by-products. Video Modeling can also contribute positively to the social inclusion of bilingual children with ASD in school settings.

DAĞDELEN & KÖSTERELİOĞLU investigated the effect of conceptual change texts in overcoming misconceptions in "people and management" unit of a Social Studies Course. Their quasi-experiment study reveals that using conceptual change texts can be a helpful

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strategy for prevent and overcoming misconceptions related to several topics in social studies.

ÖZSOY, KURUYER & ÇAKIROĞLU looked at the relationship between a small group of students' mathematical problem solving skills in relation to their reading levels. The researchers utilized several methodological approaches. Their findings show that there is a close relationship between the students' problem solving skills and their reading skills.

LUO presents a case study examining 3rd, 4th and 5th graders' design fixation and cooperative learning in an engineering design project. A mixed methods instrument, the Cooperative Learning Observation Protocol (CLOP), was adapted to record frequency and class observation on cooperative learning engagement through detailed field notes. She identifies three major themes for design fixation and the challenges the students encountered in cooperative learning process.

GRAHAM, GRAHAM & WEST take up an important issue: Vocabulary development. They designed a study to demonstrate the effect of implementing multi-component vocabulary strategy instruction in fourth grade social studies. Their study will without any doubt be an important contribution to our knowledge base with regard to teaching strategies for vocabulary development.

KAŠPAROVÁ addresses the legal and principal aspects of home education. On the basis of a longitudinal ethnographic study, she discusses how the homeschoolers combat the structural discrimination embodied in their lawful protection in the Czech Republic. Her main argument is the importance of the right of homeschoolers to be included. In her analytical discussions, she includes Pierre Bourdieu's theoretical perspectives regarding various forms of capital.

I would like to thank all of the authors, peer reviewers and IEJEE's staff for their contributions.

Dr. Turan Temur
Editor-In-Chief

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Understanding an Elementary School Teachers' Journey of Using Technology in the Classroom from Sand Table to Interactive Whiteboard

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Abstract

The aim of this study is to understand an elementary teachers' experiences about using interactive whiteboard (IWB) in the classroom. Narrative inquiry were adopted to conduct the study. The data were collected through semi-structured interviews with the teacher and analysed through narrative analysis. In the study, two major stories emerged. The first story was about the characteristics and difficulties of being an innovative and transformative teacher. In the second story, the use of technology in the classroom were cited. Second story consisted of such sub-stories as changing student profiles, teaching-learning process, measurement and evaluation process, infrastructural adequacy, stakeholder interaction, facilitator role of the technology and challenges of using IWB in the classroom. In all these stories, the examples and advantages of effective use of IWB in the classroom were explained. We can have the following suggestions from the words of the classroom teacher who has been using various technological tools in his classroom for about 40 years, including 10-year IWB use: Teachers should be open-minded for innovation in the sense of professional development, consider the interests of students, reduce the prejudice about the use of technology, utilize the processes that increase and facilitate the learning.

Keywords: Narrative research, Classroom teachers, Interactive whiteboard

Introduction

How and by whom the integration of information and communications technology (ICT) will be achieved is one of the priority issues in the field of education. The ways of using the ICT effectively is another important matter in this regard. This is because teachers are expected to both use the ICT effectively and teach students the ways of accessing

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information through the ICT. In this context, the increasing use of interactive whiteboards (IWBs) in the instructional process has attracted the attention to what teachers actually do in this process, what kind of problems they experience, how they deal with these problems and what the effective practices are.

The use of technologies like IWBs in the classroom can provide teachers and students convenience and variety. Lack of such technologies means that the quality and the benefit of the process cannot be observed (Tataroglu & Erduran, 2010). IWBs can be defined as new generation whiteboards that facilitate and support learning and teaching (Turel, 2011) In different countries, projects are implemented and large amounts of money are spent to ensure the technology integration in education, use technology effectively and make its use widespread (Ekici, 2008; Lai, 2010; Saltan, Arslan & Gok, 2010; Turel, 2011; 2012). In this regard, countries such as Australia, England, United States and South Africa have many projects and investment particularly at the elementary school level (Lai, 2010). For example, in 2007, IWBs were used at 98% of high schools and 100% of primary schools in England (Becta, 2008, cited in Lai, 2010). Based on the literature, Emeagwali and Naghdipour (2013) lists the benefits of IWB to the instructional process as follows:

- Increasing student motivation and sense of responsibility.
- Increasing participation.
- Increasing the effectiveness and frequency of student-teacher and student-student interactions.
- Providing the opportunity to prepare for the lesson effectively.
- Supporting teacher development and providing an opportunity for it.
- Providing the opportunity to re-produce instructional materials into the digital environment.

Studies on IWBs show that teachers' attitudes are positive, IWBs are used relatively easily and some problems are experienced (Saltan et al., 2010). In a study, middle school teachers emphasized the benefits of using IWBs in their classes and the importance of participating in workshops on how to use them. Besides, they stated that the practical knowledge of IWBs was extremely important and this would be helpful in integrating IWBs into courses (Lai, 2010). In England, the effect of IWBs on student-teacher interaction was investigated in teaching reading-writing and mathematics. Based on the findings, it was emphasized that IWBs had a small effect on discourse moves in the context of teaching through interacting with the whole class, there was quicker progress in lessons taught with IWBs and less time was spent on group-work activities (Smith, Hardman & Higgins, 2006).

According to a study conducted with 2007 teachers from 12 cities to determine teacher competencies in Turkey, the rate of teachers who never use instructional technologies in their classrooms was found to be 22%, and that of those who use these technologies a few times a month was 49%. From this perspective, it can be argued that the investment in instructional technologies can be ineffective without necessary teacher competencies (Turkish Education Association, 2009). Similarly, according to the results of a study by the Ministry of National Education, 43% of teachers needed professional development in instructional technologies and materials development. 30.21% of teachers also needed in-service training on "using IWBs". Considering that this study was conducted with 57.358 teachers, it seems that nearly 25.000 teachers needed support in instructional technologies, and nearly 18.000 teachers in the use of IWBs (Ministry of National Education, 2012a).

The studies in the literature report that IWBs are tools that are beneficial, useful and facilitate the instructional process (Ekici, 2008; Saltan et al., 2010; Tataroglu & Erduran,

2010), workshops and practical knowledge on usage are of importance (Lai, 2010), and with IWBs, the instructional process progress more quickly and group-work activities become easier (Smith et al., 2006). On the other hand, student motivation decreases when IWBs are not used effectively, and there are problems due to the lack of infrastructure and teachers' lack of knowledge (Turel, 2012). Among the studies presented in this section, those conducted in Turkey mostly included quantitative methodologies (Ekici, 2008; Saltan et al., 2010; Turel, 2012; Tataroglu & Erduran, 2010). Therefore, there is a need for studies that examine the use of IWBs more deeply. In this sense, this study is expected to both provide more in-depth insights to IWBs and contribute to the field in terms of narrating the process from the perspective of a practitioner. Besides, this study is also the first of the studies that examine the use of IWBs through narrative inquiry in the field of education in Turkey.

One of the reasons behind the widespread use of IWBs at schools is the increase in the software developed for IWBs in Turkey in the last 10 years and the decrease in unit cost. Technical problems experienced after the IWBs are set up in classrooms and teachers and students' lack of software and hardware knowledge can prevent macro and micro-level investments from being successful. In this regard, we need to know what teachers experience in using investments and resources related to IWBs, and students' achieving meaningful learning while having fun at the same time. Revealing teachers' experiences of IWBs through scientific processes is expected to contribute to increasing the quality of the instructional processes in addition to providing information to policy makers, planners and investors. Therefore, a more in-depth and detailed examination of the experiences of particularly the teachers who are experienced in using IWBs can be argued to be more meaningful.

In the study, the transformative learning theory was adopted in understanding the professional development of an elementary school teacher in using IWBs. The transformative learning theory firstly appeared in Mezirow's 1978 study on the drastic changes and experiences experienced women after they got back to university. The meanings that these women's experiences formed in their own worlds and how they were seen by others are the dimensions that this theory mostly focused on. The primary emphasis of transformative learning is on adult education and professional development of teachers or teacher candidates (King, 2002; 2004; Mezirow, 2000; 2003). In this study, the transformative learning theory formed the basis for holistically examining an elementary school teachers' IWB experiences, including before and after.

Transformative learning is the learning that transforms problematic reference frameworks into a form that is more intrinsic, open, reflective and open to change. In another definition, transformative learning is adults' meta-cognitive questioning (Mezirow, 2003). According to Mezirow (1997), individuals develop a world in which they define their feelings, thoughts, concepts and values based on their experiences in daily life. These definitions are called the *reference framework* that individuals form themselves. Accordingly, this reference framework is divided into two as "*habits of mind*" and "*perspective*". Habits of mind is individuals' thinking, feeling and acting based on cultural, economic, educational, political or psychological codes they live in. Ethnocentrism is an example of habits of mind. Perspective, on the other hand, is open to change compared to habits of mind. In perspective, individuals change/revise their assumptions based on their state of solving the problems they encounter. This study focused on revealing how the participant's habits and perspective regarding the use of technology in education in general and IWBs in particular changed, and his reflections on the factors affecting these issues and their consequences.

Transformative learning highlights statements, reflexivity and autonomy (King, 2004; Merriam, 2004; Mezirow, 2003). With statements, the emphasis is on individuals' evaluations regarding their own beliefs, feelings and values, and thus, their meta-cognitive questioning. Reflexivity is about the interaction of a new experience with individuals' prior experiences. Experiencing, by itself, is not enough for individuals. They need to make sense of their new experiences by making a critical evaluation of the existing situation, and achieve the transformation. Autonomy is regarded as individuals' taking the responsibility of their own learning based on their knowledge, skills and moral values. These assumptions of transformative learning were discussed in the study with reference to what the elementary school teacher, whose IWB experiences were examined, did to adapt to the transformation in technology, and his professional experiences in the process. In this regard, Mehmet Bey's technology usage and reasons for using technology, and his understanding, point of view and experiences in adapting to the transformation in instructional technologies in his professional life of nearly 40 years between the years 1975-2014 were addressed from the perspective of the transformative learning theory.

The aim of the study was to reveal an elementary school teacher's experiences regarding the use of interactive whiteboards in his classroom. The following research questions were specified based on this aim:

- What does the elementary school teacher think about the use of technology in education?
- How does he make sense of the development of using technology in education in the course of time? What are his experiences in this respect?
- How does he make sense of his own professional development process regarding interactive whiteboards?
- What are his experiences related to the contributions of interactive whiteboards to the instructional processes?
- How does he solve the problems he encounters in using interactive whiteboards in the instructional processes?
- What are his suggestions to teachers who use interactive whiteboards in the context of professional development?

Method

Design

In the framework of transformative theory, this study was designed as a narrative inquiry. Narrative inquiry is an individual's effort to present the events he has experienced in the past in an orderly manner, and his presenting simple or important events he has experienced by gathering them considering time and place (Sarbin, 1986 cited in Guler, Halicioglu & Tasgin, 2013). Connely and Clandinin (1990) claim that what we know about education is based on others' stories of educational experiences (cited in Webster & Mertova, 2007). Narrative inquiry includes examining one or more individuals' experiences, collecting data by gathering the life stories of these individuals, reporting individual experiences, and chronologically listing the meanings that these experiences involve (Creswell, 2007). In other words, narrative inquiry is analysing and discussing the stories that are narrated, heard and read with respect to education (Webster & Mertova, 2007). Narrative inquiry in education mostly focuses on understanding how teachers structure their practices. Reflective practice and teacher research emphasize hearing teachers stories and listening to their voice (Bell, 2002). In this scope, Johnson (2007)

states that to understand teachers' professional development, how teachers' define their learning experiences should be firstly revealed.

In accordance with the basic assumption of narrative inquiry, the transformative learning theory was adopted in this study. In this regard, taking the transformative learning theory as the basis was thought to provide better insights into how the elementary school teacher makes sense of his professional development process with IWBs both in terms of place and time, and from his own perspective. It was aimed to understand what the elementary school teacher, whose experiences were examined in the study, did to use IWBs in his classes through his own statements. The study is of significance in terms of presenting what the teacher did to use IWBs effectively in the context of his professional development from his perspective. Therefore, narrative inquiry was deemed to be suitable to reveal the complexity and the development of the teacher's practices with IWBs in the course of time.

Elementary school teacher, Mehmet Bey, and his participation in the study

The professional experience of the elementary school teacher, Mehmet Bey (i.e. a pseudonym), is nearly 40 years. He retired after working as an elementary school teacher at state schools for a total of 25 years, 15 years in villages and 10 years in cities. Afterwards, he continued to teach at private schools. He was interested in using tools in the instructional processes because his elementary school teacher did experiments in lessons and used simple tools when he was an elementary school student, and thus, he used every kind of contemporary technology in his classes during his teaching career. He was known in the city where he worked as one of the elementary school teachers who first used IWBs with their own efforts. He had used IWBs in his classes for approximately 10 years. Mehmet Bey convinced parents to financially support the school for IWBs, and after he successfully used an IWB in his classroom, he supported and pioneered some of the elementary school teachers in his school to use IWBs. After starting to use IWBs due to the elementary education curricula renewed in 2005, which prescribed the use of technology in the instructional processes, and his own interest, he trained other teachers on the use of IWBs with the FATİH[1] Project and shared his experiences with them.

The participation process of Mehmet Bey to the study can be summarised as follows. The second author of this study conducted a semi-structured interview with Mehmet Bey as an assignment for a doctoral course, Qualitative Research Methods, in 2013. In this assignment, the aim was to develop interviewing skills and carry out a pilot study. The first author, who was the instructor of the course, evaluated the assignment and realised that the teacher had unique experiences regarding the use of IWBs and provided interesting examples. As a result of reviews and discussions on what type of a study can be conducted with this teacher, it was decided that a narrative inquiry could be performed. The researchers got an appointment from the teacher, the research project was explained and he was asked whether he would participate in the study. The teacher stated that he would participate voluntarily. The necessary permissions were then received from the Ethics Committee of the University and the Provincial Directorate of National Education.

[1] The FATIH Project: "Movement of Enhancing Opportunities and Improving Technology", known as the FATIH Project, is one of the most significant educational investments in Turkey. The FATIH Project proposes that "Smart Class" project is put into practice in all schools around Turkey. With this project, 42.000 schools and 570.00 classes will be equipped with the latest information technologies and will be transformed into computerized classes (MoNE, 2012b).

Data gathering and analysis

The research data were gathered through three successive semi-structured interviews with Mehmet Bey. The first interview was on December 26, 2013, which was within the scope of the doctoral assignment. Following this interview, the researchers decided on the design of the study to be narrative inquiry after reviewing the literature and discussions for nearly six months to determine the re-planning process of the study. The second interview was conducted on September 23, 2014. This interview consisted of questions towards deepening the data obtained from the first interview and planning the process within narrative inquiry. To deepen and make sense of the data obtained from the first two interviews, questions were developed for a further interview and the third interview was conducted on December 6, 2014. All the data obtained from the three interviews were examined by the researchers and the necessary preliminary works were completed.

In qualitative research, data analysis is about organising the raw data in a way that they can be presented to the reader (Liamputtong, 2009). This can be achieved by transforming the data into a clear and meaningful form (Liamputtong, 2009; LeCompte, 2000). The data of this study were analysed using narrative analysis. Narrative analysis includes analysing participants' stories and re-storying them in a way that is meaningful to the reader. In this process of re-storying, elements such as time, place and set of events are examined. Because individuals do not present their stories in a chronological order in narrative inquiry, the researcher needs to pay attention to such elements and make the analyses that would present the events in a chronological order. More clearly, while a narrator narrates his/her stories in a random order, a researcher needs to analyse the story of this narrator in a way to present it as "introduction, body, conclusion" or "past, present, future" (Liamputtong, 2009).

Atkinson (1998) emphasizes three important points regarding the process of analysis in narrative inquiry. One of these is that the researcher should look for links between stories and events rather than being judgemental in the narrative process. The researcher should try connecting events without judging transitions, classifications and stories. The second point is that the phenomenon that is focused in narrative inquiry is a life story, and it is a text like a poem or a novel. In other words, the researcher should present the interaction of the hero with the world to the reader without detracting its originality. This is because it will find its own audience like a poem or a novel. The third point is that every life story is from within the life. Therefore, it will present people examples from life. In this study, the researchers aimed to present the stories of Mehmet Bey, the elementary school teacher who shared his experience with IWBs in his classroom, in a process as natural as possible. Mehmet Bey's experiences are narrated to teachers who use or want to use IWBs in their classrooms.

Findings

In this study focusing on understanding Mehmet Bey's experiences of using IWBs, two main stories were constructed as a result of the narrative analyses. These are "Mehmet Bey as a Teacher" and "His Use of Technology in the Classroom". The first main story consisted of four sub-stories including what the technological tools that Mehmet Bey experienced in his professional life of 40 years were, how these tools transformed in the course of time, how the teachers and students adapted to this transformation, and how and for what purpose he used IWBs in his classroom. In addition, his story of teaching also involved becoming innovative and transformative teachers, and its difficulties. In the second main story, he narrated stories about his personal experiences of technology-based professional development and his perspective on technology.

Mehmet Bey as a teacher

Graduating the teacher's training school in 1975, Mehmet Bey started the profession as an elementary school teacher in a village of Kutahya province in the same year. After working in a village of Ankara, he was appointed to Eskisehir and retired here. Following his retirement, he worked as an elementary school teacher at two private schools in Eskisehir. He had still been working at a private school at the time of the study. Mehmet Bey met IWBs at a state school in 2005. His working at private schools was due to his competency in using IWBs in recent years. He stated that he was the first teacher in Eskisehir who used an IWB by saying "I am one of the teachers, actually the teacher, who had an IWB installed to his classroom 10 years ago" (Ref3-7), and he shared his experiences with his colleagues in those years. In this sense, he also said "It was 10 years ago. We even gave a demonstration at the teacher's house. Of course there were also principals invited." (Ref3-4). He expressed the role of IWBs in his being invited to work at a private school and then working at another private school after his retirement from a state school by saying:

> They hired me there (private school B) because I was using technology. They didn't have any IWBs in first grades, and they said they would buy. I used to project to a curtain behind which there was the board. It was a brand which I don't remember now. I used to stick it to the board and then installed the Smart Word on it. I already had it at state school A. I used it like an IWB in the classroom for a year... I made it myself. Then the school administration saw this. They said I deserved it and set up an IWB in my classroom. Then we used it quite easily. Something happened in the second year. They bought nine IWBs, to the library, to the entrance of the school, and I don't know, to the science high school section. They took it from my classroom. When they did it, I objected and left the school (Ref2-10).

Leaving the private school B because the school administration took the IWB from his classroom after working for nearly two years at this school following his retirement, he started working at another private school and was teaching fourth graders whom he took over as first graders at the time of the study. His views on why technology should be used in education are as follows:

> Technology is used in every area of daily life. There are scarcely any areas without technology. As in all professions, we have to use technology in the teaching profession. If we don't, we cannot teach effectively because today's children are inherently native users of new technology. So we can only teach them through technology (Ref1-1).

> I think technology is a must in education. At the beginning, I said I had been teaching for 38 years. We used to use blackboards. For about 10 years, I have been using IWBs. That's why I am one of those who can see the difference more clearly (Ref1-1).

One of the most important points that Mehmet Bey emphasized in his stories was that he told the transformation of the technologies he used in his life in a chronological order. In this chronology, he listed his experiences regarding the technologies used before IWBs. He went through a technological journey from the sand table he made in his classroom, cassette-player, videotape, presenting instructional videos on TV and using a tablet computer to finally IWBs. He narrated how he taught reading and writing by using a sand table in 1970's by saying:

> In the village where I worked in Ankara... A village house was rented, and taught children there. We only had desks. We didn't even have a blackboard. While I was thinking how to teach them in these conditions, we made a sand table in a corner of the classroom... Because there was no blackboard and how could I make them write? This idea came up at that moment... It was very interesting to the children as well. They did it. They wrote to their notebooks and there. Even in those conditions, without any equipment, teaching can be done (Ref3-1 and 2).

His journey of using technology in the classroom started with teaching reading and writing on a sand table and continued in accordance with the conditions of the day. He summarized this process from the sand table to IWBs as follows:

> In the past, they used to publish journals and lecturing CDs. We even bought TVs to classrooms or brought the ones at home, and make children watch DVDs on a topic. These were also effective in those times, and children would never forget what they learned. It is effective like going to the cinema (Ref2-2).

> We used cassette-players after the sand table. In those periods, some lectures were on cassettes. We used those. They also included tales. These were really effective in children. Of course technology developed after cassettes. Video came up. Videos were different in the past, we had VHS. Then, there were CDs and MP3s. We bought a TV to the classroom. ... there were various journals. They also included a CD for the course. We watched them. For example we watched a movie, Canakkale, about the War of Independence. We watched movies about it. So it was beneficial, but it wasn't enough. In 2005, they said every school would buy a projector. It was necessary, and I bought a laptop when they said we would teach with presentations projected to a curtain (Ref3-7).

His transition to IWBs happened first in the state school where he worked before his retirement. Based on his statements, this transition was in three stages. The first stage is the school A before his retirement, the second is the private school B and finally the third is private school C. In school A, he reported his transition to the IWBs as follows:

> I made the transition to technology in school A. This is how it happened: Computers just became widespread those days. I started preparing questions and making annual plans on a computer. ... After that, I thought if I could do this or that, and I expanded what I could do on a computer. We bought a TV to the classroom. We watched DVDs on it. Then this felt like it wasn't enough. In a search ... we encountered projectors. We projected from a projector to the curtain, but we couldn't write on it. While searching on the Internet how we could do it, I discovered that there was something called IWB. ... I contacted the company. They brought it to the school (Ref2-6).

Mehmet Bey as an innovative and transformative teacher

Mehmet Bey thought that one of his distinct characteristics as a teacher was being open to innovations. He perceived this characteristic as of significance in terms of his professional development. Therefore, in his stories, Mehmet Bey insistently emphasized a teacher's characteristic of being open to innovations. He explained the influence of his elementary school teacher behind his characteristic of being open to innovations as in the following:

> I was the first graduate of Afyon Gazli Village Elementary School. I can't forget my elementary school teacher. He was cutting out tins, and producing electricity with water vapour. He used to do experiments like this. It was really interesting to me. It has been inside me since that time. I mean I always want to make an innovation... So that goes back to those days (Ref3-1).

As a teacher, Mehmet Bey was passionate about new technologies to provide better education to elementary school children and have an effective communication with them. Mehmet Bey's following current technologies and using them in his classroom as a pioneer was sometimes criticized by his colleagues and immediate environment. However, he both developed himself and continued to set a model for his colleagues in searching and using new technologies. Mehmet Bey's views on his being open to innovations in the context of his professional development are as follows:

> I am in a constant research process. Most people get astonished; let's say you are teacher for 38-40 years. What on earth are you doing with an IWB? There are those who think like 'Did we use to do things like this in the past?'. I am open to innovations. This is my biggest advantage. Perhaps the current technology will become primitive in the future because everything changes every other day. Children also change. If we tried to teach them as if it is 30-40 years ago, we would lose these children. They can't gain anything. They can't understand and do anything (Ref2-1).

Mehmet Bey thought that only doing research, being open to innovations and sharing experiences with colleagues were not enough to use technology in the classroom effectively, and children should also be listened to and observed. In doing so, he personally experienced learning many things from students. Mehmet Bey explained how he learned some features of IWBs from his students and how this contributed to his professional development by saying:

> A teacher should know how to learn as much as he knows how to teach. I mean not like he/she doesn't know, but by saying they want to learn from students (Ref3-5). Let's say there is an eraser on the board. I was erasing words one by one, but a student came up and said we could erase all the text. He drew a circle, touched in the middle of it and erased all the text. I didn't know that for instance (Ref3-6).

Foreseeing that classrooms would be technology-supported in the future before he started using IWBs, he developed himself in this respect. He shared his experiences as "Discovering further. I said myself this [technology equipped classrooms] was what we would have in the future. There would be projectors, and computers would be used for it. I thought I needed to learn these. I prepared myself. There were courses given by schools back then, and there were also computer courses, I attended those (Ref3-9)".

Mehmet Bey, as an innovative and transformative teacher, shared his vision for the future regarding the technology integration in education and what he did in this regard. He associated his interest in using technology in education with the experiments that his elementary school teacher did during his student years. As a teacher who used IWBs in his classroom for nearly 10 years, he pointed out that he learned some features of IWBs from students and teachers should be open to this while using technology in the classroom. Moreover, he thought that students were more advanced in using technology than teachers. According to Mehmet Bey, an innovative teacher should also learn from his/her students and this constitutes an important part of professional development.

Difficulties of being a transformative teacher: Prejudice and competency

In the process of using IWBs for the first time during his teaching at a state school, Mehmet Bey mentioned some difficulties he had with his colleagues, the resistance to innovation, prejudices and how he coped with all these issues. With respect to teacher prejudices, he stated his views on what should be considered in professional trainings on IWBs and sharing experiences with colleagues, the reasons for prejudices and how these prejudices can be overcome. Mehmet Bey asserted that teachers did not want to give up on the systems that they were used to and perceived as successful, which was behind the prejudices of his colleagues. His views on his colleagues' prejudices against innovations and his experiences of overcoming these prejudices include the following:

> Nobody wanted to. Because they needed to learn. They thought learning would take hours, days. But it's not (Ref2-3).

> I discovered IWBs and had one installed to my classroom. Everybody looked at it, I told them where to touch or how to use it... they were scared. That was something that they hadn't done before. They thought how it was going to be like. They thought they didn't have a teacher like that before. But they were successful the way it was. So they

> thought how it was going to work out. They didn't want to do it. Some teachers still have this fear (Ref3-1).
>
> At first they said it was emitting radiation. Then I did a research about it all night long. The next day I explained it to my colleagues in a meeting. Zero. I mean the radiation rate of this IWB is zero. But the rate of a fluorescent light is 1800. So a smaller fluorescent light emits more radiation. When I explained this, they couldn't find any other excuses. ... I mean they had a system that they were used to ... Giving up on a system for another system, they see it as a burden. It is difficult for them. I mean they were successful the way it was for years. They were used to it. They thought they will fail when they changed it (Ref2-4).

After persuading the teachers in his school to use IWBs, Mehmet Bey organised seminars on introducing and using IWBs for other schools and the provincial directorate of national education. According to him, there was an interest aroused in IWBs after these were used for the first time in his school, and he received requests for seminars. Mehmet Bey shared his experiences with his colleagues regarding the process of choosing IWBs, the limitations and advantages of markers and how they can be used in the classroom. Some of his views regarding his experiences in this respect are as follows:

> These boards were firstly used at school A. It was then made available to other schools. There was even a meeting organised at the provincial directorate of national education. We also showed them there... Yes, I and a colleague of mine gave a talk. We were only two. Since he was also using an IWB, we gave the talk together (Ref2-7).
>
> It became widespread in Eskisehir. In that year, there were only two classrooms at school A, but this number suddenly went up to eight. After that meeting. There were a total of 24 classrooms, and eight of them had these IWBs. It also started to be used in other schools. .... Teachers need to know how they will use it at the first stage, and what benefits they will gain. Since they don't know these, the selling company only tell them the aspects that are, let's say, cool. It quickly does that, turns this around, splits a circle into four, etc. Teachers get confused since they tell these features really quick. That's why they don't want to do anything (Ref2-8).

Mehmet Bey thought that the trainings for teachers who would use IWBs for the first time should be given by teachers who actually used IWBs in their classrooms. In this regard, he observed that the trainings given by the staff of IWB companies or university instructors were not sufficient. He stated that the teacher who uses an IWB in his/her classroom can best teach another another teacher. He also thought that the trainings that are not given by a teacher can even negatively affect teachers' use of IWBs. Some of his views regarding his experiences are as follows:

> For instance, I have been using IWBs for nearly six years in this school (private school C). Although it has a history of six years, they still have such problems. They couldn't apply themselves. To the IWBs. They don't even know that an IWB has a material like this. That's why there should be a training for this. In fact, there was a training at the school. However, since the trainers were the sellers and they just told everything they knew one after another, the teachers didn't know which one would be useful for them or not. For example, they don't use the tools for angles until the fourth grade (i.e. the grade in which angles are taught). Because it was not used since the time it was told, it was forgotten in 3-4 years. Maybe that's why he can't use it. I showed a few colleagues, and they liked it. Now they started using it (Ref2-2).

His use of technology in the classroom

His use of technology in the classroom comprised of different sub-stories in which he told the dimensions of using IWBs including the technologies he used in the classroom before using IWBs. These sub-stories that focused on technology were named as "technology in the instructional processes, the change in children, perspective of future, adequacy of

infrastructure, assessment and evaluation, facilitator role, family involvement, and challenges". The scope of these sub-stories is respectively explained below.

Technology in the teaching-learning processes

In his stories on the instructional processes in the lessons he taught with an IWB, Mehmet Bey mentioned issues such as the technologies he used before IWBs, positive and negative experiences with using technology, attractiveness and facilitative role of learning with IWBs, making use of different features of IWBs, and teacher readiness in using IWBs. He reported his experiences regarding the technologies he used before IWBs as follows:

> I am one of the teachers, actually the teacher, who had an IWB installed in his classroom in Eskisehir 10 years ago. It became widespread in Eskisehir after me. After all the work I have done. By doing research, and this was because the curriculum changed in 2005. With this change, every classroom was obliged to have a computer and projector. We used to project contents to the board with the projector. For instance, PDF files, I don't make student carry books, I make them leave the books in the classroom. I scan them into PDF files and give these to students. They only need to have their flash drives with them (Ref1-1).

> I had them in my flash drive. We used to project these to the board. But we couldn't write on it. While doing research on it, I found tablet computers first. I connected my tablet to the computer in the classroom. Since it had a cable, I took them to students so that they could write, and then we projected it to the board. This was quite difficult. Then, in another research, I found that the device that could do this job was IWBs. That's how we headed towards IWBs (Ref1-2).

Due to the elementary curricula implemented as of 2005 in Turkey requiring the use of contemporary technologies in the classroom, Mehmet Bey used a computer and projector at first, a tablet computer for a short amount of time and lastly an IWB. After he started using a computer in his classroom, he transferred the coursebooks to the electronic environment as PDF files. He explained the reasons why he used a tablet computer in his classroom for a short amount of time by saying: "With the tablet... the students would come to my desk and project it to the board. Well, to the curtain. We had a curtain, not a board. That was really difficult. And time-consuming. After that, we headed towards IWBs" (Ref2-1). His trying to use a single tablet computer of himself in the classroom was not functional and effective. This made him take an interest to IWBs.

Mehmet Bey thought that IWBs made learning more interesting compared to other technologies he used. In this regard, he reported his experiences with different dimensions such as angles, visuals and performing mathematical operations in the mathematics course with his following statements:

> Being able to project and write on it. This is one of the best features of IWBs. Another feature is being able to move materials in the resources, which is also very effective. For example, most of my colleagues say that they cannot draw a triangle, or a circle on the IWB. But it is easier to draw on it. Our first lesson this semester was on angles. I showed the students and they enjoyed drawing the angles and circles. Because it has its own materials and tools. It has its goniometer, protractor, divider (Ref2-1).

Mehmet Bey compared using IWBs in teaching and teaching with a traditional blackboard, and explained that the instructional processes were easier, more practical and effective with IWBs. According to him, with IWBs, more questions can be answered, the content can be finished in time, the subjects can be covered multidimensional, and students can have more meaningful learning. Some of his views regarding his experiences are as follows:

> If I had a traditional board, I would write a question on the board, and write the answers below. I can barely solve six or seven problems in a lesson. But with an IWB, the questions are ready. I copy and paste questions at home the previous evening and we can handle 40-50 questions in a lesson. This is the difference in-between. By solving many different problems, children become versatile and learn... (Ref2-4).
>
> In the past, we couldn't even finish the course-books, now we can even finish the supplementary books (Ref3-1).
>
> It attracted students' attention and enhanced their power of learning. Children cannot concentrate on something that does not attract their attention, but they learn well when they can concentrate (Ref3-7).

That using IWBs in the classroom attracted students' attention, facilitated learning and reduced undesirable student behaviours was among the experiences that Mehmet Bey reported. He associated reducing undesirable student behaviours by using IWBs in the classroom with students' active participation and directing their attention to lessons, and said:

> Students feel happy because they apply themselves. Otherwise, they cause disturbance and distract their friends because it doesn't attract their attention. In that case, it becomes difficult to control the class. But if you do something that is interesting to them, they listen to you with complete attention... And they direct all their attention to it. Sometimes children do something different from what they listened to. They make something up. Then they try it out during the break. They become successful or not. They are happy by learning in this way (Ref3-10).

Mehmet Bey narrated stories about his experiences of how he used technical features of IWBs such as saving, recalling, editing, sending e-mails and connecting to online learning environments in the instructional processes. He reported his experiences as in the following:

> Of course, you can send e-mails to students and those who are not in the classroom also know about the assignments. And you can send the contents covered on that day. I read on the Internet that IWBs with a more advanced technology can also record audio. The one we have can also record audio. You can record audio and send it (Ref2-5).
>
> There are useful links now. .... You can go to those links and make your students watch videos about the topic of that day... (Ref3-2).
>
> For example we have an OKULISTIK (i.e. an online learning platform) membership that the school bought. Students can log in with their passwords. If there is a video about a topic that we will cover, they watch it there. It has simple questions that students answer afterwards. Then we cover it again in the classroom… It is usually like this. It is reinforcing. Students can even ask the teacher questions on the topic that they had difficulty with (Ref3-5).

Another story that he narrated with respect to his experiences of using IWBs in the classroom is about getting prepared for a lesson. This story is also related to the story of "*the change in children*". Because he thought that students adapt to new technologies quickly, he explained the necessity of a teacher's coming to the classroom prepared for the content to be covered and for teaching it with an IWB by saying:

> T: If he comes to the classroom unprepared, children can ask interesting questions and he can have difficulty in answering them. Therefore, the teacher need to be prepared not to be embarrassed in front of the students.
>
> R: Well, you say that he shouldn't put something that he doesn't know well on the IWB.

> T: Yes, he shouldn't. Otherwise what he says can be wrong and that would be worse. Preparation is a must because of this. I sometimes don't teach a subject if I'm not prepared for it. I leave it to the next day. Today's children are very smart and come up with interesting things that you don't even understand (Ref3-3).
>
> If you don't come to the classroom prepared, then you can't be effective on that day. I wouldn't feel comfortable, I would be unhappy. Maybe I would teach them with my prior knowledge, after all I have experience, based on this experience. I might have missed a current event of the day. That makes you feel uncomfortable, that's why the teacher should always come to the classroom prepared. I mean you can't be unprepared in front of today's children. ... A student of mine told me. I didn't know a star called the dog star. He told me that while counting starts (Ref3-8).

Mehmet Bey's story regarding his experiences of using IWBs in the instructional processes showed that the emphasis of technology in the new elementary curricula implemented as of 2005 and his interest in new technologies were behind his decision to use an IWB in his classroom Although the new elementary curricula has made it necessary to use technology in the instructional processes, it is known that teachers do not have a obligation in this respect. However, Mehmet Bey's tendency to technology, being a pioneer in ensuring the technology integration into instruction processes in his school and having personal characteristics such as being open to innovation did not limit him with only computers and projectors and led him to use an IWB in his classroom.

The change in children

Mehmet Bey thought that the change in students was a driving force for his efforts in adapting to technology and innovations. Accordingly, the continuity and inevitableness of change led him to teach in accordance with the interests of today's children. He mentioned his observations regarding his students' adapting to the IWB quickly in the process. Mehmet Bey stated the following with respect to the continuity of change:

> Today, all children have a mobile phone in their hands. They know everything. They can use technology comfortably. That's why one needs to open to innovation. We need to follow what is new. This is what comes before everything. You cannot succeed unless you follow innovations. Because things change every other day (Ref2-1).

He stated that students sometimes knew some features of IWBs better than him. This can again be associated with his statement that students can adapt to the transformation more quickly. In addition, he asserted that he learned some features of IWBs from students. He stated his views as follows:

> Sometimes a student wants a word and shows me a shorter way to do something when I choose a longer way. We do what they say and thank them. ... so today's children are into it, and they want it. It attracts their whole attention. Other tools are done now (Ref1-3).
>
> Sometimes a child shows me how to do something that he/she discovered although I have been using this for 12 years. I learn from them. Today's children are quite into technology (Ref2-2).

Three dimensions appeared in the stories that he narrated with regard to the change in children. These are the continuity of change, students coming to the classroom having learned the technologies used in daily life and teachers having to know current technology.

Adequacy of infrastructure

The stories that Mehmet Bey narrated related to infrastructure to be able to use IWBs without any problems in the classroom contained issues such as "technical features and

economy of IWBs, calibration problems and power cuts". His story in which he narrated his research on IWBs in terms of technical features and economy and his first experiences of using an IWBs is as follows:

> T: I contacted the company. They brought it to the school. We had a look and it was really nice. We also arranged a few other colleagues from other classes because it would be really expensive for us. At the beginning, we bought them only to two classrooms and started using them. It was indeed convenient.
>
> R: What year was that when you first started?
>
> T: I was 2004 or 2005. Then various companies came to the school for advertising. But none of them was like the brand A. This one is different.
>
> R: What is special about it?
>
> T: The features and software they have are not as comfortable as this. No touch screen. Markers were quite expensive. There was the risk of falling and breaking down. If this breaks down, buying a new marker costs like almost half amount of the board. So even if the markers of brand A fall and breaks down, they will be all right. And you can use them without any markers, too. With your fingers. They are more advantageous since they have touch screens (Ref2-1).

He explained the infrastructure problems regarding IWBs firstly referring to the brand, and then giving examples of electricity cuts and calibration maintenance. He stated that he compared different brand, and chose the one that was more economical. This is because these problems can negatively affect using IWBs effectively in the classroom. He touched upon the calibration problem that he had while using IWBs in the classroom by saying "sometimes I couldn't properly set the calibration of the board... On those days, I couldn't do anything on the board. I used other techniques without making students feel the absence of it. I had the school key, and at the end of the day, I tried to fix it, till the morning if necessary" (Ref3-2). Another problem that he had was the electricity cuts while using IWBs in the classroom. On this issue, he said: "When the electricity blacks out for a moment, the calibration immediately resets. Sometimes you need to calibrate every other minute... and it affects the flow of the lesson. .... When the electricity is cut, you can find a solution, but when it blacks out for a moment, that is difficulty to solve" (Ref3-3).

Assessment and evaluation

Mehmet Bey told how he made use of IWBs in the instructional processes based on his own and his friend's experiences. He reported that he use digital materials in assessment and evaluation, and in this way, he could obtain information regarding students' learning more clearly and quickly. He stated his views on this issue as follows:

> T: I have a look at the exam results and analyse them. Let's say there are many students who couldn't answer 7th or 15th questions. I go back to that objective. I teach it again and the level of the students comes to a balance. (...) Assessment and evaluation are very important in this respect. I mean I use assessment and evaluation really well. This is an advantage brought by the technology. Because I use it, I know everyone's level.
>
> R: Do prepare the exams in a digital environment?
>
> T: Sure, digital.
>
> R: How do you do it?
>
> T: There are companies that sell materials in the digital environment. We buy questions from these companies. Afterwards, since the objectives that these questions refer to are certain, I prepare the exam answer sheet as an optical form (Ref2-1).

Besides using it in his classroom, he narrated the story in which he helped one of his colleagues to transfer assessment and evaluation to the digital environment by saying:

> I taught one of my colleagues how to scan it. He applied his exam and I had free time. And his classroom was opposite the teacher's room. As he scan the forms, it makes a sound like ding ding. If a student gets all the questions right, everybody applauds him/her. I hear all these from the teacher's room. He also feels happy. He sees something in there. If desired, the teacher can also give student a report card (Ref3-2).

Facilitator role

In his stories, Mehmet Bey frequently emphasized that IWBs facilitated all instructional processes. Examples on how he used IWBs, while either teaching or solving questions, were provided. He said the following with regard to how he used IWBs in teaching:

> You can draw pictures on an IWB. Particularly, it is very suitable for teaching fractions in mathematics. Drawing lines or a circle. You don't waste much time. It has a magic box right over there. You choose triangle and resize it as you want. Or you can erase it. You can also scroll down the board as much as you want, you don't need to erase to make up space. You can save the content you teach that day for students who may not be present. You copy it to their flash drive when they come to school the other day so that they can review it at home, or you can send them an e-mail. Children can be sick and may be absent. In this way, they also have the chance to keep pace with their peers. However, there was no opportunities like this in the past, you solve a problem on the board but you don't have to erase it. Some children cannot copy them to their notebooks in the lesson, so they can do it in the break (Ref1-3).

His statements on his use of IWBs in the classroom showed that IWBs facilitated teaching, problems can be easily solved in especially the mathematics course with the digital environment they present, they give students who miss the lesson the chance to keep pace with the process, and they facilitated the lessons in terms of time and effort. In this sense, he thought that he acted economically and provided teaching to each of his students equally.

Family involvement

Family involvement referred to the technologies that Mehmet Bey used to interact with his students and parents. He founded a class web site during the years 2005-2006, then used the OKULSIS (i.e. an online platform for school administrators, teachers, students and parents), and created a Facebook page for his class. In this regard, examples from his views on how he founded the web site in the first place and for what purpose are as follows:

> I founded a class web site. I have been using it for almost 12-13 years. Studens scores, grades are all on it (Ref2-1).

> In those times, even schools didn't have a website. It was for sharing children's pictures and their in-class activities with parents. It was also for parents to follow their children's assignments (Ref2-3)

> In 2006... The school had a web site. I uploaded what I did in the classroom to the web site, and other colleagues felt disturbed by that. Because it was the school web site. They said it was like the web site of grade 1-A. When they said that, I decided to found my own web site for my class, and thought it would be more beneficial. For instance, I could publish the course timetable, and everybody could check it. I could publish our activities and upload children's pictures. This is how it came up. We did that, we even uploaded the poems of those who could write well, and chose the poem or text of the week. Publishing online also attracted great attention (Ref3-1).

> I uploaded the weekly timetable on the website. For instance, parents can see what courses their children have the following day. Announcements, what the meetings to be held, when children can come to school without having to wear uniforms. These are all sent to parents by handing them to children but sometimes they lose them. Therefore, some parents come to meetings, some don't. The site is really useful in this sense (Ref2-2).

He stated that he founded a web site for his own class after the criticisms of some colleagues when he posted about his class to the school web site in 2006, and he shared announcements with students and parents on the class web site. In addition, it was also inferred from his statements that due to the OKULSIS program that the school bought in the 2013-2014 school year and the widespread use of Facebook, the class web site could not be used actively any more. He expressed his views on the OKULSIS program the school bought as "I used to assign homework to students like that. But I don't know. This is what stopped me: the school bought a program called OKULSIS. Assignments are given on that platform and feedback is received from students. So that made the school web site less popular" (Ref3-1). In addition, he also emphasized that the Facebook group reduced the effect of class web site by saying "We now have a Facebook page. Both for the school and the class... So the school web site somewhat lost its charm" (Ref3-1).

He made use of different technological environments, beside IWBs, for parents' involvement. When listed chronologically, the technologies that he used included interactive whiteboards and the school web site, then the OKULSIS program with change in the school, and the decrease in the popularity of the class web site with Facebook.

Challenges

The stories that Mehmet Bey narrated with regard to the problems he experienced while using IWBs in the classroom comprised of the brand and features of IWBs, students' breaking the IWB, calibration and backup. He mentioned that in the period when he first met IWBs, the school chose an IWB with the wrong brand and features, but gave up on that brand afterwards. In addition, he shared his knowledge and experiences of IWBs with the colleagues and administrators in the Provincial Directorate of National Education in his region. He narrated the following related to students' deleting or changing the content or material on the IWB knowingly or unknowingly, and how this can be overcome.

> T: During the break, children delete the program I installed, it is not that they do it in purpose. I touch the board without knowing it. If the computer is on, they can delete that program without noticing. That can also be a problem. They don't do it in purpose.
>
> R: What is the solution then?
>
> T: The solution is to have a flash drive or a hard disk with you all the time. I realize that something is deleted. For instance, I downloaded the course-books this year. They were deleted, but I had a backup (Ref3-7).

For eliminating the problems that he experienced while using IWBs, the right brand with effective and functional features should be firstly preferred, and the data on IWBs should always be backed up in case students delete some features or documents on the IWB, knowingly or unknowingly, causing various problems. Calibration problems and electricity cuts could also affect the instructional processes negatively.

Conclusion and suggestions

In this study that examined the journey of Mehmet Bey, an elementary school teacher for nearly 40 years, in using technology in the classroom, it was found that Mehmet Bey had certain characteristics regarding using technology. He used every kind of technology in his

classroom since the day he started the teaching profession. While the first technology he used was the sand table that he made himself, he was using IWB at the time of the study. Besides, radio, television, computer, VCD, MP3, tablet computer and projection were the other technologies he used. It was drawn from Mehmet Bey's stories that he was not merely interested in technology as a fashion, did research on which technology was economical and technically suitable, took the technology that he wanted to use to the classroom after he mastered it, shared his experiences with the school and the local educational institutions, and made an impression of an innovative and transformative teacher. Moreover, he was a teacher who introduced the technologies he used to his colleagues, convinced them to use these technologies, had the economic support of parents for new technologies, and shared the achievements he obtained by using technology in the classroom with parents. Mehmet Bey's stories based on his experiences of using technology revealed that teachers play the primary role in using technology in the classroom effectively. During the interviews, he made statements that he was the first teacher who used the technology of IWBs in Eskisehir. As a result, Mehmet Bey was innovative, transformative and a voluntary technological change agent in the schools he worked.

His reasons for using current technology in the classroom included trying to adapt to the technology-based change in children, interest in following innovations and technology, and the elementary curricula of 2005 prescribing the use of technology. In terms of using the class time effectively, it was inferred that more questions can be solved by means of an IWB, it enhanced the interaction with students, and thus affected achievement. This is consistent with some of the studies specifying the positive aspects of IWBs in the literature (Ekici, 2008; Pamuk, Cakir, Ergun, Yilmaz & Ayas, 2013; Sad & Ozhan, 2012; Saltan et al., 2010; Smith et al., 2006; Tataroglu & Erduran, 2010; Yang, Wang & Kao, 2012). He attributed the increase in his students' exam results to solving more questions by means of IWBs, sending students the course materials and notes digitally, and memorability due to their being active. This can be explained by the lessons taught with IWBs attracting students' attention and ensuring their motivation. He also stated views in this direction.

One of the notable findings of the study was Mehmet Bey's belief that for effective technology integration to education, teachers should overcome their prejudices against technology and be open to innovation. He stated this view based on his experience of using technology in the classroom for nearly 40 years, and the resistance that his colleagues showed against technology. The characteristics that Mehmet Bey observed in other teachers such as showing resistance to innovation, continuing teaching with traditional methods, having prejudices against using new technologies and not accepting innovative teachers can be regarded as important reflections. In this regard, Kim and Kankanhalli (2009) state that variables such as "*self-efficacy for change, organisational support to change, colleague views and perceived value*" are determinant in showing resistance to new information systems. In this study, it was also seen that teachers who perceive themselves as innovative do not feel themselves competent for change, and they need the views and guidance of their colleagues in using IWBs. In addition, as Cakiroglu, Akkan and Guven (2012) state, and it was also observed in this study, the acceptance of new technologies by teachers requires a long period of time and should be encouraged and guided by both administrators and colleagues. Mehmet Bey, who is an innovative teacher, played a pioneering role in encouraging teachers to use IWBs in state and private schools, and shared his experiences with elementary school teachers within seminars organised by the provincial directorate of national education. He made all these efforts voluntarily. The importance of being voluntary in the technology integration to education confirms what Mehmet Bey did during his career in this respect.

Mehmet Bey, whose experience of using IWBs in the classroom for nearly 10 years was examined in the study, was observed to encounter a set of problems. These problems were related to the Internet and electricity infrastructures, calibration and backup. In addition, Mehmet Bey stated that classroom management and effective teaching could be difficult without preparation, and various problems could be experienced in touch screens and electronic markers if a good brand was not chosen. Touch screen problems, boards not having their markers, classroom management problems and various IWB problems due to lack of knowledge, which were reported in a study by Pamuk et al. (2013), were those that Mehmet Bey solved himself, but warned to be careful about. In terms of the problems that Mehmet Bey overcame with his competencies but can be encountered, the study can be argued to have revealed similar results with the studies in the literature (Pamuk et al., 2013; Sad & Ozhan, 2012; Saltan et al., 2010; Turel, 2012). Mehmet Bey's suggestion that in addition to learning how to teach effective lessons with an IWB, teachers should also train themselves in solving little technical problems due to user mistakes is meaningful for those who want to use IWBs in the classroom. For example, changing the colour setting of the marker, or performing a task in another way. Teachers should train themselves in technical matters so that these little problems would not disturb the lessons.

Mehmet Bey's stating that the trainers in meetings such as in-service trainings and seminars in which demonstrations are made to teachers regarding using IWBs and similar technologies should not be company representatives is a notable finding. He thought that the trainings of company representative mostly included the technical aspects of IWBs, but teachers needed information on how to use those features in teaching mathematics, science or Turkish based on experience. For this reason, it should be laid emphasis on his suggestion that there should be interactive trainings in which teachers of similar subject areas share their experiences with each other. Based on this suggestion, workshops toward ensuring effective use of IWBs in the classroom can be organised. In these workshops, teachers like Mehmet Bey who use technology in their classroom environments, technical staff who can teach the technical features of IWBs and academics who do research on this issue can be gathered together. Besides, values like Mehmet Bey can be introduced to the educational community through events such as good examples or successful practitioners in using IWBs in their classrooms. In this way, other teachers can be encouraged.

To better understand the technology integration to education from teachers' perspective, long-term studies based on observations can be conducted. In the context of elementary teaching, the use of IWBs in the classroom can be associated with a subject area such as social studies, and can be examined to include more detailed insights and examples. Particularly, quantitative studies can be designed to determine whether Mehmet Bey's suggestion of receiving training from teachers who actually use the technology rather than university instructors or technical staff is meaningful.

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Investigation of Teachers' Mathematics Teaching Self-efficacy *

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Abstract

The aim of this research is to investigate primary school teachers' characteristics by comparing their mathematics teaching self-efficacy beliefs. In this research, qualitative research method is used. In order to determine the participant teachers, firstly, "Self-Efficacy Beliefs toward Mathematics Teaching Scale" (Dede, 2008) was applied to 33 primary school teachers, at seven public primary schools, in Adana, Turkey, in 2011-2012 school years. Then, according to results of the scale, four teachers are chosen to carry out semi-structured interviews. The interview data were analysed by conducting qualitative analytic methods. The results demonstrated that teachers with a higher self-efficacy belief have some different characteristics to those with a lower self-efficacy belief such as showing a higher level of effort and persistence with students, being more open to new ideas and new methods, believing in students' achievements and taking responsibility for students' success, placing more importance on building a warm relationship with their students rather than with the parents.

Keywords: Primary schools, Primary school teachers, Mathematics teaching, Self-efficacy belief.

Introduction

The contribution of mathematics to scientific development and its importance in people's lives, are critical factors in giving mathematics high priority in all levels of education programmes. The aim of teaching mathematics is to provide students with mathematical knowledge and abilities which are needed in everyday life, to solve problems and to develop strategies based on problem-solving approaches (Altun, 2005). Through mathematics education, people can find opportunities to develop abstract, logical and critical thinking, to become confident in using mathematics to analyse and solve problems both in school and in real-life situations. Students' mathematical learning and achievement are extremely important because of these reasons. According to Trends in International Mathematics and Science Study (TIMSS) (2011), there are many affective variables that

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influence students' learning and achievement in mathematics, such as student attitudes, home support for learning, type of school, school resources, instructional approaches and teacher characteristics.

Teacher characteristics, such as gender, age and experience, are regarded as affective variables that can influence student learning experiences and achievement (Clotfelter et al., 2006; Hanushek et al., 2005). In addition, researchers agree that teacher beliefs toward mathematics and the teaching profession are also important factors in order to have a positive effect on students' learning (Borko et al., 1992; Borko & Rutnam 1996; Shulman 1986). In this regard, teacher self-efficacy, which is defined as teachers' sense of personal ability to organise and execute their teaching (TIMSS, 2011), is not only linked to professional behaviour, but also to enhancing students' achievement (Allinder 1994; Ashton & Webb 1986; Woolfolk & Hoy 1990).

The construction of self-efficacy belief is presented in Bandura's article (1977) Toward a Unifying Theory of Behavioral Change'. He (1995, p. 2) defines self-efficacy as "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations". In other words, self-efficacy refers to an individual's 'I can' or 'I can not' belief. Since the 1970s, Bandura (1982, 1986, 1993, 1996, 1997) has carried out many studies in order to develop and defend the idea that people's beliefs in their capabilities powerfully affect their behaviour, motivation, and ultimately their success or failure.

Thus, exploring teachers' self-efficacy belief toward their mathematics teaching, as an affective variable in students' mathematical achievement, is of paramount significance for researchers. Understanding this factor is directly associated with the increase of students' achievement in mathematics.

Therefore, the aim of this study is to investigate the differences between teachers who have high and low self-efficacy belief regarding their mathematics teaching in terms of efficacy in mathematics teaching, belief in their ability to motivate students and to take on responsibility, effective teaching. In order to answer this question, the following broader research questions must be addressed:

1. What are teachers' perceptions about how their teaching abilities of mathematics help students to learn mathematics?
2. What are teachers' perceptions about the reasons for some students' low mathematics achievement?
3. What are teachers' perceptions about which factors can increase the efficacy of the mathematics teaching process?
4. What are teachers' perceptions about how students' motivation toward mathematics can be improved?
5. What are teachers' perceptions about if parents commented that their child is showing more interest in mathematics, what they would attribute this to?

Method

Qualitative research method is used for this study. In this research, semi-structured interviews are conducted to compare results and gain insights into primary school teachers' self-efficacy beliefs toward their mathematical teaching in terms of efficacy in teaching, their belief in ability to motivate students and to take on responsibility for students' learning and success, and effective teaching.

Sampling

In this study, as a non-probability sampling method, purposive sampling strategy (Cohen et al., 2005) is used. Firstly, 'Self-Efficacy Beliefs toward Mathematics Teaching Scale' (Riggs & Enochs, 1990; adapted by Dede, 2008) is administrated to 33 primary school teachers in 7 schools in Adana, Turkey, in 2011-2012 school years. Results of the Self-Efficacy Beliefs toward Mathematics Teaching Scale are illustrated in Table 1.

Table 1. *Summary of descriptive statistics for teachers' self-efficacy belief*

	N	Minimum	Maximum	*M*	*sd*
Teachers' Self-efficacy Beliefs	33	47	66	55.63	4.29

As shown in Table 1, 33 primary school teachers participate in the study. According to the results of the study, it is evident that all teachers have quite high self-efficacy beliefs toward mathematics teaching.

The questionnaire used to conduct the study has three sub-factors: efficacy in mathematics teaching (4 questions), the belief to motivate students and to take on responsibility for students' learning (6 questions), and effective teaching (4 questions). The results of the sub-factors are shown in Table 2.

Table 2. *Summary of descriptive statistics of sub-factors for teachers' self-efficacy belief*

	N	Minimum	Maximum	*M*	*sd*
Efficacy in mathematics teaching	33	12	20	16.06	1.87
Belief to motivate students and to take on responsibility	33	17	27	22.36	2.68
Effective teaching	33	8	15	12.82	1.59

As Table 2 shows, primary school teachers' self-efficacy belief toward their mathematics teaching is comprised of three sub-factors. According to results of the questionnaire, with regard to the first sub-factor almost all (97%) of the teachers have fairly high efficacy in teaching mathematics and only one teacher out of 33 (3%) indicate that his self-efficacy belief is average. With regard to the second sub-factor, a substantial majority of teachers (90%) respond that their belief to motivate students and to take on responsibility is high, while 6% state that their belief is average, and only 3% report that they have low belief. On the other hand, the questionnaire does not produce similar results when it came to the third sub-factor related to self-efficacy belief in providing effective teaching. Here, 57% of teachers indicate that they have high self-efficacy in providing effective teaching, 24% of them are average, and 18% have a low self-efficacy belief for this factor. These findings reveal that participant teachers felt themselves to have high efficacy in mathematics teaching and in motivating students and taking on responsibility for students' learning. However, they do not feel such high self-efficacy when it came to providing effective teaching for their students.

Secondly, by using purposive sampling strategy, the 4 primary school teachers who get the highest and lowest scores from the questionnaire are included in the study through conducted interviews. The ages of the interviewees are between 35 and 45 and all of them

are female. In addition, their teaching experiences are changing between 12 and 20 years. While three of them are graduated from a department of elementary education, one of them is originally a vocational high school teacher.

The aim of the study and details of how the knowledge would be used are clarified before the contribution of participants in order to make sure they understand the nature of the research as well as its potential impact on participants. All the participants are also informed that participation in the questionnaire and the interview is voluntary, and that they have a right to withdraw from the study at any stage, for any reason. It is also specified in the questionnaire that participants have the right to ask questions during the implementation of the instruments. During the interviews, the interviewees are asked whether they are comfortable being audio-recorded. Moreover, because of the importance of the right to privacy of participants, all questionnaires and interview transcripts are anonymous and confidential; their names are not required and not used in reporting the outcomes of this research.

In addition, a permission is gained from the Turkish Ministry of National Education by using an informed consent form which is about "the nature of the research and the purpose of the research, the risks and the benefits" (Anderson & Arsenault 1998, p. 18) in order to carry out the study in schools in Turkey.

Data collection instruments

For this study, two data collection instruments are used: a survey questionnaire and semi-structured interviews. In order to determine the interview participants, 'Self-Efficacy Beliefs toward Mathematics Teaching Scale' is administrated 33 primary school teachers. The questionnaire, the Self-Efficacy Beliefs toward Mathematics Teaching Scale, was adapted by Dede (2008). Some items of the questionnaire are based on the Science Teaching Efficacy Belief Instrument which was developed by Riggs and Enochs in 1990. As Dede indicates, constructional validity is established in the scale. In addition to this, the reliability of the questionnaire is calculated as 0.799. The questionnaire survey has 14 questions, which is sufficient for indicating teachers' opinions by using a five-point Likert scale of strongly disagree, disagree, unsure, agree and strongly agree. The minimum score of the questionnaire is 14, while the maximum score is 70.

Based on the results of the scale, the two teachers are chosen as participants in the interview who had the highest sense of self-efficacy toward mathematics teaching, and the two teachers with the lowest sense of self-efficacy belief are also chosen. After determining participant teachers, in order to compare results and gain insights into elementary teachers' self-efficacy beliefs toward their mathematical teaching in terms of efficacy in teaching, their belief in ability to motivate students and to take on responsibility for students' learning and success, and effective teaching, a semi-structured interview form is developed and used by the researcher. Interviews are carried out in a silent room. All of the interviews are audio-recorded. These interviews with teachers are lasted between 17 and 34 minutes. The audio-recorded interviews are subsequently transcribed.

Data analysis

In order to determine the participant teachers, data gained from 'Self-Efficacy Beliefs toward Mathematics Teaching Scale' (Dede, 2008) are analysed by using Statistical Package for Social Sciences (SPSS) 19 program. After that, the interview data (n=4) are analysed by conducting qualitative analytic methods. Firstly, the data recorded during the interviews are transcribed in detail on a Microsoft Word document. Secondly, the interviews are transferred into segments which represented complete thoughts on the research question with the purpose of comparing and combining data to find the best

answer to the research question. In addition to this, findings are presented by using abbreviations to quote from participants. For example, (H) is used for teachers with high sense of self-efficacy, and (L) is used for teachers with low sense of self-efficacy. Moreover, numbers are given for each participant such as (H1) and (L1).

Results

In this section, the results of the analysis of the interview data are presented. The interviews are carried out on the basis of the sub-factors the Self-Efficacy Beliefs toward Mathematics Teaching Scale. Four teachers are asked five semi-structured interview questions. Based on the results of the scale, the two teachers are chosen as participants in the interview who have the highest sense of self-efficacy toward mathematics teaching, and the two teachers with the lowest sense of self-efficacy belief are also chosen. The aim of this is to enhance understanding by comparing their answers to the interview questions. Throughout the comparison of the results of the teacher interviews, direct quotes from participants are provided in order to reinforce themes and categories. These quotes have been edited as little as possible; they are translated from Turkish to English language by the researcher.

Efficacy in mathematics teaching

The first sub-factor on the Self-Efficacy Beliefs toward Mathematics Teaching Scale refers to the teachers' efficacy in mathematics teaching. The following question is asked directly of each teacher: 'How do the teaching abilities of mathematics teachers help students to learn mathematics?' The teachers talk about teachers' characteristics and the most effective methods used in helping students to develop their mathematical learning. The results of the interview questions are set out below in Table 3.

Table 3. *Teachers' views about how their mathematics teaching abilities help students' learning in mathematics*

Teachers	The ways the teaching abilities of mathematics teachers help students to learn mathematics	
	Teachers' characteristics	Methods used
H1	Tolerance, the ability to develop a positive student-teacher relationship and to gain parental support.	Giving positive feedback, following students' personal development, and helping students gain self-confidence.
H2	Tolerance, the ability to develop a positive student-teacher relationship and to make students feel valued.	Providing opportunities for all students to participate in classroom activities, following students' personal development.
L1	(Not mentioned)	Providing opportunities for all students to participate in classroom activities.
L2	The ability to develop positive parent-teacher relationships and to gain parental support.	Organising activities to improve students' motivation.

As findings indicate, three of the teachers who participate in the interviews highlight the importance of teachers' characteristics. Teachers with higher self-efficacy belief stress in the interviews that being tolerant is a helpful factor in enhancing students' learning:

> "Teachers should be tolerant. Some families are not as tolerant as teachers. Another mission of teachers is to keep up the tolerance at home." (H1)

> "To love, to be tolerant, to be a model, these are very, very important things for students." (H2)

Also, respondents with higher self-efficacy belief comment on the importance of developing positive student-teacher relationships in order to make students feel valued, as follows:

> "That is to say, teachers' attitude and love toward their students. Students can feel their teacher genuinely love them. Teachers should make students feel it. You give students energy. When you respect your student, the child respects you so much more." (H2)

Likewise, two of the teachers who participate in the study touch upon the ability of teachers to develop parent-teacher relationships in order to gain parental support. The response of one participant is as follows:

> "Regardless of how well the teacher teaches, if there is no support at home, achieving success is difficult. If it is said that Ayse did this, Fatma did that, but you couldn't do it, the child would be affected negatively. … A parent came to the school. His child is fifth grade (11). He said that his child is probably stupid beside the student. His style was entirely wrong. I said, firstly, you should believe your child. You never say, 'You cannot do.' This causes fear of mathematics. You should always say, 'You will do, I believe in you'." (H1)

On the other hand, all teachers highlight the methods used as a way of helping students' learning in mathematics. Particular emphasis is placed by the teachers with stronger sense of self-efficacy on giving positive feedback. For example:

> "Teachers' mathematical teaching ability can enhance many aspects of students' learning. For example, it is important to say 'you can do this' or 'well done'." (H1)

Two interviewees with higher self-efficacy belief recount the impact of following students' personal development in helping students gain self-confidence. One statement from the interviews is as follows:

> "Not every child will enter a mathematics competition and will be the winner, but each of them can be improved. At least, students can gain self-confidence." (H1)

Furthermore, three teachers report providing opportunities for all their students to participate in classroom activities help them to learn. One of the interviewees mentions her students with special education needs:

> "At the moment, I have so many students with special education needs. If you do not compare their achievement with others, if you approach them by considering them at their own level, they show an unbelievable improvement." (H2)

In addition, one teacher with lower self-efficacy belief highlights the importance of organising activities in order to improve students' motivation:

> "A teacher's mathematical teaching ability is effective in organising classroom activities in order to motivate students toward mathematics. Motivation is a necessity for learning anything, not just about mathematics." (L2)

The results do not reveal a great differentiation in teachers' perception of their self-efficacy level. Nevertheless, it should be noted that teachers with higher self-efficacy place

more importance on developing the student-teacher relationship in helping students to learn. Building a positive relationship with students, which is something lower self-efficacy teachers miss out on, leads students to adjust to school more easily, view school as a positive experience, display better positive social skills, and have higher academic achievement (Buyse et al., 2009). In this sense, teachers with a lower self-efficacy belief can be regarded as having fewer efficacies in mathematics teaching than others.

Belief to motivate students, and to take on responsibility for students' learning

Another sub-factor on the Self-Efficacy Beliefs toward Mathematics Teaching Scale refers to the teachers' efficacy belief in motivating students and taking on responsibility for students' learning. In this regard, three main questions are asked of the participant teachers. The first question asked is, 'What do you think is the reason for some students' low mathematics achievement?' The participant teachers indicate that student, parent and teacher characteristics are important factors in determining some students' low achievement in mathematics. The results of the interview question are set out in Table 4.

Table 4. *The views of teachers about the reasons for some students' low achievement in mathematics*

Teachers	The reasons for some students' low achievement		
	Students' characteristics	Parents' characteristics	Teachers' characteristics
H1	Inherited ability, fear of mathematics.	(Not mentioned)	Student-teacher relationship, the ability to help students gain self-confidence, encouraging, tolerance of students, the ability to use body language and mime, different teaching methods.
H2	Perspectives on mathematics, prejudgement, the ability to use language.	The ability to use language.	(Not mentioned)
L1	Interest, the ability to do mathematics, numeric intelligence, personal talent.	(Not mentioned)	(Not mentioned)
L2	Mathematical intelligence, readiness, interests, doing exercises.	Supports	(Not mentioned)

In the light of the findings presented in Table 4, all teachers identify students' characteristics as an effective variable for determining the reason for some students' low achievement in mathematics. Three respondents highlight genetic endowment, personal talent, mathematical (numeric) intelligence, students' interests and the ability to do mathematics as reasons for some students' low achievement:

> "Some children show an inherited ability for mathematics." (H1)

> "Low achievement depends on students' interests and the ability to do mathematics. For example, let's imagine I am in a classroom. When I teach mathematics, I teach the same thing to all students. It is not different; the same thing is for all students.

> Why do some students have a low level of achievement? – It's because their mathematical intelligence is different." (L1)

One respondent with higher self-efficacy belief refer to the importance of students' perspectives of mathematics, the ability to use language, and prejudgements about some students' low achievement:

> "I think it depends on students' perspectives of mathematics and the ability to use the Turkish language. When a student cannot understand what I mean, naturally the student cannot do mathematics. Then, the student makes a prejudgement; he says that he cannot do mathematics. Absolutely, low achievement arises from this." (H2)

One of the teachers who have a lower self-efficacy belief comment on the effects of readiness and doing exercises on students' achievement:

> "It depends on student learning from previous classes. It depends on readiness. It depends on doing exercises at home." (L2)

On the other hand, two teachers who participate in the interviews indicate that the characteristics of parents can be the reason for some student low achievement. One of them mentions the parents' lack of ability in using language as an indicator of low student achievement:

> "I am sure that the language used by parents at home is important. Low student achievement depends on the number of words parents use, because students have difficulty in understanding and interpreting the Turkish language." (H2)

The other teachers indicate that parent characteristics, more than teacher characteristics, are a reason for low student achievement by stressing parental support at home:

> "It [low achievement] is not completely related to teachers. If parents do not help students at home, the expected result is for students to be unsuccessful." (L2)

In addition, one teacher who has higher sense of self-efficacy highlights the characteristics of teachers as a reason for students' low achievement. She mentions the impact of positive student-teacher relationships on students' achievement:

> "Positive student-teacher relationships are important for being successful. For example, some students have a fear of mathematics. I think this is an obstacle to low achieving students. Unless these students liked their teachers, it would be difficult to overcome this problem and to be successful." (H1)

She also indicates that helping students gain self-confidence, encouraging them and using different teaching methods can all play a vital role in preventing low achievement:

> "While the student was a first grade, I used all methods to teach 1+1=2, and finally, she has learned that 1+1=2, 1−1=0. I managed to teach these simple concepts. Finally, the child had gained self-confidence. She was able to solve simple problems. If there had been a different teacher, or a different approach had been implemented, maybe the result would have been very different." (H1)

She highlights the importance of the use of body language and humour in as factors in students' achievement:

> "If a teacher solves a problem in 40 minutes and never makes eye contact with students, never uses body language and humour, they can not achieve success." (H1)

She also refers to the importance of teachers' tolerance of students in encouraging achievement:

> "In this regard, I have never said, 'You can't do it'. When she makes mistakes, I have never asked 'Why can't you do it?' I have always accepted her and shown tolerance towards her." (H1)

The interview results demonstrate that teachers who have lower self-efficacy beliefs tend to suggest that student characteristics and parental support are the reasons for students' low achievement, while teachers with a higher sense of self-efficacy suggested that teacher characteristics are the reason for some of their students' failings as well. In this sense, teachers with lower self-efficacy beliefs could have an inadequate approach to taking on the responsibility for some students' failures. This is because research indicates that teacher characteristics such as the ability to develop a positive relationship with students, and the use of body language and humour, is related to the quality of the education process and student improvement (Çalışkan & Yeşil, 2005).

In order to elaborate the part played by teachers' efficacy beliefs in motivating students and taking on responsibility for students' learning, a second question is directly asked of the participant teachers: 'What factors can increase the efficacy of the mathematics teaching process?' Student characteristics and teacher characteristics are both mentioned by teachers as important factors in increasing the efficacy of the mathematics teaching process. The results of the interview question are shown in Table 5.

Table 5. *Teachers' views about the factors that increase the efficacy of the mathematics teaching process*

Teachers	The factors that increase efficacy of the mathematics teaching process	
	Students' characteristics	Teachers' characteristics
H1	(Not mentioned)	The ability to use various methods, various solutions, to provide various types of exercises and classroom connections with real life experiences, maintaining whole class involvement.
H2	Attention span, motivation, concentration, readiness, intelligence.	Student-teacher dialogue, the ability to help students gain self-confidence, to use various different methods.
L1	Numeric intelligence.	(Not mentioned)
L2	Readiness.	(Not mentioned)

As can be understood from Table 5, all teachers who participate in the interviews, except for one teacher who have a high sense of self-efficacy, describe student characteristics as an effective factor in increasing the efficacy of the mathematics teaching process. One interviewee highlights the effect of students' readiness as being an important factor in the efficacy of the mathematics teaching process:

> "As I said, whatever methods we use to teach mathematics, students' readiness affects the efficacy of the mathematics teaching process." (L2)

However, another teacher with higher self-efficacy belief mentions students' attention span, motivation, concentration, readiness and intelligence as important student characteristics for increasing the efficacy of the mathematics teaching process, while highlighting the importance of teachers' characteristics such as using different methods and helping students gain self-confidence as well:

> "It is related to students' threshold of perception. It is related to students' attention span, motivation, concentration, readiness, intelligence. The characteristics of students are critically important, but using different methods and helping students gain self-confidence are also important." (H2)

In addition to this, this teacher touches upon student-teacher dialogue as an important teacher characteristic in helping students gain self-confidence:

> "For example, I had a student who could not even count her fingers. I regularly talked with her; I always applied different methods for helping her learning. Now, she is very good – even she does not believe it. She has increased her self-confidence as she can do mathematics." (H2)

Another teacher with higher self-efficacy belief stresses teacher characteristics, including the ability to use various methods, provide various types of exercises and find different solutions:

> "… different methods, for example, dramatization is important. For want of a better word, not to take a limited perspective, not to have blinkers on: mathematics should teach with different examples. For instance, sometimes I say to students that they should find different ways of solving problems. Some teachers show only one certain solution. That narrows students' ideas. In this regard, students should be allowed to be free." (H1)

She also refers to the importance of whole class involvement in increasing the efficacy of the mathematics teaching process:

> "I said, 'What we can do now? Let's look together.' If the problem is too difficult, I say 'Let's solve it together.' One of them raises his hand, and says we should do this first. I say 'Okay.' Then, 'What we should do now?' You say, you say, you say 'Let's solve it together.' Then the achievement of the class approximates to 100 per cent." (H1)

The interview results reveal that teachers with a higher sense of self-efficacy refer to both student and teacher characteristics. On the other hand, teachers with lower self-efficacy belief only address student characteristics as a factor in increasing the efficacy of mathematics teaching. This means that teachers with lower self-efficacy belief do not feel sufficient responsibility for improving their mathematics teaching, which could lead to better student performance.

The third question 'How can students' motivation toward mathematics be improved?' is asked in order to broaden the data regarding the teachers' belief about motivating students and taking on responsibility for students' learning. The data related to the question is quite clear, because all teachers who participate in the interviews responding the same direction and talk about the importance of the role of teachers in improving students' motivation toward mathematics. The results of the interview question are presented in Table 6.

Table 6. *The views of teachers about the ways of improving students' motivation towards mathematics*

Teachers	The ways of improving students' motivation toward mathematics Teachers' role
H1	Giving positive feedback, setting modest goals, making all students feel successful, providing opportunities for all students to participate in classroom activities.
H2	Helping students gain self-confidence, encouraging and supporting students.
L1	Making mathematics appealing to students, providing opportunities for all students to participate in classroom activities, making all students feel successful.
L2	Giving positive feedback, providing opportunities for all students to participate in classroom activities, making all students feel successful.

As shown in Table 6, all teachers state that teachers play a vital role in improving students' motivation toward mathematics. Particular emphasis is placed on the importance of giving positive feedback in improving students' motivation toward mathematics. For example:

> "Well done, it is perfect. How beautiful it is, you did it. For example, during a mathematics exam assessment, a student solves half of the problem. He cannot find the exact answer. I give him the thumbs up. Maybe, it isn't a good thing, but I do. I don't want to discourage them. I show them the shortcomings of the answer. In the next exam, I see that they find the exact answer." (H1)

In addition to this, three respondents comment on the teachers' role in providing opportunities for all students to participate in the classroom in order to enable all students to feel successful:

> "The teacher's role is vital. The teacher should provide a classroom atmosphere in which even low achieving students can participate in the activities and all students can feel themselves to be successful." (L1)

One of the teachers stresses setting modest goals to motivate students toward mathematics:

> "... that is to say, small steps to success. You cannot expect the same success from every student." (H1)

Related to this point, one teacher participating in the study touches upon the fact that teachers play an essential role in helping students gain self-confidence by encouraging and supporting students:

> "That student, who I mentioned just now, was terribly unhappy. I always give confidence to her. I always say 'No, you will do it, you can do it.' I always support her and I always stand behind her." (H2)

Making mathematics more appealing is also indicated by one interviewee as a factor in motivating students:

> "The most efficient way to improve motivation is by making the subject appealing [to the student]." (L2)

The interview results do not reveal a significant difference between the teacher statements of teachers with a higher sense of self-efficacy and those with a lower sense of self-efficacy in terms of the ways of motivating students' toward mathematics. They all highlight the importance of the teachers' role in increasing the students' motivation towards mathematics, which has a positive potential effect on student performance.

Effective teaching

The third sub-factor on the Self-Efficacy Beliefs toward Mathematics Teaching Scale refers to the effective teaching. In this regard, the following question is directly asked of participant teachers: 'If parents commented that their child is showing more interest in mathematics, what they would attribute this to?' Teachers touch upon teachers, students and parents' characteristics as possible factors in an increase in a student's mathematical interest that could be identified by parents. The results of the interview question are illustrated in Table 7.

As results illustrated, all teachers responding to this question highlight teachers' characteristics, and two teachers particularly say parents might attribute the increase in students' mathematical interests to the teachers' ability to teach mathematics:

"They attribute an increase in their students' interest to the teacher because, for parents, the teacher is everything. They think that everything is given by teacher." (L1)

Table 7. *Teachers' reasons for an increase in students' mathematical interests as commented on by parents*

Teachers	Reasons for an increase in students' mathematical interests		
	Teachers' characteristics	Students' characteristics	Parents' characteristics
H1	The ability to make mathematics appealing, to use different methods, to provide fun ways of teaching mathematics.	Individual differences, the ability to do mathematics, mathematical intelligence, inherited ability.	The ability to provide additional courses.
H2	The ability to teach mathematics, to use different methods.	The ability to do mathematics, intelligence.	(Not mentioned)
L1	The ability to teach mathematics.	The perception of students, the ability to do mathematics, intelligence.	Parental support at home, helping with homework, checking homework, the ability to provide additional courses.
L2	The ability to organise activities for students at each achievement level.	The ability to do mathematics.	Parental support at home.

One teacher with higher self-efficacy belief stresses that parents attribute the increase in children's mathematical interest to teachers' ability to make mathematics appeal to the children and to provide fun ways of teaching mathematics:

"I make solving problems fun for students. Who will be the first? I give students numbers. Actually, by doing this, I understand how many children solve the problem. But, they concentrate on solving problems, and compete with each other to take a number. I have endeared so many children to mathematics in my classes and they learn how to solve problems." (H1)

Teachers who have higher self-efficacy belief highlight teachers' ability to use different methods as a significant reason for an increase in students' mathematical interests for parents:

"If a student did not have any mathematical improvement before being taught by the teacher, and if the teacher dealt with the student and improved him, the parents would probably attribute this to the teacher. They think that the teacher has used the correct method for teaching mathematics." (H2)

One teacher with lower self-efficacy mentions the teachers' ability to organise activities for students at each achievement level:

"When we look at low achieving students, activities organised by teachers are probably not appropriate for low achieving students." (L2)

In addition to the teacher characteristics, all participants mention the ability to do mathematics as a student characteristic. They all mention student characteristics like inherited ability, individual differences, mathematical intelligence and the ability to do mathematics. For example:

> "… But, if the student was good at doing mathematics since before now, they would probably attribute this to their child's abilities to do mathematics." (H2)

Moreover, three teachers state that parent characteristics could be a reason for the increase in students' mathematical interest in the eyes of parents, while one of teacher with a high sense of self-efficacy does not mention it.

Two of the participants mention the parents' ability to provide additional courses:

> "Our school environment, ımmm… Our students can't get additional courses or private lessons. But, parents who can provide their children with additional courses, they probably attribute their child's interest to the courses." (L1)

Moreover, two teachers with lower self-efficacy indicate that parental support at home in helping with homework and checking homework are possible reasons for an increase in students' mathematical interest:

> "If parents check homework at home, if they help their children do their homework, if they study together, they will probably attribute the increase in their children's mathematical interests to their support." (L1)

The interview results could indicate that the perceptions of teachers are not considerably differentiated by their self-efficacy level. Nevertheless, minor differences do exist and should be noted. Teachers with lower self-efficacy tend to highlight student and parent characteristics rather than teacher characteristics and teaching methods used. On the other hand, teachers with higher self-efficacy belief highlight teacher characteristics and methods used – as well as student and parent characteristics – as reasons for the low achievement of some students and as the factors that increase the efficacy of mathematics teaching. However, it is difficult to say there is a significant differentiation between teachers' interview results in terms of helping students' mathematical learning, improving students' motivation toward mathematics and increasing students' mathematical interests for parents.

Discussion

In this sample it was found out that all teachers have quite high self-efficacy belief toward their mathematics teaching. Similar to this result, Tertemiz and Şahinkaya (2010) have also suggested that pre-service teachers have high self-efficacy belief scores in terms of teaching mathematics. Even all participant teachers have quite high self-efficacy belief; there are some differentiations between teachers with higher and lower self-efficacy belief in terms of teaching mathematics. Studies have suggested that students who have efficacious teachers are likely more successful than those in other classes (Akbari & Allvar, 2010; Anderson et al., 1988; Berman & McLaughlin, 1977; Moore & Esselman, 1992; Tschannen-Moran & Hoy, 2001). In addition to this, Ashton and Webb (1986) supposed that teachers' sense of self-efficacy belief is associated not only with enhanced student achievement, but also with an impressive profile of teacher behaviours including warmth, responsiveness, acceptance of student initiative and attention to individual needs. The interview results from this present study are quite similar to those of Ashton and Webb (1986) in terms of revealing these kinds of teacher behaviours. These are as follows:

Level of effort and persistence with students

The interview results from the present study have revealed that teachers' level of effort and persistence with their students is differentiated in a similar way to their sense of self-efficacy. In other words, teachers who possess a secure sense of self-efficacy demonstrate a high level of effort and persistence with their students, compared to teachers with lower self-efficacy belief. One of the teachers with lower self-efficacy says:

> "You have to organise activities for every level of student. This is, how can I put this, I cannot say this for whole class… In a word, is it boring to work with low achievement students? I suppose it is tiresome for teachers… Teachers work comfortably with successful students and enhance their achievement, but with low achievement students, how can I put it, with students who do not like doing mathematics, however much I make an effort, the result is zero since the student does not want to learn." (L2)

According to Gibson and Dembo (1984), in contrast to efficacious teachers, teachers who have lower self-efficacy belief easily give up on low achieving students. Parallel to the findings of the present research, Tschannen-Moran and Hoy (2001) have also suggested that teachers' perceived level of self-efficacy belief, which has the potential to predict outcomes such as student achievement, can also affect teachers' level of effort and persistence with students.

Openness to new ideas and new methods

The interview results from this study show that teachers with a stronger sense of self-efficacy tend to be more open to new ideas and more willing to experiment with new methods in order to better meet the needs of students, compared to teachers who have lower self-efficacy belief. In the light of these findings, it can be said that teachers who have high self-efficacy belief produce higher student achievement. Similarly, Tschannen-Moran et al. (1998, p. 215) indicate that teachers' self-efficacy belief is related to 'their openness to new ideas'. Guskey (1988), in his exploratory study, revealed a significant relationship between teachers' self-efficacy belief and their attitudes toward the implementation of new instructional practices such as minor changes in classroom activity, the use of an entirely new curriculum, or the adoption of a very different instructional approach. In addition, Stein and Wang (1988) conducted a study to investigate the relationship between teacher success in implementing innovative programmes and teacher perception of self-efficacy. The researchers used behavioural observations, interviews and questionnaires on several occasions to measure teachers' performance, self-perceptions and attitudes. The results of the Stein and Wang's (1988) work supports the interview findings of this study in terms of demonstrating a significant relationship between teachers' sense of self-efficacy and their implementation of innovative programmes.

Belief in students' achievements and taking responsibility for students' success

In addition, this study finds that teachers with high self-efficacy belief are more optimistic and take more responsibility for students' achievement and failures. As one of the more efficacious teachers states:

> "Exactly, it is achievable; no one can say, "I don't have the ability to do mathematics," "I can't do mathematics." If a teacher deals with the student, if a teacher finds the most appropriate method for the student, I believe it can be done …"(H2)

Teachers with high self-efficacy belief are more optimistic about achieving success and feel responsibility for enhancing their students' achievement. According to Ashton (1985), this is important because teachers who seek the solutions outside their own classroom and who attribute the cause to external factors tend to more often refer students for special education. In addition, Ware and Kitsantas (2007) stated that teachers with low self-efficacy belief tend to blame outside factors. Similarly, Shechtman et al. (2005) found that teachers with strong self-efficacy belief are keener to help their students achieve better, even when their students have learning and behavioural difficulties, and are more optimistic than teachers with low self-efficacy belief. This situation naturally affects teachers' performance which can be regarded as a predictor of students' achievement.

Need to build relationships with parents

Akbari and Allvar (2010) supposed that parental engagement leads to increased student achievement. Hoover-Dempsey et al. (1987, 1992) explored a significant positive relationship between teachers' sense of self-efficacy and parental involvement. They indicated that teachers with higher self-efficacy belief report greater participation by parents in conferences and volunteering in the school, and involvement in helping their children with school-related skill development at home, such as homework. Similarly, Ashton, Webb and Doda (1983) have suggested that teachers with low level efficacy can be a cause of a weaker teacher–parent relationship. According to Hoover-Dempsey et al. (1987), because they are more confident in their teaching ability, teachers with high sense of self-efficacy belief are more willing to invite parental involvement and to accept parents' initiation of involvement activities. However, the interview results of this study demonstrate that teachers who have lower self-efficacy belief touch upon parental involvement in helping their children at home, the importance of building parent–teacher relationships, and the need to gain parental support more than other teachers with higher self-efficacy belief. The reason for this result could be related to teachers' perception of taking responsibility for their students' achievements and failures. As mentioned previously, teachers with lower self-efficacy belief are likely to attribute their students' achievements and failures to outside factors, such as parents, while teachers with stronger self-efficacy belief tend to take responsibility for their students' failures or successes. For example, one teacher with lower self-efficacy belief points out:

> "Parents think that the teacher is everything. However, parent education is also an important factor in raising their children's achievement. Are they adequate to help their children at home? When children ask a question, when children ask about how to solve a question, can the parent support their children? This is important." (L2)

Building professional relationships with students

The interview results of this study find that there is a relationship between teachers' self-efficacy belief and their ability to build warm relationships with their students. One teacher who has a higher self-efficacy belief states the following:

> "Indeed, it is related to teachers' characteristics rather than teachers' mathematical ability, that is to say, teachers' attitude and love toward their students. Students can feel their teacher genuinely love them. Teachers should make students feel it. You give students energy. If you respect your student, the child will respect you so much more. There is no other explanation: to love, to be tolerant, to be a model, these are very, very important things for students." (H2)

Teachers with higher self-efficacy belief tend to rely on positive relationships with their students for raising student achievement, rather than parent–teacher relationships. These results regarding the ability to a build positive teacher–student relationship parallel those of Ashton et al. (1982) who reported that teachers who possess a secure sense of self-

efficacy are able to build a positive relationship with their students, even with low-achieving students. In this context, Babaoğlan and Korkut (2010) carried out a study to investigate the relationship between teachers' sense of self-efficacy belief and the level of their classroom management ability to regulate teacher–student relationships. The statistical findings of the study were similar to this study's results in terms of indicating a significant relationship between teachers perceived self-efficacy belief and the ability to build warm relationships with students.

Helping students develop their self-confidence as learners of mathematics

Some researchers have indicated that a negative attitude toward mathematics, including fear and anxiety about mathematics, has a negative effect on achievement (Townsend et al., 1998). This study find there is a relationship between teachers' perceived self-efficacy belief and their approach to improving students' attitudes toward mathematics. As one of the teachers with higher self-efficacy states:

> "I address difficult problems to the higher achieving students; I prepare the easiest for other students. Thus, they can join the activities in the classroom. They become happy. What has happened? They have got over the fear of mathematics." (H1)

Teachers with higher self-efficacy belief attempt to improve their students' attitudes toward mathematics and help them overcome fear of mathematics in order to enhance their achievement in mathematics. On the other hand, Showalter (2005) indicated that there is no statistically significant relation between a mathematics teacher's self-efficacy belief and his or her students' attitudes toward mathematics. Even though the statistical findings did not expose any significant relationship, data gathered from qualitative research methods of the study revealed that the teacher has an influential role in determining how a student views mathematics. In this regard, qualitative research methods can be regarded as more appropriate for exploring people's beliefs, attitudes and fears (http://projects.exeter.ac.uk/prdsu/helps). The findings of Showalter's study (2005) do not differ very greatly from the present study's results. In summary, it can be stated that teachers with high sense of self-efficacy positively affect their students' achievement by improving students' attitudes toward mathematics.

Understanding differentiation and supporting low attaining students

Besides helping students develop their self-confidence, the interview results from this study find that there is a relationship between a teacher's perceived self-efficacy belief and the ability to show tolerance. As one of the efficacious teachers emphasis:

> "… during a mathematics exam assessment, a student solves half of the problem. He cannot find the exact answer. I give him the thumbs up. Maybe, it isn't a good thing, but I do. I don't want to discourage them. I show them the shortcomings of the answer. In the next exam, I see that they find the exact answer." (H1)

Showing tolerance towards students' mistakes has a positive effect on students' achievement. In other words, teachers with stronger self-efficacy belief reveal that they tolerate their students' mistakes as a way of enhancing achievement. Similarly, Gibson and Debro (1984) indicated that teachers who have high self-efficacy belief are less critical of students' incorrect answers.

Conclusion

It is found that teachers with a higher self-efficacy belief have some different characteristics to those with a lower self-efficacy belief. For example, teachers who have a higher self-efficacy belief also show a higher level of effort and persistence with students. In addition, they are more open to new ideas and new methods, believe in students' achievements and take responsibility for students' success. Furthermore, they place more

importance on building a warm relationship with their students rather than with the parents. They are more tolerant, tending to support low-attaining students. They make more effort to help students improve their self-confidence as learners of mathematics. As discussed previously, these differences between teachers with higher and lower self-efficacy belief naturally lead to better student performance in mathematics.

In conclusion, teachers' sense of self-efficacy belief is an important factor in helping students to achieve success. Based upon this conclusion, I make the following recommendations.

1. Improve student teachers' self-efficacy belief toward mathematics.
2. Organise the learning environment to enhance student teachers' abilities to provide effective teaching in mathematics.
3. Provide in-service training courses.
4. Improve teachers' attitudes toward the teaching profession.

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Perception of Teaching Efficacy by Primary and Secondary School Teachers

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Abstract

This research aims to identify how teaching efficacy is perceived by teachers working at state schools. Having a survey model design, this study hosts a total of 678 primary and secondary school teachers -401 females and 277 males- working in the province of Tokat during the academic year of 2013 and 2014. Research data has been collected through teaching efficacy scale consisting of 28 items and 6 sub-dimensions. Analyses have revealed that teachers mostly regard themselves as efficient especially in class management dimension. On the contrary, the dimension that participating teachers feel the least efficient has been determined to be instructional methods/strategies. Significant differences have been noted among teachers' perception concerning teaching efficacy across different variables such as the faculty they graduated, gender, course match, in-service training, branch, and seniority.

Keywords: Teaching efficacy, Primary school, Secondary school, Teacher training.

Introduction

Undoubtedly, teachers are the core figures in all teaching-learning processes. Thus, it is of paramount significance to select teachers, to train them, to designate them with teaching positions, and to offer them chances for self-improvement during their professional life. A perfect school, a perfect curriculum, and perfect students would make sense only with teachers doing their best at work. Teachers contribute dramatically to the learning settings not only with their skills and expertise, but also with their up-to-date world knowledge, values and philosophical backgrounds, and with their personal characteristics. Therefore, teachers have to be trained thoroughly and multi-functionally.

Good teachers are trained via good training programs. (MEB, 1982; Küçükahmet, 2001). The first institution to raise teachers was established in 1848, approximately 160 years ago, in our country. Meanwhile, tremendous changes have taken place in the training Because the quality of education is highly correlated with the quality of teachers, they have to be trained well both during pre-service years and in-service years, which is crucial

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for the quality of educational services (Şisman, 2001). Sönmez (2007: p. 149) underlies that teaching profession is an important occupation requiring special knowledge, skills, and interest, and that no one should be allowed to teach without proper pedagogic training. Ministry of National Education (1999) also underpins that teachers' features are directly influential on the quality of educational processes since they are the ones who constantly communicate with students, apply the instructional programs, manage learning, and who assess both the students and the instruction. Each component of teachers' characteristics has a crucial impact on students (Küçükahmet, 2001).

So far, countless studies have been designed to determine the qualities that a teacher should bear. These are as follows: a solid command of field and world knowledge, ability to use different techniques and methods, advanced communication skills to build up efficient and cozy atmosphere that is interesting for students, adaptive, hard-working, well-groomed, affectionate, a good organizer, open-minded, self-confident, tolerant, and fair (Barutçugil, 2002; Gündüz, 2007; Mujis & Reynolds, 2005; Özden, 1997, Şen & Erişen, 2002; Sönmez, 2007). According to Güneş (2003), effective teachers are those who think, question, criticize, who are innovative and open-minded, and who constantly update themselves with a great love for their profession. Likewise, Good and Brophy (1997) state that good teachers are innovative, democratic, enthusiastic, eager, and good at establishing positive relations with others. Based on their research, Çelikten and Can (2003) report that ideal teachers are tolerant, trustworthy, objective, innovative, open to criticism, success-oriented, time-efficient, cooperative with administrators and colleagues, and they build a constructive and educational discipline in the class where they include the students into all activities of class management.

Recently, a large body of research on teacher efficacy has focused on identifying how teachers from different fields perceive their self-efficacy in terms of their profession and their specialty. Shortly, self-efficacy is the awareness of one's skills to complete a task and the belief to succeed. Teachers' self-efficacy is a vital element in teacher training, and it matters significantly in terms of understanding how teachers' self-efficacy develops, what are its building blocks, what factors contribute to the formation of strong and positive teacher efficacy, and what kind of educational programs should be developed and how these programs should be used in order to help boost teachers' efficacy (Pajares, 1997). Studies on teachers' efficacy within the literature mainly revolve around examining self-efficacy in different fields across various variables (Akkoyunlu & Kurbanoğlu, 2003; Aksu, 2008; Azar, 2010; Çelikkaleli & Akbas, 2007; Kaya & Durmus, 2010; Klassen & Tze, 2014; Kurt & Ekici, 2013; Kutluca & Ekici; 2010; Lancester & Bain, 2007; Ören, Ormancı & Evrekli, 2011; Özdemir, 2008; Romi & Leyser, 2006).

Chang, Lin and Song's (2011) classification has served as the basis for the dimensions of teaching efficacy studied in this research. As for Chang, Lin and Song (2011), the concept of teaching efficacy bases itself onto Bandura's (1997) social-cognitive theory and self-efficacy theory. The first element of teaching efficacy as described by Chang, Lin & Song (2011) is course design. Saban (2000) discusses that the success of teaching is highly dependent on the consistency between planning of the goals in a course and the practice. Instructional methods/strategies applied by teachers are the second element in teaching efficacy, and they are mostly accountable for an effective learning process (Şahinel, 2003). Instructional methods are listed among the factors influencing students' success. The core responsibility of choosing and applying relevant instructional methods and techniques falls onto the teacher. The increase in the efficiency and productivity of any program is directly correlated with teachers' skills to fulfill this responsibility. On the other hand, there are many other factors affecting how teachers carry out the expected responsibilities. Among these is the awareness and implementation of teaching principles

and methods by teachers (Erden, 1998). What comes as the third in teaching efficacy is technology use, which is crucial for all current disciplines. It is common knowledge that technology use enhances the quality of learning and the efficiency of teaching, decreases the time both students and teachers need to attain their goals, lessens the cost of education without any loss of quality, and activates the students in the learning environment (Uşun, 2007). Öğüt, Altun and Koçer (2003) note that advances in info-communication technologies have also positively influenced the quality of education. Apart from enriching the quality of education, use of technology also helps raising individuals who are familiar with and able to use technology in their lives (Köseoğlu et al., 2007). Class management is the forth element of teaching efficacy. Establishing quality education and learning settings can be linked to efficient school and class management, which later can also be attributed with class management skills teachers have. Therefore, the quality of education is considerably dependent on the quality of class management (Şenturk & Oral, 2008). Interpersonal relations can be taken as the fifth element of teaching efficacy. Especially teachers, students, administrators, and other workers should be communicating effectively in order for education to properly actualize (Çilenti, 1998). A teacher with efficient communicative skills understands his/her students better, accepts them, and bears positive feelings. In such a setting, students, too, develop more positive attitudes and behaviours towards their teachers and peers (Kısaç, 2002). The quality of in-class communication plays a crucial role on students' personality development and academic success (Ergin & Birol, 2000). As for Chang, Lin and Song (2011), learning assessment is the final component of teaching efficacy. Assessment is regarded as the most important element of teaching process. Proper, trustable, and objective assessment requires valid and reliable evaluation tools, methods, and standards (Kayabaşı, 2007). According to Daniel and colleagues (1998), another feature that teachers should possess is a good command of skills and knowledge about assessment and evaluation.

Aim of Research

The aim of this research is to determine how primary and secondary school teachers perceive teaching efficacy. Accordingly, answers for the following questions have been sought:

1- How do teachers working at schools affiliated with the Ministry of Education perceive teaching efficacy?
2- Do teachers' perception of teaching efficacy vary across;
    a) The faculty they graduated from (education faculty vs. the others),
    b) Gender,
    c) Course Match,
    d) Training,
    e) Seniority, and
    f) Branch?

Method

Research Design

Examining primary and secondary school teachers' perception of teaching efficacy, this study has a survey model design. Survey model presents the findings in quantitative and numerical forms after identifying what the participants' attitudes and opinions are (Creswell & Miller, 2000).

Research Group

The research group of this study consists of primary and secondary school teachers working at state schools located within the province of Tokat during the academic year of

2013 and 2014. Teachers who filled in the questionnaire completely partook in the research (*N*= 678). Besides, branches with participants lower than 10 have also been excluded from the analyses.

Table 1 depicts the demographic information concerning the participants.

Table 1. *Demographic Information about the Participants*

Demographic Features		*N*	%
Gender	Female	401	59.1
	Male	277	40.9
Course Match	Full Match	202	30.6
	Partial Match	458	69.4
Training	Trained	524	79.4
	Not trained	136	20.6
Seniority	<6	142	20.9
	6-10	138	20.4
	11-15	215	31.7
	16-20	70	10.3
	>21	113	16.7
Branch	Mathematics	46	6.8
	Science	69	10.2
	Social Studies	113	16.7
	English Language	71	10.5
	Turkish Language	77	11.4
	Class Teacher	232	34.2
	Others (Arts, music, physical ed. Religion	67	11.5
	Missing Data	3	.4
Faculty	Education	536	79.1
	Others	142	20.18

Data Collection Tool

This research has employed the "*Teaching Efficacy Scale*" developed by Chang and colleagues (2010; 2011). Being a 4-point Likert type scale, the tool contains six dimensions (Course Design, Instructional Strategy, Technology Use, Classroom Management, Interpersonal Relation, and Learning Assessment) and 28 items. The Teaching Efficacy Scale was adapted to Turkish by the researcher. Factor loadings for designed to measure each factor were consistently range between .57 to .86. The six factors accounted for 71.93% of the total variance. Cronbach alpha values of the dimensions are as follows: course design *a*= .70, instructional strategy *a*= .76, technology use *a*= .81, classroom management *a*= . 67, interpersonal relations *a*= .73, and learning assessment *a*= .76.

Table 2. *Sample Items from Teaching Efficacy Questionnaire*

Dimension	Item #	Sample Items
Course Design (CD)	5	Establish comprehensive teaching objectives
		Select appropriate teaching material
Instructional Strategy (IS)	5	Teaching according to students' various levels of readiness
	5	Utilize effective teaching methods to improve students grades
Technology Use (TU)	5	Know how to produce relevant teaching media.
		Employ software relevant teaching media
Classroom Management (CM)	5	Nurture a pleasant learning environment,
		Maintain a good relationship with my students
Interpersonal Relation (IR)	3	Provide assistance to students whenever they encounter difficulties in learning
		Provide appropriate assistance to my students if they are incapable of completing the assignments
Learning Assessment (LA)	5	Utilize a variety of Assessment methods to evaluate students' learning results
		Improve my teaching according to assessment results

Data Analysis

Research data has been analysed via arithmetic mean, standard deviation, t-test (gender, faculty of graduation (Education / Others), match between background education and the courses, and participating in trainings), and one-way ANOVA (seniority and branch). The analysis of the quantitative data was conducted using parametric test. One-Sample Kolmogorov-Smirnov test was used to determine whether the data followed normal distribution and as a result it was found that the data followed normal distribution.

Findings

This part presents findings obtained after testing the research questions. All findings concluded after analyses are displayed in Tables and interpreted. The order of findings is the same with the order of research questions.

How do teachers perceive teaching efficacy?

Table 3. *Summary of Teachers' Perception Concerning Teaching Efficacy*

Dimensions	*M*	*sd*	Rank
Course Design	3.51	.33	2
Instructional Strategy	3.45	.40	6
Technology Use	3.47	.41	5
Classroom Management	3.67	.33	1
Interpersonal Relation	3.50	.43	3
Learning Assessment	3.48	.39	4

Note: 4 scale 4= Strongly agree 1=Strongly disagree

Table 3 depicts the summary as to how teachers perceive teaching efficacy. The dimension that teachers feel the most competent is classroom management (*M*= 3.67).

Course design *(M*= 3.51), interpersonal relations (*M*= 3.50), and Learning Assessment (*M*= 3.48) are the second, third and fourth dimensions that teachers feel efficient about. Instructional Strategy (*M*= 3.28) stands as the dimension that teachers feel the least efficient about.

Do teachers' perceptions of self-efficacy vary in terms of the faculty they graduated from?

Table 4 displays the comparison between teachers who graduated from faculty of education and the graduates of other faculties in terms of teaching efficacy perception. A statistically significant difference has been identified on three dimensions in favour of those who graduated from faculty of education; course design [$t_{(676)}$= 2.15, p<.05], classroom management *[*$t_{(676)}$=3.21, p<.05], and learning assessment [$t_{(676)}$= 2.72, p<.05]. Although participants with a degree from faculty of education have a higher mean score on instructional strategy, technology use, and interpersonal relations, this discrepancy is not statistically significant.

Table 4. *t-Test Results of Teaching Efficacy Scale in terms of the Faculty of Graduation*

Dimensions	Faculty of Education (*n*= 536)		Others (*n*= 142)			
	M	*sd*	*M*	*sd*	*t*	*p*
Course Design	3.53	.36	3.45	.39	2.154	.320
Instructional Strategy	3.46	.42	3.45	.39	.444	.657
Technology Use	3.48	.40	3.45	.45	.579	.563
Classroom Management	3.75	.32	3.65	.33	3.213	001
Interpersonal Relation	3.52	.43	3.46	.38	1.506	.133
Learning Assessment	3.50	.38	3.40	.40	2.720	.007

p< .05

Do teachers' perception of teaching efficacy vary in terms of gender?

Table 5. *t-test Results of Teaching Efficacy Scale in terms of Gender*

Dimensions	Female (*n*=401)		Male (*n*= 277)		*t*	*p*
	M	*sd*	*M*	*sd*		
Course Design	3.53	.37	3.51	.37	.285	776
Instructional Strategy	3.46	.42	3.44	.38	.573	592
Technology Use	3.47	.45	3.47	.39	.299	765
Classroom Management	3.71	.34	3.65	.32	2.133	.033
Interpersonal Relation	3.55	.46	3.48	.42	2.067	.039
Learning Assessment	3.57	.38	3.42	.39	4.862	.000

Upon analyzing teachers' teaching efficacy perception in terms of gender, no significant difference has been noted across dimensions of course design, instructional strategy, and technology use. However, a difference in favor of female teachers have been determined across the other dimensions; classroom management [$t_{(676)}$= 2.13, p< .05], interpersonal relations [$t_{(676)}$= 2.06, p< .05], and learning assessment [$t_{(676)}$= 4.86, p<.05].

Do teachers' perception of teaching efficacy vary depending on the match between their background education and the courses they teach?

Table 6. *t-test Results of Teaching Efficacy Scale in terms of Course-Match*

	Completely (*n*= 219)		Partially (*n*= 468)			
Dimensions	*M*	*sd*	*M*	*sd*	*t*	*p*
Course Design	3.64	.29	3.46	.38	6.094	.000
Instructional Strategy	3.53	.40	3.41	.39	3.455	.001
Technology Use	3.49	.38	3.46	.43	.930	.353
Classroom Management	3.71	.31	3.66	.34	1.893	.059
Interpersonal Relation	3.51	.47	3.50	.42	.386	.700
Learning Assessment	3.57	.36	3.44	.39	4.159	.000

As can be seen in Table 6, the dimensions of technology use, classroom management, and interpersonal relations are not significant affected by the match between teachers' background education and the courses they teach. As for course match, a statistically significant difference has been noted across the dimensions of course design [$t_{(676)}$= 6.09, p< .05], instructional strategy [$t_{(676)}$= 3.45, p< .05], and learning assessment [$t_{(676)}$= 4.15, p< .05] in favor of those teachers with a full match.

Do teachers' perception of teaching efficacy vary depending on attending a course about the professional?

Table 7 depicts teachers' teaching efficacy perception scores in terms of attending or not attending a course about the profession. As for partaking in a training course or not, only the dimension of classroom management is free from a significant difference. All the other dimension scores point a significant difference in favor of those who participated in a training course; course design [$t_{(676)}$= 6.00, p< .05], instructional [$t_{(676)}$= 5.58, p< .05], technology use [$t_{(676)}$= 5.76, p< .05], interpersonal relations [$t_{(676)}$= 2.34, p< .05], learning assessment [$t_{(676)}$= 4.08, p< .05].

Table 7. *t-test Results of Teaching Efficacy Scale in terms of Attending a Course about the Profession*

	Yes (*n*= 537)		No (*n*= 141)			
	M	*sd*	*M*	*sd*	*t*	*p*
Dimensions						
Course Design	3.56	.34	3.35	.42	6.000	000
Instructional Strategy	3.49	.39	3.28	.38	5.589	000
Technology Use	3.52	.39	3.29	.45	5.767	000
Classroom Management	3.68	.32	3.63	.37	1.182	238
Interpersonal Relation	3.52	.44	3.43	.40	2.341	020
Learning Assessment	3.51	.38	3.36	.38	4.088	000

p< .05

Do teachers' perception of teaching efficacy vary in terms of seniority?

A closer look at teachers' teaching efficacy perception in terms of changes based on seniority indicates a statistically significant difference across all the dimensions of the scale, but classroom management; course design [F= 5.47, p< .05], instructional strategy [F= 4.54, p< .05], technology use [F= 2.58, p< .05], interpersonal relations [F= 4.21, p< .05], learning assessment [F= 9.41, p< .05].

Teachers' teaching efficacy perception has been recorded to be the highest for teachers with more than 20 years and less than 6 years of experience. With respect to course design, the difference is in favor of teachers with less than 6 years of experience as opposed to those with 6-to-10, 11-to-15, and 16-to-20 years of experience. Furthermore, participants with more than 20 years of experience have also been identified to have higher teaching efficacy perception compared to those with 6-to-10 and 11-to-15 years of experience.

As for instructional strategy, a similar layout has been noted: teachers with less than 6 years and more than 20 of experience consider themselves more efficient than those with 6-to-10 and 11-to-15 years of experience, respectively.

Likewise, teachers with less than 6 and more than 20 years of experience have been recorded to be more efficient about technology use than those with 16-to-20, and 6-to-10 & 11-to-15 years of experience respectively.

Moreover, participants with 20 years of teaching experience regard themselves more efficient than those with 11-to-15 and 16-to-20 years of experience in terms of interpersonal relations.

Table 8. *ANOVA Results of Teaching Efficacy Scale in terms of Teaching Experience*

	< 6 (n= 142)		6-10 (n= 138)		11-15 (n= 215)		16-20 (n= 70)		>20 (n= 113)			Post hoc
Dimensions	*M*	*sd*	*M*	*sd*	*M*	*sd*	*M*	*sd*	*M*	*sd*	*F*	
Course Design	3.59	.35	3.46	.33	3.51	.36	3.38	.41	3.57	.38	5.47*	1>2;3;4 5>2;4
Instructional Strategy	3.51	.37	3.42	.41	3.47	.46	3.37	.38	3.54	.38	4.54*	1>2 5>2;3
Technology Use	3.51	.37	3.42	.42	3.47	.46	3.37	.38	3.54	.38	2.58*	1>4 5>2;4
Classroom Management	3.67	.33	3.73	.28	3.66	.33	3.62	.29	3.67	.40	1.57	
Interpersonal Relation	3.46	.47	3.53	.42	3.49	.40	3.39	.48	3.63	.40	4.21*	5>2;4
Learning Assessment	3.55	.35	3.39	.38	3.47	.37	3.35	.39	3.63	.42	9.41*	1>2;4 5>2;3;4

Not: 1=below 6 years, 2=6-10 , 3=11-15, 4=16-20, 5= above 20 years
p< .05

A similar finding has been determined with respect to learning assessment dimension of the scale; teachers with less than 6 years of experience feel more efficient than those with 6-to-10 and 16-to-20 years of experience, and participants with more than 20 years of experience consider themselves more efficient than those with 16-to-20, 11-to-15, and 6-to-10 years of teaching experience.

Do teachers' perception of teaching efficacy vary across their branches?

Table 9 shows that teachers' perception of self-efficacy vary significantly across all dimensions of the scale in terms of the branches they teach; course design [F= 2.97, p< .05], instructional strategy, [F= 5.58, p< .05], technology use [F= 4.09, p< .05], classroom management [F= 4.82, p< .05], interpersonal relations, [F= 4.82, p< .05], learning assessment [F= 5.09, p< .05].

As for course design, the difference in the scores is in favor of Turkish Language teachers as opposed to Social Studies teachers. With respect to instructional strategy and classroom management, mathematics teachers have been noted to have the highest score of teaching efficacy among all others. When it comes to technology use, English Language teachers have been determined to feel more efficient than class teachers. Besides, another significant difference has been recorded in favor of Class teachers, English Language teachers, and Turkish

Table 9. *ANOVA Results of Teaching Efficacy Scale across Branches*

	Class (n= 232)		Math. (n= 46)		Social Studies (n= 113)		Science (n= 69)	
Dimension	*M*	*sd*	*M*	*sd*	*M*	*sd*	*M*	*sd*
Course Design	3.50	.38	3.51	.33	3.47	.36	3.53	.32
Instructional Strategy	3.49	.39	3.61	.43	3.42	.34	3.33	.39
Technology Use	3.47	.42	3.45	.38	3.53	.44	3.28	.40
Classroom Management	3.67	.35	3.82	.26	3.66	.36	3.58	.32
Interpersonal Relation	3.51	.40	3.57	.38	3.50	.45	3.36	.45
Learning Assessment	3.57	.38	3.58	.29	3.37	.38	3.27	.38

	English (n= 71)		Turkish (n= 77)			
Dimension	*M*	*sd*	*M*	*sd*	F	Post hoc
Course Design	3.53	.31	3.58	.39	2.97*	6>3
Instructional Strategy	3.32	.44	3.50	.39	5.58*	2>1345; 6>5
Technology Use	3.605	.30	3.54	.41	4.09*	5>1 156>4
Classroom Management	3.66	.34	3.68	.32	2.60*	2>13456
Interpersonal Relation	3.43	.58	3.60	.41	2.15*	126>4, 36>5
Learning Assessment	3.46	.35	3.57	.44	6.46*	1>345, 56>43

Note: 1=Class Teacher, 2=Mathematics, 3=Social Studies, 4=Science, 5= English, 6=Turkish
p< .05

Language teachers compared to Science teachers. As for interpersonal relations, similarly, Class teachers, Mathematics teachers, and Turkish Language Teachers have scored higher than Science teachers. Moreover, another significant difference has been identified in favor of Social Studies teachers and Turkish Language teachers as opposed to English Language teachers. With respect to learning assessment, the figures in the table

indicate that the difference is in favor of Class teachers as opposed to Social Studies teachers, and also that Class teachers have higher teaching efficacy scores than both Science and English Language teachers. Finally, English and Turkish Language teachers have been determined to feel more efficient than Social studies and Science teachers.

Discussion and Conclusion

This research has examined teaching efficacy perception of teachers working at state primary and secondary schools. Classroom Management has been determined as the highest efficacy dimension for all the participants. Other dimensions in a descending order are course design, interpersonal relations, learning assessment, and technology use. The dimension that teachers feel the least efficient has been identified as instructional strategy. Similarly, Chang et.al. (2011) also concluded that instructional strategy is the least efficient dimension for faculty members. A teacher with weak knowledge on methods may easily end up instructing monotonous lessons (Celik, 2002: p. 120). Ozturk (2004) reports that teachers continue to employ traditional methods in their classes. Soylu (2009) concludes that Mathematics teachers feel efficient with traditional methods but not with contemporary ones. Teachers working at all levels of education are expected to attract students' attention and to help them retain information through use of various methods and techniques. Especially the success of programs designed in accordance with constructivist approach depends highly on teachers' skills in employing methods and techniques based on student-centered activities. Aslantas (2011) reports that instructional strategies-methods and techniques, communication, and assessment and evaluation skills are teachers' weaknesses. Furthermore, other studies also point that teachers are not good at using methods and techniques compatible with student-centered approach, and they often resort to traditional methods. Yesilyurt (2013) and Akcadag (2010) conclude that teachers are in need of further training about teaching methods and assessment and evaluation.

In this research, teaching efficacy has been analyzed across six dimensions. Many other studies focus on only one of the dimensions for teachers of different branches and teacher candidates. Results that other studies have concluded so far are as follows. Duran, Mihladiz & Balliel (2013), who focused on the dimension of assessment and evaluation which happens to be the fourth efficacy field in this research, state that teachers' efficacy levels concerning alternative assessment and evaluation procedures are generally high. On the contrary, Gelbal, Kelecioğlu (2007) report that teachers mostly use traditional assessment methods and they need extra training about assessment and evaluation techniques. In this study, course design has been identified as the second highest efficacy dimension for teachers. Gozutok, Akgun and Karacaoglu (2005) conclude that teachers go through serious problems regarding instructional planning skills. Interpersonal relations have been noted to be the third dimension of efficacy for the participants in this study. Likewise, Bagci (2007), Gonen and Kocakaya (2006), Yıldırım and Demir (2003), and Pehlivan (2005) also report that teachers feel efficient about communication skills.

A comparison of teaching efficacy perception between the graduates of education faculties and those of other faculties yields that graduates of education faculties feel more efficient about course design, classroom management, and learning assessment. Since students at education faculties take comprehensive courses about all the dimensions of the scale and they consider themselves as teachers during undergraduate years, this result is not surprising at all. With respect to gender, the difference is in favor of female teachers in terms of classroom management, interpersonal relations, and learning assessment. However, Seferoglu (2004) states that there is no difference between female and male teacher candidates in terms of teaching efficacy. On the other hand, Ozdemir (2008; 2009), Dilci (2012) express that female teacher candidates have a higher efficacy perception

about methodology than males. As for the match between teachers' background education and the courses they teach, the significant difference is in favour of those with a full match in terms of course design, instructional strategy, and learning assessment. With respect to attending a professional course, those teachers who partook in training have higher levels of teaching efficacy perception across all dimensions, but classroom management. Unver and Demirel (2004) report that teacher candidates who attended the training sessions organized by the authors improved their planning skills. Karacaoglu (2008) also states that teachers participating in in-service training have higher levels of teaching efficacy perception. Considering the seniority of participating teachers, results point to statistically significant differences across all the dimensions of the scale, but classroom management. On the whole, teachers with less than 6 and more than 20 years of experience have been noted to have higher levels of teaching efficacy perception. This result may be explained as follows; relatively new teachers are more enthusiastic to teach what they learned during their education and to prove themselves, and teachers with more than 20 years of experience feel efficient due to their long years of working life. Yet, Dilci (2012) reports that seniority does not lead to any difference in teaching efficacy perception. Lastly, teachers' perception of teaching efficacy has been determined to vary across all dimensions in terms of the branches they teach. Similarly, Ozdemir (2008) and Karacaoglu (2008) also conclude that teachers' efficacy levels differ across various branches.

It was required that teachers have three main efficacy; general cultural knowledge, field knowledge and professional teaching knowledge in our country. The teaching efficacy of teachers examinated in the study associated with teaching profession. Celebi (2004) expressed that teachers efficacy should have include course design, instructional method/ strategy, class management, communication skill, learning assessment according to MEB. Teaching efficacy classification performed by Chang and colleagues (2010; 2011) similar to this teaching efficacy classification. Only difference from classification performed Chang and colleagues (2010; 2011) were the lack of in the use of technology. Additionally, teacher training programs have been included more technology courses. It was expected that primary/secondary school teachers more use technological materials in our country.

Recommendations

As mentioned earlier, instructional methods/strategies have been noted as the weakest point of efficacy for the participating teachers. Therefore, it may be wise to increase the amount of relevant courses during undergraduate education. Apart from principles and methods of teaching course, other compulsory courses focusing on active learning methods and techniques may be incorporated into the curriculum, and these classes may be taught based on practice. Since the graduates of education faculties have higher levels of teaching efficacy perception, appropriate regulations may be mandated to employ only the graduates of education faculties as teachers. Moreover, teachers should be encouraged to teach only the courses within their branch because participants with a full match have been identified to have higher levels of efficacy perception. Teachers may be offered opportunities (such as graduate studies) to improve themselves in accordance with their interests and needs.

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Students' Opinions on the Light Pollution Application

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Abstract

The purpose of this study is to determine the impact of computer-animated concept cartoons and outdoor science activities on creating awareness among seventh graders about light pollution. It also aims to identify the views of the students on the activities that were carried out. This study used one group pre-test/post-test experimental design model with 30 seventh graders. The data in the study were collected via open-ended questions on light pollution and semi-structured interview questions. The open-ended questions on light pollution were administered as a pre-test and a post-test. After the post-test was administered, semi-structured interviews were conducted with seven students. The data collected from the open-ended questions and semi-structured interviews were qualitatively analysed and quotes from the students' statements were included. Looking at the answers of the students to questions on light pollution, it was understood that the activities that were carried out were effective. Furthermore, all of the students that were interviewed made positive statements about the activities that were carried out.

Keywords: Light pollution, Concept cartoons, Students' views.

Introduction

Humans are an indispensable part of the environment that they live in. Due to the rapid increase in population, overurbanization, industrialization and, consequently, the excessive use of natural resources, today, environmental issues have become global issues. Currently, light pollution is one of the global issues that are negatively affecting the whole world. Light pollution is defined as the wrong use of light in a way that disturbs living things (Aslan, 2001). Various studies have revealed the reasons and effects of light pollution. Crawford (2001) found that wrong outdoor lighting causes light pollution. Osman, Isobe, Nawar and Morcos (2001) and Çetegen and Batman (2005) stated that light pollution is an important problem for astronomical studies, the environment and the

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economy. In their studies, they suggested what could be done. In their study on the reasons, results and solutions to light pollution, Percy (2001) and Hanel (2001) found that people did not have sufficient knowledge on light pollution. Sadık, Çakan and Artut (2011) examined the perceptions of students on environment problems via the pictures that the students drew. They found that the students drew the loss of forests, air pollution, decreasing species, spoiling ozone layer, sound pollution, soil pollution, global warming, etc., as environmental problems in a reason-result relationship. However, they saw that only one student drew a picture about light pollution.

It is necessary to move beyond determining the current state and create educational activities that are aimed towards preventing light pollution and thus, creating awareness among individuals. In Greece and Hungary, which recognized the significance of creating awareness in society on light pollution, various activities are carried out among primary school teachers and students in order to teach the subject and create awareness (Demircioğlu Yıldız & Yılmaz, 2005). Studies that have been conducted have revealed that students do not have enough knowledge on light pollution, which is an interdisciplinary issue concerning many disciplines (Sadık, Çakan & Artut, 2011; Seçgin, Yalvaç & Çetin 2010).

As environmental problems negatively affect all living things, environment education, which is an important part of science classes, has become a significant necessity. The aim of science teaching is to educate science-literate individuals. Enabling students to find solutions to problems primarily in their environment using scientific process skills is an important step towards developing science-literacy. In the seventh grade science teaching curriculum, various environmental problems are discussed. However, light pollution, which is an important issue in ecological, economic and astronomical terms, is not included. This study discusses light pollution, which is included within the topic of environmental problems and their impact in the science classes of seventh graders. This topic aims to teach students about the light pollution topic through computer-animated concept cartoons and outdoor educational activities. The learning outcomes concerning this topic in science and technology classes are given below:

The students collect information on an environmental issue in our country and in the world. They present it to the classroom and discuss its consequences.

The students suggest collaborative solutions towards environmental problems in our country and in the world, and participate in activities.

The research problem of the study can be stated as: “What are the students’ views on computer-animated concept cartoons and outdoor education activities?” In the current study, the scenarios that are related to light pollution are supported by computer-aided concept cartoon animations in order to attract the interest of the students. In teaching through concept cartoons, some alternative ideas concerning scientific facts are drawn on paper as cartoons. However, only one of these given ideas is scientifically correct. The concept cartoons start a discussion concerning the concepts in the characters included in the cartoon and present them (Keogh, Naylor & Wilson, 1998; Keogh & Naylor, 1999). Thus, the aim is to reach the scientifically correct idea. In concept cartoons, generally, the questions or views of three or more characters on a daily issue are given in speech balloons (Uğurel & Moralı, 2006). The ideas are then discussed by the whole classroom through the cartoon characters.

The purpose of this study is to create awareness among seventh graders about light pollution through computer-animated concept cartoons and outdoor science activities. It also aims to enable the students to develop solutions and reveal their views concerning the activities and practices that are carried out.

Within the scope of outdoor educational activities, sky brightness was measured with a sky quality meter during the night in selected settlements of Ordu province, which is located in the Black Sea coast of Turkey, in selected dark locations and natural living environments. In addition to numerical measures, the photographs of the sky were taken with a camera with a wide-angle lens and thus, light pollution is shown visually. In addition, the students took photographs showing the light pollution within the city and conducted studies towards removing the existing light pollution. With this study, the studying and thinking environments in which the students were active and carried out activities towards solving an everyday problem were created. In order to ensure meaningful learning on light pollution and create awareness among the students about the importance of the issue, computer-animated activities, which were enriched with concept cartoons and outdoor educational activities, were carried out. The students' views on the activities that were carried out were taken. We found that the results of previous studies indicated the positive impact of materials that had been prepared using animations in computer-aided teaching in student achievement and in removing misconceptions (Yılmaz & Saka, 2005; Rotbain, Marbach-Ad & Stavy, 2008; Çepni, 2009; Özyılmaz Akamca & Hamurcu, 2009). Taking such results into consideration, the current study used animations in preparing the concept cartoons concerning light pollution. One of the most efficient activities that are used to make education more fun and interesting is computer animations (Arıcı & Dalkılıç, 2006). With their colours and motions, animations increase retention and make it easier to materialize abstract concepts or things and to visualize them in mind (Rieber, 1990; Çakır, 1999). Thus, it is possible to create rich learning environments for students.

In this study, which aims to create awareness among students about light pollution, scenarios and concept cartoons concerning the reasons and effects of light pollution were prepared, considering the negative impacts of light pollution in ecological, economic and astronomic terms (Osman et al., 2001; Percy, 2001; Demircioglu Yıldız & Yılmaz, 2005). We tried to make the concept cartoons visually interesting for the students through computer animations. In addition, work sheets that were prepared for each animation with concept cartoons were administered to the students. Only one of the character's statements on light pollution in the concept cartoons is scientifically correct. In the activities that were prepared and developed, the students were asked which concept cartoon's idea they agreed with. Thus, a discussion was started and they were made to reach the correct one. The students worked in groups and stated which cartoon character's idea they agreed with.

The scientific content of the concept characters in the computer animations were examined by two experts working in the field of science. Furthermore, the draft animations were examined by experts who prepare animations in flash programme and thus, the identified gaps were filled.

Method

Participants

As this was an experimental study, a study group was taken instead of choosing a sample. This study was carried out with 30 seventh grade students (18 males and 12 females) studying at a secondary school in Ordu province during 2014-2015 academic year.

Research Design

One group pre-test-post-test experimental design model was used in this study. In this model, assessments both before the experiments (pre-test) and after the experiment (post-test) were made (Karasar, 2014). Research design is shown in Table 1.

Table 1. *Experimental design*

Before the experiment	Experimental process	After the experiment
Pre-test (T_1)	Instruction through computer-animated concept cartoons and outdoor science activities.	Post-test (T_1, T_2)

T_1: Open-ended questions related to light pollution
T_2: Semi-structured interview form

Data collection

The data in this study were collected through open-ended questions and semi-structured interview questions on light pollution, which were prepared and developed by Aydın (2015) and used by Özyürek and Aydın (2015) in their project study. The open-ended questions related to light pollution were administered both as a pre-test and post-test. The experimental study took two weeks. In the first week of the experiment, five computer animated concept cartoon activities were carried out during four class hours. The pilot study of the activity was carried out with 19 seventh grade students. The activities carried out were: "Why are the roads dark?", "Where is the sea?", "The migratory routes", "What unconscious lighting causes" and "Where should I make astronomical observations?"

Additionally, in the second week, outdoor education activities were carried out with the students. Using a sky quality meter, the sky brightness measurements were made in the school garden, city centre and Yoroz City Forest during the night. Thus, areas where there was light pollution were identified and the common features of these places were discussed. Similarly, Aydın and Özyürek (2015) used a sky quality meter for night sky brightness measurements in their study. In addition, the students were made to take photos of wrong lighting, which could cause light pollution. The wrong lighting practices, as well as the solutions to them, were discussed through the photographs that the students took. After the experimental study was completed, post-tests were administered. With seven students among the 30 participating students of the study, semi-structured interviews were made to determine the students' views on the activities conducted, and these interviews were recorded.

Analysis of data

The students' answers to the open-ended questions were descriptively analysed. The data were reduced, categorized and put into tables. The data collected via the open-ended questions from 30 students were analysed by two researchers. To ensure its reliability, the consistency between the two analyses was controlled. The reliability rate was found to be 93%.

According to Miles and Huberman (1994), the analysis of the data collected from an interview follows a consecutive three-step that affect each other: reduction of data, data display and conclusion drawing and verification. In order to reduce the data, raw data are coded based on certain categories (Patton, 1990). Within the framework of these categories, the data are coded, the essential parts are extracted and the remaining parts are taken out. The decodings of the semi-structured interviews were recorded by a tape recorder and controlled by two researchers. This ensured that the decodings were correct. The two researchers examined the data from the interviews and the themes and codes of the interviews were formed. The reliability percent between the two was found to be 95%. The data that were collected from the descriptive analysis of the interviews were summarized and interpreted according to the pre-set themes. Furthermore, in order to

reflect the opinions of the individuals that were interviewed, direct quotations were included.

Findings

The purpose of this study is to determine the impact of computer-animated concept cartoons and outdoor science activities on creating awareness among seventh graders about light pollution. It also aims to identify the students' views on the activities that were carried out. The findings of the study are presented within the framework of a descriptive analysis of open-ended questions and themes from the semi-structured interviews, which were carried out with seven students among 30 participating students to whom open-ended questions were administered.

Table 2 includes the frequencies and students' statements concerning their answers to the types of pollution that could be considered as an environmental problem today.

Table 2. *The frequencies of and students' statements to "What do you think are the types of pollution that could be considered as an environmental problem today?" question.*

Types of environment pollution	Pre-test (*N*= 30)		Post-test (*N*= 30)	
	f	Student statements	*f*	Student statements
Air	18	Air pollution, drying up of water resources, not making forestation, light pollution (2nd student).	20	Air, light, environment and sea pollution are significant environment issues (2nd student).
Water	12	That people throw litter after they have a picnic and this litter is not collected. That factories throw their litter into water and do not attach filters to their chimneys (7th student).	16	Light pollution, air pollution, water pollution and soil pollution, etc. (7th student).
Light	20	Throwing litter on the ground, spitting on the ground, unnecessary lighting of street lights, etc. (11th student).	30	Light pollution, air pollution, water pollution, environment pollution (11th student).
Soil	1	Throwing litter on the ground, spitting on the ground, that factories throw litter into the sea, cigars polluting the air (13th student).	15	Light pollution, sea pollution, and soil pollution (13th student).
Sound	14	Light pollution, sound pollution, air pollution, environment pollution and water pollution (23rd student).	8	Light pollution, sound pollution, soil pollution, environment pollution and water pollution (23rd student).

As Table 2 shows, the students saw air, water, light, soil and sound pollution as types of pollution that could be considered as environmental issues today. Furthermore, there was an increase in the students' answers on all types of pollutions in the post-test and they all mentioned light pollution.

Table 3 shows the frequencies and students' statements concerning their answers to what kind of negative effects light pollution has on the environment question.

Table 3. *The frequencies of and students' statements to "What kind of negative effects do you think light pollution has on the environment?" question.*

Negative effects of light pollution	Pre-test (*N*= 30)		Post-test (*N*= 30)	
	f	Student statements	*f*	Student statements
On animals	13	There will be excessive light, which disturbs both humans and animals and thus, causes light pollution (23rd student).	22	There will be excessive light and the migrating birds move towards these lights and therefore, they lose their way. Sea turtles hatching move towards the light instead of the sea and they could die (23rd student).
On humans	17	Light pollution negatively affects the human eye: eyes prone to excessive light lose their seeing ability (12th student).	18	Light pollution might affect us economically. It could cause problems in our eyes (12th student).
On economy	4	Excessive light causes us to lose our energy. Excessive lighting in a place causes to unnecessary use of light (2nd student).	11	It causes animals, for example, Caretta Carettas, to move towards the coast instead of the sea due to the lighting and to die, as a result. Similarly, it causes us to lose our energy (2nd student).
On astronomical studies	-	-	6	We cannot see the stars during the night because there is so much light, we spend a lot of energy (3rd student).

As it is seen in Table 3, the students indicated that light pollution has negative impacts on animals, humans, economy and astronomical studies. There was an increase in the frequency of students' answers to the negative effects of light pollution on the environment after the application. Meanwhile, there was no student who could state that light pollution could negatively affect astronomical studies. There were six students in the post-test who mentioned this fact.

In order to find out the opinions of the students on the activities and practices that were carried out, they were asked: "Were there any differences between how the light pollution topic and other topics were previously taught?". All of the students indicated that there were differences in how the light pollution topic was taught, compared to the other topics that were previously taught.

Table 4 shows the students' statements concerning what kind of differences the students see between how the light pollution topic was taught, compared to other topics that they were taught before.

Table 4. *The frequencies of and students' statements to "What kind of differences did you see in how the light pollution topic in science class was taught compared to other topics that were taught before?" question.*

Differences in how the light pollution topic was taught	*f*	Student statements
Measurements that were made	3	In other classes, it was mere teaching but when we were taught about light pollution, we conducted activities and made measurements (8th student).
Outdoor education activities that were made	5	In the activities that were related to light pollution, we carried out outdoor education activities. However, in other topics, we only made activities within the school; the difference is doing activities outside (10th student).
Activities that were carried out	4	With the visual activities that we carried out, I learnt more (23rd student).

In Table 4, it is seen that the interviewed students stated that there were such differences as making measures, carrying out outdoor education activities and practices in how the light pollution topic was taught in science classes, when compared to other topics of the same course.

Table 5 shows the views of the students about what caught their attention the most when the light pollution topic was taught.

Table 5. *The frequencies of and students' statements to "What caught your attention the most when the light pollution topic was taught?" question*

Things that caught the students' attention when the light pollution topic was taught	*f*	Student statements
Animations of migrating birds	2	I was very impressed with the slowing down, hindering and even stopping of the migration of migrant birds and, as a result, with their death (25th student).
Caretta-Carettas animations	3	That Caretta Carettas could not move towards the sea because of the artificial lighting and they died (27th student).
Taking measurements using a sky quality meter	2	Measuring light pollution with a sky quality meter (3rd student).
Astronomy animations	1	I was impressed with whether or not we see the stars and the brightness of the activity of the stars (8th student).

It is seen in Table 5 that the students stated that they were impressed with the animation of migrant birds, Caretta-Carettas animations, taking measurements with the sky quality meter and astronomy animations while the light pollution topic was taught.

Table 6 shows the views of the students on what they think about the activities and studies that were carried out while the light pollution topic was taught.

Table 6. *The frequencies of and students' statements to "What do you think about the activities and studies that were carried out while the light pollution topic was taught in science classes?"*

Opinions on the light pollution activities	*f*	Student statements
Fun	3	It was fun to tell our personal ideas and discuss them with the group that was formed after we watched the animations on light pollution... (27th student).
Interesting	3	Outdoor education activities were fun. It was interesting and enjoyable to have the chance to make measurements with the sky quality meter... (10th student).
Easy to remember	2	In science classes, it is easy to remember the things that were prepared with animations (25th student).
Didactic/informative	5	First of all, with these activities, I produced an idea, I mean, I did not know much about light pollution and I learnt more (23rd student).

Table 6 shows that the students stated that the activities and studies that were carried out while the light pollution topic was taught were fun, interesting, easy to remember and didactic/informative.

Table 7 shows the views of the students on the activity that they liked the most while the light pollution topic was taught.

Table 7. *The frequencies of and students' statements to "Can you please tell the activity you liked most while you were taught light pollution? Why did you like that activity?" question*

The activity that the students liked the most	*f*	Student statements
Taking measurements using the sky quality meter	5	…The data that we measured with the sky quality meter and, in particular, the data from the city forest attracted my attention. For example, I did not know that there was so much light pollution around the school. We learnt it more easily with that device. In other words, we learnt more... (23rd student).
Group discussions and decision-making after the animations	1	...The activity that I liked the most was the animations and the activities in which our opinions were asked. We expressed our ideas freely and learnt about the topic (25th student).
Caretta Carettas animations	3	I most liked the Caretta Carettas animations and I was very sad that they die because of light pollution (8th student).

According to Table 7, it is seen that, of all the activities conducted while the light pollution was taught, what the students liked the most were making measurements using the sky quality meter, group discussions and decision-making after the animations and Caretta Carettas animations.

Table 8 shows the views of the students on whether they would like other topics to be taught in the way that light pollution was taught.

Table 8. *The frequencies of and students' statements to "Would you like to learn other topics in Science classes in the way you were taught light pollution? Why?" question*

The reasons for demanding other topics to be taught in the way that light pollution was taught	*f*	Students' statements
Fun	3	Sure I would want that. First of all, it was fun. We normally do not do such wide scale activities at school - what we normally do is very limited (10th student).
Interesting	4	There are more visual activations and I liked them more, they were more interesting (23rd student).

According to Table 8, the students stated that the reasons behind demanding other topics to be taught in the way that light pollution was taught are because it is fun and interesting.

Table 9 shows the opinions of the students on what kind of benefits learning science classes in the way that light pollution was taught would bring.

Table 9. *The frequencies of and students' statements to "What kind of benefits do you think learning Science classes in the way you were taught light pollution will bring?*

Benefits of learning science in the way that light pollution was taught	*f*	Students' statements
Detailed /comprehensive learning	3	...In other subjects, we cannot spend as much time as we did on light pollution... (27th student). … For example, I did not know that there was so much detail and information about light pollution. With such things as outdoor observations, I believe I will learn a lot more (23rd student).
More permanent learning	3	…It is more permanent and we learn better (11th student).
Easy to learn	2	We learn more easily when we are doing enjoyable activities or experiments ... (10th student).
Fun	1	...For example, while we are taught a topic, we are sometimes bored and do not want to listen to the teacher or we cannot understand because we are bored. However, the measures we take outside of school are fun and permanent (10th student).
Creates awareness/ raises consciousness	3	For example, before we did the activities and practices concerning light pollution, I would not realize the places where there is light pollution and would just pass by (25th student).

It is seen in Table 9 that the students stated that learning other topics in science class in the way that light pollution was taught would be beneficial. This is because it will ensure more detailed/comprehensive learning and permanent learning. It will also make learning easier and more fun, as well as creating awareness and raising consciousness.

Discussion, result and suggestions

Computer-supported concept cartoons that enabled the students to fill work sheets, which are made up of concept cartoons, in groups and outdoor school activities increased the rate of correct answers to the open-ended questions in the post-test. While the number of students who indicated light pollution as an environmental issue was quiet small in the pre-test, this number increased in the post-test. Similarly, Sadık, Çakan and Artut (2011) examined 206 fifth grade students' perceptions on environment problems studying at three different primary schools from different socio-economic levels via the pictures that the students drew. They saw that the students drew the loss of forests, air pollution, decreasing species, spoiling ozone layer, sound pollution, soil pollution, global warming, etc., as environmental problems in a reason-result relationship. However, they saw that only one student drew a picture about light pollution. Additionally, Taşlıdere (2013) indicated in his study that the work sheets that were enriched with concept cartoons had positive effects on the students' conceptual learning.

It is believed that the activities that are carried out with seventh grade students concerning light pollution will ensure that the students have awareness on the ecologic, astronomical and economic results of light pollution and that they will develop solutions towards preventing light pollution.

All of the interviewed students from the classroom, in which computer-animated activities enriched with concept cartoons and outdoor education activities were carried out, stated positive views on the activities that were conducted. The students stated that they learnt the reasons and impacts of light pollution well. In addition, it was seen during the interviews that the students did not think that light pollution could harm some living things. The students also indicated that they enjoyed making computer-animated activities and outdoor education activities.

The students stated that the way light pollution was taught was different from the way that other science topics were taught and that they did activities, outdoor education activities and measurements.

All of the students stated that they wished science classes were taught in the way that light pollution was taught. They also stated that learning in this way is more enjoyable and interesting.

The students stated that the activities were fun, interesting, informative and easy to remember.

The following suggestions can be made for further studies:

Concept cartoons, which prevent misconceptions and support students to learn by searching and questioning, can be used to determine and remove misconceptions.

It is believed that including light pollution by emphasizing its ecological, astronomical and economic significance within the scope of a science teaching programme will create awareness of the topic among students - in other words, among the future generation.

It is believed that using computer-aided concept cartoons in learning environments and learning science through outdoor education activities will contribute to meaningful learning among students and will make classes more interesting for them.

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APPENDIX – A

Picture 1: An outdoor science education activity with students

Picture 2: An example for light pollution

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Instructional Materials Commonly Employed by Foreign Language Teachers at Elementary Schools*

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Abstract

This study aimed to determine the teachers' choices of instructional materials in teaching English at elementary schools. The reasons behind preferring or not preferring some certain instructional materials specified within the research were analysed. To this end, during the course of School Experience, 68 prospective English teachers observed 38 teachers of English working at 14 elementary schools on a weekly basis, and they completed a questionnaire. A semi-structured interview was also conducted with five randomly selected teachers to identify their reasons for choosing certain instructional materials. The descriptive results revealed that most of the teachers were reluctant to use many of the highly beneficial materials due to reasons including overcrowded classes, limited technological knowledge, lack of time for preparation, curricular time constraints, heavy work load, burnout etc. The study suggests that apart from course-books teachers should be encouraged to use other instructional materials to motivate learners and offer an interactive foreign language teaching atmosphere.

Keywords: Instructional materials, Elementary schools, Teachers, Language teaching, Technology.

Introduction

Changes in learning styles of students and types of instructional materials available have put a great amount of pressure on the teachers, who inevitably need to keep up with the innovative techniques in technology and teaching methods. It is a fact that teaching, which is admittedly a long and hard process, is primarily composed of five components: students, teachers, instructional materials, teaching methods, and evaluation (Kitao & Kitao, 1997). Of these components, instructional materials in foreign language teaching can refer to a variety of things. They can be defined as any tool that teachers use to assist their students in adequately learning the target language; means used to increase students' access to that language; every instrument that contributes greatly to students' progress; anything which

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is used by teachers and learners to facilitate the learning; and the keys to have influence on what goes on in the classroom, just to list a few (Brown, 1995; Crawford, 2002; Jones, 2009; Littlejohn, 2012; McDonough, Shaw & Mashura, 2013; Richards, 2010;Tomlinson, 2008).

As regards the use of instructional materials to foster foreign language learning, foreign language teachers tend to employ them at the right time and in the right proportion. Offering a myriad of benefits to both teachers and learners in teaching and learning English as a foreign language (EFL) context, a variety of instructional materials need to be included in the agendas of teachers. Research proves that instructional materials highly facilitate learning and greatly draw learners' attention to the target language (Littlejohn, 2012; McDonough, Shaw & Mashura, 2013; Solak & Çakır, 2015; Tomlinson, 2012). Simply put, they have a considerable influence on foreign language learners and they play an extremely influential role in the EFL classes. To support this view, Richards (2001) asserts that instructional materials generally serve as the basis of much of the language input that learners receive and the language practice that occurs in the classroom. Thus, it is suggested that instructional materials need to be motivating and interesting. According to Chomsky (1988), 99% of teaching is making the students feel interested in the material. To make the materials more interesting for foreign language learners, teachers should seek to find and present alternative techniques. In this sense, the present study with its findings and suggestions aims to contribute to the professional development of the teachers and preservice teachers so that they can be more effective and well equipped in teaching the target language.

Significance of the study

This study intends to shed light on the issue of professional and qualified language teachers' need to be able to use instructional materials properly. Investigating this issue is important for teachers currently working at schools and student teachers who will take active roles in the classes in coming years. Additionally, it can be asserted that this study is significant in that there is not much research exploring the instructional material preferences of English language teachers at elementary schools in Turkey.

Review of literature

The essence of the current century brings about an overwhelming amount of information which involves using efficient mechanisms to ameliorate learning and teaching activities (Kuzu, Akbulut & Şahin, 2007). In this respect, as mentioned above, it is worth stressing that instructional materials play a crucial role in any EFL setting. Before explaining its role in language teaching settings, it would be wise to clarify the types of materials that are commonly utilized by teachers and learners. Tok (2010) categorizes these instructional materials into two groups: printed ones such as course-books, workbooks, teacher's guides etc.; and non-printed ones such as computer-based materials, videos etc. Correspondingly, Tomlinson (2012) classifies the language teaching materials in terms of instructional purposes as follows: informative (informing the learning about the target language); instructional (guiding the learner in practicing the language); experiential (providing the learner with experience of the language in use); eliciting (encouraging the learner to use the language); and exploratory (helping the learner to make discoveries about the language). In other words, instructional materials in an EFL context have an indispensable role as they facilitate language learning (Tomlinson, 2008), draw learners' attention, motivate learners towards foreign language learning, provide comprehensible input (Krashen, 1985) and authentic language (Lee,1995), make learning more concrete and more meaningful, and guide the learner in practicing the language.

From a general perspective, instructional materials can be categorized in three groups: (1) Traditional materials; (2) audio and visual materials; and (3) information communication technologies (ICT) based materials. Traditional materials that can be regarded as classic or old usually include board, course-book, worksheet, chart, realia, flashcard, teacher made materials, etc. As for audio and visual materials, which are regarded as new for many teachers, are video player, audio materials, video camera, computer, projection device, and so on. The third category for the instructional materials, widely acknowledged as the newest, is ICT based materials such as Interactive White Boards (IWB), materials providing mobile assisted language learning (MALL) such as Web 2.0, tablet computers, the internet, podcasts, smartphone, Web 3.0 etc.

Of all the materials listed above, particularly, course-books are the only materials that most of the foreign language teachers use in the EFL classrooms, and they are automatically expected to include all aspects of language (Çakır, 2010). Course-books play a pivotal role in language classrooms in all types of educational institutions – state schools, colleges, language schools – all over the world (Rahimpour & Hashemi, 2011). Sheldon (1988) regards the course-book as the visible heart of any ELT program and she puts forth a number of reasons to justify the widespread use of course-books in the teaching of English as a foreign or second language throughout the world. They are the universal elements of language teaching (Hutchinson & Torres, 1994) for many teachers as they have ready-made materials and syllabi designed by the specialist in the field. In Cunningsworths' (1995) words, "course-books provide a resource, a source of activities, a reference, a syllabus, a great support for inexperienced teachers, and serve as a source for self-directed learning or self-access work" (p.7).

The other issue that should be focused on regarding the use of course-books in English language teaching (ELT) is its role in raising learner's motivation. In attempt to figure out whether there is a positive relationship between the course-book and language learning, Rahimi and Hassani (2012) conducted a study on Iranian foreign language learners. The result revealed that there was a positive relationship between Iranian students' positive attitudes towards EFL course-books and their attitudes towards learning English as a foreign language. On the other hand, Richards and Renandya (2002) claim that many of the course-books as preplanned teaching materials have some possible following disadvantages (as cited in Kayapınar, 2009): (a) They fail to present appropriate and realistic language models; (b) They propose subordinate learner roles; (c) They fail to contextualize language activities; (d) They foster inadequate cultural understanding; (e) They fail to teach idioms. In consistent with this claim, Tsiplakides (2011) believes that among the main negative effects of the use of course-books is that they may contain inauthentic language, may distort content, may not satisfy students' needs, and may be expensive to buy. Educationally speaking, course-books are not a magical tool, and they have both advantages and disadvantages for EFL learners and teachers.

It is widely accepted that presenting the target language only through ready-made printed materials does not always contribute to comprehensive and meaningful understanding. Thus, apart from the course-books or textual materials, teaching should also be supported by other visual materials such as pictures, flashcards, posters, tables, charts, etc. In this context, Mayer (2009) claims that visual materials play an important role in assisting instruction in order to clarify, define and explain the related teaching point. Therefore, it is safe to say that in order to create a meaningful learning atmosphere and to offer a comprehensible input, word and pictures need to be presented simultaneously. In this way, learners have a chance to construct both verbal and pictorial mental schemas and build connections between them (as cited in Kuzu, Akbulut & Şahin, 2007). Furthermore, words and visual aids brighten up the classroom and bring more

variety and interest into language lessons, as well as help to provide the contexts which illuminates the meaning of utterances, and helps in giving information of one kind or another about life in the foreign country concerned (Lee & Coppen, 1971). The other contribution of visual materials to language learning is that they assist teachers by giving them time for necessary classroom activities like drills, exercises, instructions and explanation (Abebe & Davidson, 2012).

It is true that with the rapid advancements in technology, new facilities and devices such as ICT based materials have been brought into the EFL classroom. New trends in teaching are increasingly technologically interactive, which precedes the instructional materials at the service of learners and teachers. In this digital age, particularly foreign language teachers must cope with new challenges, responsibilities, and duties. As Shamylee and Phill (2012) agree, the tradition of English teaching has been drastically changed with the entry of technologies. In this respect, language teachers cannot disassociate themselves from new technology, which allows for the application of scientific knowledge to practical tasks (Çakır, 2006). In other words, technology satisfies both auditory and visual senses of the students in learning environments (Shyamlee & Phil, 2012). It is undoubtedly true that audio-visual materials offer paramount effects on understanding of both written and spoken language. Some of the basic audio-visual aids that are frequently used in foreign language teaching include audio books, mp3, sound files, podcasts, the Internet, CDs, songs, videos, etc. Ali, Ghani and Ali (2010) maintain that the history of the audio-visual aids can be traced back to the Greek Period, however, the technological advancements have brought new innovations in the form of computer assisted programs and accessories. That is to say, technology is seen that it is not a new issue concerning only modern teachers. This long history also explains the effectiveness of audio-visual materials (Rao & Jyoti, 2012).

Foreign language teaching, in particular English language instruction has been conducted with primarily the most available instructional materials, such as course-books, flashcards, audio recordings, video etc., despite their countless benefits, instructional materials have not been utilized properly to assist language learning. In many cases, unfortunately, it can be observed that a great amount of teachers resist using innovative materials due to limited knowledge and time. However, it is widely accepted that a single extracurricular material or activity brings a wide variety into the classroom. In this regard, it would be wise to cite the famous Chinese proverb "A picture is worth a thousand words", which clearly and simply explains the function of a single material to clarify the meaning of something better. Therefore, it is essential for foreign language teachers to utilize a variety of instructional materials so that language teaching can turn out to be fun and motivating for learners.

The study reported here aimed to identify the types of the instructional materials that were employed or overlooked by the foreign language teachers. To this end, the following research questions were formulated to guide the present study:

1. What kinds of instructional materials do foreign language teachers use at elementary schools?
2. What are the possible reasons for utilizing certain instructional materials in the EFL classrooms?

Method

Participants

Participants included 38 teachers of English working at elementary schools in Kayseri, Turkey and they were informed about the observations to be conducted. The age range of

the participants was 24-48 with an average age of 30.97 and standard deviation is 4.783. There were 25 male and 13 female participants with the average working experience of 7.73 years. They were observed by 68 students majoring in English language teaching at a state university. The student teachers, who were selected randomly on a voluntary basis, were assigned to take notes of instructional materials specified in the questionnaire that the participants used to promote teaching English. The student teachers were all fourth-year students and had a compulsory training program in which they were required to complete the related procedure of school observation. That is, they attended the related schools and observed the participants in fulfilment of the requirements of their course of School Observation course. Apart from this course, the student teachers also took the course of Materials Development and Evaluation in Foreign Language Teaching, in which all kinds of instructional materials were introduced and evaluated.

Research instrument

In order to gather data about the types of instructional materials used to teach English, a questionnaire was designed by the researcher. In the development phase of the survey, the instrument was forwarded to four faculty members and an outside expert in the same field. Upon receiving the positive feedback, the survey was first piloted with ten prospective ELT teachers in order to determine whether or not the content of the questions were valid. The comments taken during this process were considered in redesigning some of the items in the questionnaire. The questionnaire consisted of Likert-type questions using a three-point scale seeking the frequency of the usage of 15 instructional materials that language teachers are supposed to use in EFL classrooms. It was assumed that in order to motivate and draw learners' attention teachers should vary the types of materials used.

Data analysis

To conduct this descriptive study, the questionnaire was distributed to 68 ELT department students. They were asked to evaluate 38 teachers that they had been observing two times a week for three months. They were requested to evaluate objectively and choose the correct usage frequency of materials by teachers. The data obtained from the questionnaire were analysed through SPSS 17 program using descriptive statistics and frequencies. The researcher also interviewed with five randomly selected teachers during and at the end of the research to explore the reasons behind employing or not employing the instructional materials specified in the research instrument. The questions in the interview were spontaneous to cross-check the data in the questionnaire.

Findings

The aforementioned survey included 15 instructional materials that might be utilized in EFL classes by foreign language teachers. The findings of this study were analysed in four groups. Materials were classified with regard to their functions in teaching process, such as: main sources, visual aids, audio-visual aids, technological aids, and other materials. The items associated with the main sources included course-books, workbooks, printed materials (worksheets, photocopies etc.), and board; the second category, visual aids, to investigate was composed of visual, audio, and audio-visual aids such as flashcards, pictures/posters, audio/recording materials (speakers, etc.), songs or podcasts, and videos and films. The third group of instructional materials under research was composed of information communication technologies (ICT), interactive white boards and projectors, and Internet based materials such as Dyned, Morpa Campus etc. The last part of the research instrument included the materials of real objects, authentic materials, and games.

Table 1. *The percentage of the basic materials use*

	Instructional Materials	*Always*		*Sometimes*		*Never*	
		f	%	*f*	%	*f*	%
1	Course-book	35	92.1	3	7.9	0	0
2	Workbook	27	71.1	10	26.3	1	2.6
3	Printed Materials (Worksheets etc.)	13	34.2	22	57.9	3	7.9
4	Board	32	84.2	6	15.8	0	0

As can be estimated, the materials employed by the participants are those that can be easily available such as course-book, workbook, printed materials, and the board. The results revealed that participants in the study heavily depended on the printed materials listed in Table 1. It is clearly indicated above that almost all of the participants (*always*= 92.1% and *sometimes*= 7.9%) regarded course-books as the fundamental element of teaching. Thus, it is obvious that course-book remains as the main component of English teaching settings as every teacher in this study, without exception, uses it. In addition, almost all of the respondents (97.4%) stated that workbook would help them to practice the target language. Apart from the course-book and workbook, additional printed materials were also among the most frequently used ones by the participants to enhance classroom instruction. Being a traditional material, the board (*always*= 84.2%, *sometimes*= 15.8%) was the other most frequently employed material by the participants. Even if it seems to be a traditional or outdated material, it still serves as a useful tool in teaching settings for many classroom teachers.

Reasons for too much reliance on the course-book and board

In a semi-structured interview conducted with five teachers, the reasons for over-employing the course-book and board to assist teaching were investigated. In this respect, following questions were asked. "What are the advantages and disadvantages of course-books?", "Why do you think many teachers are heavily dependent on course-books and boards to assist teaching the target language?", "What makes you feel secure about using the course-book?". It needs to be clarified here that due to the small sample size, the statements below cannot be overgeneralized for all the teachers of English working at elementary schools in Turkey. The following is a selection of representative interview quotes from teachers talking about their heavy reliance on the course-book and board:

- They are ready-made materials and everything is provided. (T1, T3, T4)
- When we have a course-book we feel more secure. (T2, T4, T5)
- We don't have enough time to prepare extra materials.(T2, T3)
- They are enough to teach the target language. (T4, T5)
- We need to follow the syllabus set by Ministry of Education (MoE). (T1, T2, T3, T5)
- When we use extracurricular materials, students cannot follow them easily. (T3, T5)
- We feel that we need to write everything on the board. (T3, T4)
- Students are used to copying everything on their notebooks. (T2, T4)
- It is easier to explain the teaching point on the board. (T3, T5)
- Students do not learn when we don't use the board. (T1, T4)
- When I don't write the rules/sentences on the board, I feel something missing in my teaching. (T3, T5)

As is clearly seen course-book keeps its popularity in the eyes of the teachers. In this regard, Prodromou (1999) points out that teachers do not often introduce any extraneous material into the lesson as they regard the course-book as a holy book which is not tampered with or questioned. According to the quotes obtained from the participants, a general view is that students don't need to be offered other instructional materials when the course-books are accompanied with the board. Additionally, they think that these two close friends would be sufficient for both themselves and students as long as they are exploited properly.

Table 2. *The percentage of visual, audio, and audio-visual aids use*

	Instructional Materials	*Always*		*Sometimes*		*Never*	
		f	%	*f*	%	*f*	%
5	Pictures /Posters	4	10.5	15	39.5	19	50
6	Flashcards	2	5.3	12	31.6	24	63.2
7	Audio/recording materials (speakers, etc.)	2	5.3	10	26.3	26	68.4
8	Songs/podcasts	4	10.5	9	23.7	25	65.8
9	Videos/films	3	7.9	12	31.6	23	60.5

Table 2 indicates that half of the participants (50%) prefer pictures/posters as visual aids to facilitate teaching. The reason why they are used more than others might be due to their availability. Despite their effectiveness and availability, it is seen that more than half of the participants (*never*= 63.2%) do not utilize flashcards as instructional materials. The other type of instructional materials that were investigated in this study were audio/recording materials. Research proves that listening materials have a great benefit for learners to acquire the target language as they provide linguistic and communicative input. However, the results indicate that 68.4% of the participants do not pay much attention to the use of audio/recording materials. This fact is also supported with the results obtained from other audio visual materials such as songs and podcasts (*never*= 65.8%) and videos and films. The percentage of those who never use video in their EFL classrooms is 60.5%. It seems that less than half of the participants (*always f*= 2, *sometimes f*= 10) are eager to use audio and recording materials as technological tools. However, the use of audio materials would always be beneficial for non-native speakers as such kinds of tools bring the real language into the classroom. The productive role of video and audio materials in EFL setting is undeniable. They enable learners to be exposed to the target language in its real context. It is not always possible for non-native English teachers to otherwise create realistic language-usage situations in the classroom. Furthermore, recording materials, when applied appropriately, can be used for multiple purposes such as listening to audio recordings, recording learners' own voices, conducting a podcast activity, listening to songs and podcasts etc. In other words, the use of podcasts as a new technology has huge potential in enhancing second language learners' listening and speaking skills (Jarvis, 2004; Stanley, 2005). In this study, the results show that the percentage of those who use audio/recording materials is very low (*always*= 5.3%, *never*= 68.4%). To maintain an enjoyable and attractive teaching atmosphere, songs, and more recently podcasts are regarded as two important materials that deserve to be utilized by teachers. Particularly the use of songs which are now available in many course-books delivered by the Ministry of National Education carries crucial importance in teaching some language patterns and chunks. Educationally speaking, young learners, even adults, enjoy learning through songs. However, this research proves that many of the teachers (*never*= 65.8%) are not particularly willing to make use of songs.

Table 3. *Responses to the use information communication technologies (ICT)*

	Instructional Materials	*Always*		*Sometimes*		*Never*	
		f	%	*f*	%	*f*	%
10	Projector/Interactive White Board (IWB)	2	5.3	13	34.2	23	60.5
11	Internet based materials	1	2.6	18	47.4	19	50
12	Courseware programs (DynEd, Morpa Campus, etc.)	2	5.3	6	15.8	30	78.9

The data obtained from the class observations and semi-structured interviews demonstrate that teachers rarely use ICT materials. It was noticed that teachers were reluctant to use projection device and IWB although many schools had either projection device or IWB. According to the results, 60.5 % of the participants do not use it whereas only 5.3% of the participants adopt it for educational purposes. When it comes to Internet based materials, it is seen that half of the participants use them (*always*= 50%). The other type of instructional material that is freely offered to the use of students at state elementary schools is DynEd Courseware. Apart from DynEd, some other online e-course software programs such as Morpa Campus, Dahiders, etc. are also available for many foreign language teachers. As it is indicated in Table 3, most of the teachers (78.9%) do not use the freely offered courseware as a supplementary material for learners. On the other hand, when utilized appropriately, mobile assisted language learning (MALL) based materials entail myriad of benefits for foreign language learners in that they are fast, effective, flexible, authentic, personal, motivating, portable, and sometimes informal. Furthermore, as they are easy to use anytime and anywhere, the effective use of technology in and beyond the walls of the classroom would help learners gain autonomy.

Table 4. *Responses to the use of other materials*

	Instructional Materials	*Always*		*Sometimes*		*Never*	
		f	%	*f*	%	*f*	%
13	Real objects	4	10.5	11	28.9	23	60.5
14	Authentic materials	1	2.6	10	26.3	27	71.1
15	Materials for games	5	13.1	18	47.4	15	39.5

The positive role of real objects and authentic materials in foreign language settings is undeniable and they should be utilized in every stage of language teaching. In this way, it would be possible for learners to study and acquire the target language meaningfully and communicatively, rather than through mechanical and rote learning. However, the results of this study demonstrate that such crucial materials are not employed as required. As shown in Table 4, while one third of the participants (28.9%) used authentic materials, the percentage increased to 38.9 % for real objects. On the other hand, 60.5% of the participants prefer games for instructional purposes in the classrooms, which supports the belief that the participants are aware of the benefits of games in elementary education. Thus, it is highly suggested by the researcher that young learners should be introduced to the target language by using concrete objects efficiently.

Reasons for not employing instructional materials effectively

To figure out the reasons for not using a range of instructional materials sufficiently and efficiently, five randomly selected teachers were requested to express their opinions. Therefore, the following spontaneous questions were asked to the interviewees. “Do you use additional materials in the class?”, “What sort of problems do you encounter when you use extra instructional materials?”, What do you think about utilizing instructional materials in teaching English?”. Based on the results, the following statements clearly reveal that employing extracurricular activities and materials might bring extra workload

on many teachers. For that reason, they tend to avoid such efforts. Some of the prominent results that the teachers stated are listed as follows:

- We have to cover the content of the curriculum in a given period. (T1, T2, T3, T4, T5)
- My students don't understand when I use extra material. (T3, T4)
- Once I tried to use audio material, the class didn't react positively. They didn't understand and lost their motivation. (T2)
- I have too much workload. I can't spend much time on the use of materials. (T3, T4, T5)
- I have a course-book. I think that is enough for my class. (T2, T4, T5)
- Students need to learn grammar first. (T3)
- My students won't go abroad. So I don't need to focus on communicative activities that require additional materials. (T4)
- When I attempt to use an instructional material apart from the book, I need to prepare beforehand. However, the course-book entails all the activities for teaching English. (T1,T3,T4)
- It is not my way of teaching. It is not easy to get used to novelty. It takes time. (T1, T4)

The statements above clearly reveal that utilizing extracurricular instructional materials is not quite possible for the participants due to some factors. Possible factors include the content of the curriculum, time constraints, time allocated to the course, adapting the new materials etc. The participants also believe that a course-book itself would be efficient to cover the units. In general, it can be concluded that utilizing instructional materials apart from the course-book is not appreciated adequately by the participants.

Discussion

The current study aimed to determine the types of instructional materials that the foreign language teachers employed to teach English in the state elementary schools in a city in the centre of Turkey. To do this, 38 teachers were observed for fourteen weeks in terms of the instructional materials they preferred to supplement their English teaching. In this descriptive study, five of the teachers who were observed were also interviewed during the term to validate the data and to explore their reasons for using or not using some of the materials. A general finding in this study is that most of the teachers are not so very willing to take part in teaching activities that require additional material, effort and time. When analysed carefully, it is possible to come across some factors such as burnout, not attending to professional development activities, limited technological knowledge, limited time to prepare and apply the related materials, workload, etc., one of the important factors that lead teachers to avoid implementing the innovative techniques and materials in the EFL classes would be to suffer from burnout (Cephe, 2010). For that reason, it is suggested that the teachers need to update themselves and their knowledge regularly in order to keep up with the innovations in the field. Depending on the results obtained in this study, it is highly suggested that teachers should participate in the conferences, workshops, symposiums and in-service training programs. To support this view, Akyel (1999) collected some data from the semi-structured interview with foreign language teachers to find out the reasons for not participating in the professional development activities. The results that she obtained are consistent with the findings of the present

study, including too much workload, low salary, not enough enthusiasm, administrative problems, etc., professionally speaking, it can be stated that foreign language teachers should attend professional development activities regularly in order not to lose their motivation and to stay up-to-date.

Based on the results in this study, it can also be stated that course-books still remain the indispensable teaching tool for many teachers. Sheldon (1988), Hutchinson and Torres (1994), and Richards (1990) believe that course-books lie at the heart of any English language teaching situation. Furthermore, they offer advantages for teachers and language students alike, and they constitute a useful resource for both teachers and learners. Moreover, they are irresistible tools in ELT contexts because, as indicated in this study, it is difficult for teachers themselves to create their own teaching materials. Not only for teachers, but also for students course-books are an unavoidable component of language instruction since their progress and achievement can be measured concretely when they are used in the English classroom (Haycraft, 1998; Hashemi, 2011). The interviewees in this study also generally stressed that course-books allowed them to guarantee a degree of consistency in the course taught by a number of different teachers.

Although the participants in this study seem to depend heavily on course-book and the board, it is clear that they have tendency to use some other audio visual materials to facilitate language learning in the classroom. Pictures (50%) and flashcards (36.8%) are two sorts of visual materials that the participants employ in the classroom. The percentage of the ones who always and sometimes use video in EFL classrooms is 39.5% with 5.3% use of audio recording materials, it can be concluded that the participants are not technologically friendly enough to cover the courses as required. On the other hand, it is a fact that use of audio-visual materials makes learning more long-lasting than the use of traditional textbooks (Craig & Amernic, 2006).

Findings in this study indicated that teachers, unfortunately to a great extent, tend to use the traditional instructional materials which do not require too much preparation for the teachers despite the existence of many other current instructional materials. One of the reasons for not utilizing some instructional materials in the class is that they are not always possible for the participants to reach. However, although many schools have either a projector device or an IWB and they offer a lot of advantages for language learners, the results (*never*= 60.5%) show that they are not adopted as required. The results of this study support the finding of Turel and Varol (2012) in that teachers are reluctant to use technology due to limited knowledge of technology.

Additionally, the results of the study prove that authentic materials, real objects and materials used for games aren't exploited efficiently. In order to expose learners to the target language in its real contexts authentic materials such as radio programs, magazines, news, songs, etc. need to be introduced to the learners. The result (28.9%) in this context is not satisfactory for the benefits of foreign language learners. As Brinton (1991) asserts, authentic materials and media bring the outside world into the classroom and thus students can build the direct relationship between the language classroom and the outside world. The number of those who prefer to use real objects is a lit bit higher (38.9%). In foreign language teaching contexts, real objects usually have a crucial role considering the fact that the more learners are exposed to concrete objects the faster they learn.

Conclusion and recommendations

This study sought to determine the types of instructional materials employed by foreign language teachers at elementary schools. Being a hard task for foreign language teachers, teaching should be supported with multiple instructional materials. To this end, teachers should also be well-prepared, well-qualified, and well-motivated. In the current century,

due to the rapid advancement of technology several technological devices have appeared to be utilized for the benefit of language teachers. Most of the learners, who are called as digital natives today (Prensky, 2001), expect to be provided with these instructional materials as well as the traditional ones. Therefore, the choice and appropriate use of instructional materials appropriately has a vital importance to increase the effectiveness of instruction.

These findings suggest that that it is necessary to refine the traditional foreign language teaching classrooms. To create an interactive and effective learning environment, learners should be provided with audio and video supported materials. If possible, learners should be able to access language learning materials easily, and also be able to communicate with their teachers and peers beyond the walls of the classroom. As for the teachers at elementary school, the use of technology needs to be encouraged and they should know how to integrate technology into the curriculum. It is crucial to know how to utilize materials at hand meaningfully and responsibly. The research proves that heavy reliance on the course-book does not lead the teachers to successful and satisfactory results. Rather, they need to consistently vary type of materials; use correct, natural, and current and standard English; and adapt and develop appropriate materials, both commercial and non-commercial, all the time.

It can be concluded that apart from the ready-made and printed materials, other instructional teaching materials, which are most likely to draw learners' attention, are also overlooked by many of the foreign language teachers. Even though most of the classrooms at the elementary schools are equipped with projection devices and IWBs, it is observed that some of the teachers remain reluctant to utilize them. It is safe to say that this study has highlighted the continuous importance of professional development of foreign language teachers through seminars, in-service training programs, conferences, and workshops. Thus, it is suggested that these development activities make it possible for teachers to gain personal growth, to familiarize themselves with innovative techniques in the field, to have professional enthusiasm, and to better exploit the materials at hand for the benefit of learners.

The present study has some limitations such as types of research methods (questionnaire, semi-structured interview), number of the participants (n= 68), types of instructional materials researched (15 types), date of the research (2012 fall term), and analysis of the data (descriptive). Further study with more sampling groups using other research methods is therefore recommended. However, the present findings of this study may offer insights for educational administrations, decision and policy makers, and, of course, for many of the teachers of English working actively at schools today.

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A Bilingual Child Learns Social Communication Skills through Video Modeling-A Single Case Study in a Norwegian School Setting

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Abstract

Video modeling is one of the recognized methods used in the training and teaching of children with Autism Spectrum Disorders (ASD). The model's theoretical base stems from Albert Bandura's (1977; 1986) social learning theory in which he asserts that children can learn many skills and behaviors observationally through modeling. One can assume that by observing others, a child with ASD can construct an idea of how new behaviors are performed, and on later occasions this mentally and visually constructed information will serve as a guide for his/her way of behaving. There are two types of methods for model learning: 1) *In Vivo Modeling* and 2) *Video Modeling*. These can be used a) to teach children with ASD skills that are not yet in their behavioral repertoire and / or b) to improve the children's emerging behaviors or skills. In the case of linguistic minority children at any stage of their bilingual development, it has been presumed that some of their behaviors that can be interpreted as attitude or culture-related actions. This approach, however, can sometimes delay referral, diagnosis, and intervention. In our project, we used *Video Modeling* and achieved positive results with regard to teaching social communication skills and target behavior to an eleven year-old bilingual boy with ASD. Our study also reveals that through *Video Modeling*, children with ASD can learn desirable behavioral skills as by-products. *Video Modeling* can also contribute positively to the social inclusion of bilingual children with ASD in school settings. In other words, bilingual children with ASD can transfer the social communication skills and targeted behaviors they learn through second-language at school to a first-language milieu.

Keywords: Autism spectrum disorders (ASD), Video modeling, Bilingual children with ASD, Prevalence of ASD in Norway.

Introduction

Video Modeling is one of the recognized methods used in the training and education of children with autism spectrum disorders (ASD). The model's theoretical base stems from Albert Bandura's (1965, 1977) social learning theory in which he asserts that children can learn many skills and behaviors observationally through modeling. By observing others,

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children with ASD can construct an idea of how new behaviors are performed, and on later occasions this mentally and visually constructed information serves as a guide for their own behavior.

Children with Autism Spectrum Disorders as Visual Learners

Visual learning strategies are defined as two- or three-dimensional representations of a particular concept used to communicate and teach that idea. These strategies can take the form of pictures, icons (black and white cartoon like images), photographs, or gestures to enhance the understanding of spoken word(s) in communicating an idea. In this way, visual systems are used to strengthen the child's understanding and use of communication in his/her environment by taking advantage of the visual learning strengths of children with autism. Indeed, there is some evidence that individuals with ASD are able to process two- or three-dimensional visual supports more easily than transient input, such as auditory stimuli (Quill, 1997). Visual supports are therefore often used to aid children with ASD to maintain attention, understand spoken language, and sequence and organize their environments (Hodgdon, 1995). Hodgdon described visual supports as tools used to compensate for difficulties not only in attention, but also in auditory processing, sequencing, and organization. She contended that children with ASD display fewer behavioral problems and increased compliance when visual supports are used to communicate expectations as opposed to when these supports are not used in structured environments (i.e., school classrooms). One particularly effective visual learning strategy that has been used to teach children with autism conversational skills is *Video Modeling*.

Ozonoff et al. (1991), examined the skills of 23 individuals with autism (ages 8-20) and with IQs above 69. These individuals were matched to controls on IQ, age, gender, and SES. These researchers presented the participants with a wide variety of tasks, including a verbal memory test (Buschke Selective Reminding Test) and the Children's Embedded Figures Test (visual task). Ozonoff et al., found that those individuals with autism presented lower scores on a verbal memory test, but that there were no between-group differences on the visual task. This indicates that although individuals with autism showed deficits in verbal skills, they showed no deficits in visual skills. On the basis of these and other studies, it is established that children with ASD can be considered visual learners (Charlop-Christy, et al. 2000; Schreibman et al, 2000). There are two types of methods for visual learning: *1) In Vivo Modeling* and *2) Video Modeling.* These methods targeting desirable behaviors and skills through observation.

In Vivo Modeling

In Vivo Modeling seeks to promote visual learning through the observation of live models, including children or adults. These models may be the child's parents, siblings, teachers, or classmates. These examples allow for the subjects to model a specific kind of target behavior in a familiar context where such target behavior might naturally occur. *In Vivo Modeling* is regarded as an effective training strategy for children 2-15 years old with autism (Jahr et.al., 2000). Yet this procedure can have some limitations. *In Vivo Modeling* is time consuming, requiring intensive training of models. Another critical aspect of this method is that models sometimes that lack the necessary precision and consistency in their behavior. Furthermore, *In Vivo Modeling* necessitates the imitation of complex tasks in live models that the child must focus on, responding to several of its characteristics. This can create several problems for children with Autism Spectrum Disorders (ASD) because many of them struggle with attention and especially with over selectivity. This creates obstacles for them in drawing attention to the essential aspects of the behavior in the living models (Charlop-Christy et al., 2000).

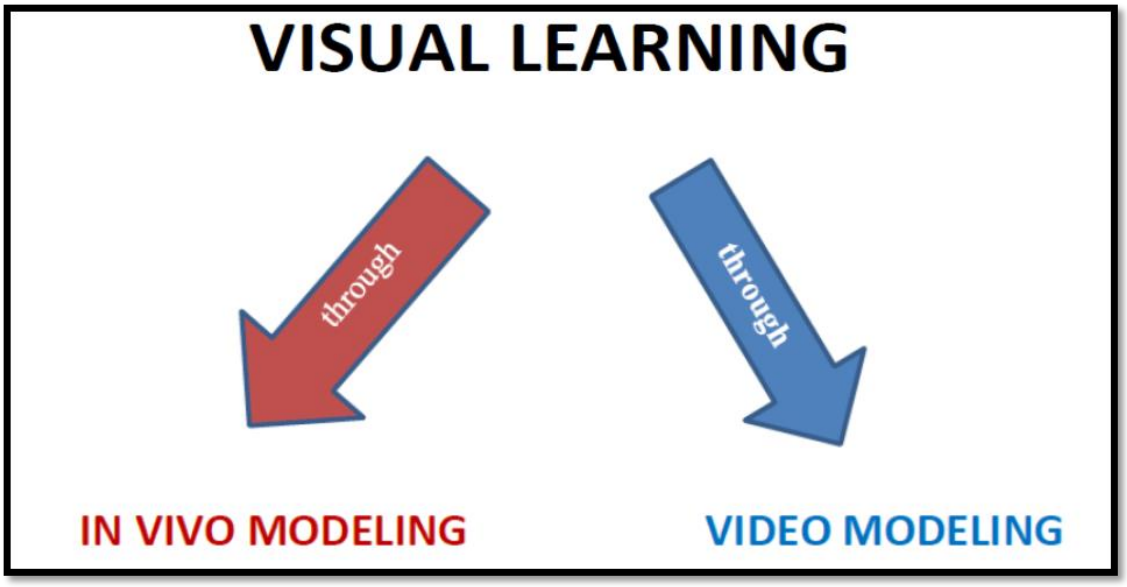

Figure 1. Two methods for visual learning

Video Modeling as an academic durable training, treatment, and teaching program for children with ASD

Video Modeling, as compared to *In Vivo Modeling,* seeks to promote visual learning by observing and imitating models that have been recorded on video and are observed by the child on a television, computer monitor, iPads or other mobile devices like iPhones. Clips from other video sources, such as from YouTube, may also be employed. *Video Modeling* can be used:

a) to teach skills to children with ASD that are not yet in their behavioral repertoire

b) and / or to improve children's emerging behaviors or skills.

Video Modeling is an effective and well-researched intervention for children with ASD, requiring them to simply watch short, filmed clips of a model completing a targeted behavior or behaviors. The child is then given the opportunity to demonstrate the observed behavior (Bellini & Akullian, 2007). In traditional *Video Modeling* programs, the child watches the video on a television screen or computer monitor repeatedly until he or she consistently exhibits the modeled behaviors. Recently, *Video Modeling* has been addressed using portable apparatus such as iPads, iPhones, and iTouch. While recent research on the utility of doing *Video Modeling* is mixed, and further research needs to be carried out, the efficacy of *Video Modeling* remains a robust finding in the United States. A recent literature review (Øzerk & Øzerk, 2013) revealed that American researchers have made tremendous progress concerning assessment, diagnosis, training, treatment, and teaching in the past three decades. Several studies have shown that behaviors, skills, and learning material to be learned by children with ASD is often best presented via visual stimuli; training and teaching activities using *Video Modeling* procedures can therefore be seen as an effective means of intervention

Researchers Steinborn and Knapp (1982) used *Video Modeling* to make a child with autism familiar with the traffic on their local street corner. The first exercises focused on pedestrian crossing and took place in a decorated classroom, where traffic and intersections were artificially made. Later, the method was used to help children transfer and apply these skills in their local environment.

Haring and Lovinger (1989) used *Video Modeling* to teach three children with ASD to go shopping using a stepwise procedure. Charlop et. al. (1990), taught two children with ASD to participate in games and learn turn taking in cooperative play using *Video Modeling*. Taylor et. al. (1999), conducted two experiments. In the first, researchers had children with ASD observe siblings and an adult as models using *Video Modeling*. The results showed that both of the children with ASD had learned to communicate adequately about interacting with adults in several play situations.

Using a multiple-baseline, within-subject comparison design, Charlop-Christy and colleagues (2000) compared the effectiveness of *In Vivo Modeling* and *Video Modeling*. Two behaviors of similar difficulty were selected for each participant and randomly assigned to be targeted via *In Vivo* or *Video Modeling*. In both examples, the child observed the targeted behavior (either by watching a live model or a televised clip) and was then instructed to demonstrate that behavior. Four of the five children acquired the behaviors targeted by *Video Modeling* faster than those targeted by *In Vivo Modeling*. For the fifth child, the rate of acquisition was the same for both training and teaching conditions. Further, *Video Modeling* was found to lead to better generalization across persons, setting, and stimuli. This increased utilization of acquired skills in untrained environments indicates that *Video Modeling* interventions are more likely to affect the children's functioning during their daily routines, which is the ultimate goal of training, treatment, and teaching. These findings support the efficiency of *Video Modeling* interventions.

In another study, Charlop and Milstein (1989) addressed the development of social-communicative skills by children with ASD. They found that *Video Modeling* increased the conversational speech of three children with autism. During baseline, the children only spoke in short phrases. Following intervention, the three children were able to engage in conversations with phrases of up to eight words. Further, the children increased their conversational speech when discussing new topics, interacting with different conversational partners, in novel settings, and in the 15 months after intervention was completed. Sherer et al. (2001), also used *Video Modeling* procedures to increase the level of conversational speech of children with autism. In addition to increasing conversational speech, *Video Modeling* has been used to effectively to promote variation in conversational speech (Charlop et al., 2009). After watching video clips consisting of multiple conversational topics, the children with autism in that study demonstrated more variation in their own conversation.

Adaptive skills have also been targeted with *Video Modeling*. Shipley Benamou et al. (2002), conducted a study that included three children with ASD. Other children with ASD (self-modeling) and several peers were used as models. The training focused on the following daily living skills such as making orange juice using a juicer, completing a letter to be mailed, taking care of animals, cleaning an aquarium, and covering a table.

The study used positive reinforcement to reward correctly implemented activities. To prepare each training video, the target behavior was analyzed in detail. Each skill was divided into sequences. The filming of these skill sequences was done from the child's perspective and focused only on the body parts that conducted each action sequence. This study proved that *Video Modeling* can be an effective educational strategy to promote such skills in children with ASD.

Utilizing *Video Modeling* can also increase other communicative behaviors. Nikopolous and Keenan (2004) used *Video Modeling* to target verbal and gestural play initiations. After watching the videos, the three participants in this study were found to increase their social initiations. Gains were maintained as long as 3 months following intervention. *Video*

Modeling procedures also effectively increased the spontaneous verbal requests of young children with autism (Wert & Niesworth, 2003; Özerk & Özerk, 2013).

D'Ateno et al. (2003), showed *Video Modeling*-clips to increase the solitary pretend play of a child with autism. After watching the videos, the child in this study increased both his play actions and verbalizations. These findings were later replicated with a larger sample of preschool children with autism (MacDonald et al., 2005). Additionally, those children also exhibited unscripted play actions and verbalizations.

Several other studies investigated the efficiency of *Video Modeling* through single case studies or studies with small groups of school age children with ASD. For example MacDonald et al. (2009), used *Video Modeling* to teach reciprocal pretend play to two children with autism (5, and 7 years) to engage in reciprocal pretend play with typically developing peers. They found that these two children with autism and their typically developing peers acquired the targeted skills. At the same the children with autism improved other social communication skills like verbalization, reciprocal verbal interaction and cooperative play.

Another study with *Video Modeling* (Rayner, 2010) showed that a 12 years old boy with ASD learned task completion and improved his skills brushing his teeth. Plavnick and Ferreri (2011) found that *Video Modeling* increased the functional mands (i.e., verbal behavior that specifies a desired outcome) demonstrated by children with autism and that children generalized observed gains. Lydon et al. (2011), found that *Video Modeling* increased the scripted play actions and verbalizations of 5 children with autism and that the children also exhibited increases in untrained settings.

Video Modeling has also been used to simultaneously target multiple verbal and nonverbal social-communicative behaviors (Charlop et al., 2010). During intervention, the three participating children watched video of an adult actor demonstrating appropriate verbalizations, intonations, gestures, and facial expressions. After watching the video three or four times, all of the children increased their demonstration of at least three of the four behaviors.

The previously described study by Charlop-Christy et al. (2000), included increased similar adaptive skills, like brushing teeth and combing hair. Additionally, *Video Modeling* coupled with other teaching strategies has facilitated the adaptive skills of children with autism. Alcantara (1994) used *Video Modeling* and other instructional strategies (including additional prompts and reinforcement) to teach children with autism and autistic tendencies to purchase items.

Ozen et al. (2012), studied teaching sociodramatic play skills to three 9-years old children with autism through *Video Modeling* in small group arrangement. The results of their study revealed that participants acquired their own roles via *Video Modeling.* In addition, they maintained the skills they acquired two weeks after the training sessions were completed. Huaqing Qi and Lin (2012) conducted a meta-analysis to determine the effectiveness of *Video Modeling* interventions on the social and communication skills of children with ASD. The researchers included twenty-six single-case design studies in their analysis. They concluded that their meta-analysis showed that *Video Modeling* interventions had a 53% improvement rate from baseline to phrases on enhancing the targeted social and communication skills for 59 children in these studies.

Here it's important to note that a vast majority of the above-mentioned psychological and educational research studies have focused on the treatment, training, and teaching of social communicative and adaptive skills in experimental studies and clinical settings.

There have been, however, several studies conducted in recent years in which *Video Modeling* was the dominating method researchers utilized in a school setting for children. As one example, Paterson and Arco (2007) targeted verbal and motor play behavior in two school-age children. They used a *Video Modeling* procedure and instructional prompts, redirection, and reinforcers, with young adults as the models. Their design was multiple-baseline across toys and a reversal. Their results show that *Video Modeling* helped children to increase their skills for appropriate play while their repetitive behavior decreased. In another study within a school setting using three school-age children, Nikopoulos and Keenan (2007) used peers as models and targeted the following skills: Social initiations, reciprocal play, and imitation. The results of this study showed that by utilizing *Video Modeling*, the three children with ASD improved the target skills. At the same time, they were able to generalize social initiations, reciprocal play, and imitation across peers. Moreover, they maintained these skills after the sessions were completed.

Another study by Scheflen et al. (2012), aimed to teach four young children with autism developmentally appropriate play and connected speech through the use of *Video Modeling*. They concluded that the four children with autism could successfully use *Video Modeling* to learn how to play appropriately with toys in both structured and generalized situations. But their progression was not very clear even though some of them demonstrated considerable improvement in their social communication in play.

In recent years several studies attempted to draw a conclusion about the effectiveness of *Video Modeling*. Acar and Diken (2012) concluded on the basis of the review of 31 studies on *Video Modeling* that video modeling is effective for teaching social skills, play skills, language and communication skills, functional skills, self-care skills, and daily life skills to children with autism. Another similar study conducted by Wilson (2013) focused on the use of *Video Modeling* in the school settings and concluded that *Video Modeling* is an evidence-based practice and it can be used easily and effectively in the school setting. As one can see in the following sections in our paper, we are not sure whether *Video Modeling* is so easy to use as an intervention method as one can get the best impression of Wilson's conclusion although the method may be effective.

Prevalence of ASD and bilingual children

Autism is the fastest-growing developmental disorder in the United States, and very likely in many other countries as well (Kim et al., 2011). The cause of this increasing rate of autism, however, remains unknown (Özerk & Özerk, 2013). When Leo Kanner described autism for the first time in 1943, he estimated autism incidence at 1 in 10,000 children. In the 1980s this ratio had risen to 2.5 per 10,000 births (Jepson & Johnson, 2007). By the 1990s, about 1 in 500 births were affected by autism spectrum disorders in the United States alone (American Psychiatric Association[APA], 2000). Several studies since that time (Yeargin-Allsopp et al., 2003; Bird et al., 2006) have further documented that when autism spectrum disorders (ASD) include Asperger Syndrome and pervasive developmental disorders otherwise not specified (PDNOS) in addition to the autism disorder, the prevalence of ASD is 1 in 166, or 1 in 155 people (Fombonne, 2005).

Based on the available data collected from the health and special education records of children who were 8 years-old and lived in areas of Alabama, Arizona, Arkansas, Colorado, Georgia, Maryland, Missouri, New Jersey, North Carolina, Utah, and Wisconsin in 2010, it was found that about 14.7 per 1,000 8 year-olds (or 1 in 68 American children) had been identified with autism spectrum disorder (estimates from the CDC's Autism and Developmental Disabilities Monitoring (ADDM), Network (2014). Here we see a significant increase in the incidence of ASD among children in US during the last few decades.

Several population studies in the 1980s and 90s concluded that a higher proportion of children from immigrant families than non-immigrant families experienced autism spectrum disorders (Gillberg et al, 1987; Goodman & Richards, 1995). A report published by the Autism Society of America (2000, s.3) states that ASF "... knows no racial, ethnic, or social boundaries." It also states the following about the relationship between social status and the incidence of autism: "Family income, lifestyle, and educational levels do not affect the chance of autism's occurrence". A comprehensive epidemiological study of 12,000 children in the UK concluded that there is no correlation between ethnicity and the prevalence of ASF (Fombonne et al., 2001). Meanwhile, a Swedish study in the city of Göteborg in Sweden (Nygren et al., 2011) revealed a dramatic increase of ASF among two year-olds. In 2000 the rate was 0.18% (*n*= 4,871); in 2005, 0.04% (*n*= 5,220); and in the latest survey in 2010, 0.80% of the city's two year-olds (*n*= 5007), in other words 1 of 125 children there were diagnosed with (ASD). In another extensive study in the Swedish capital city of Stockholm (Barnevik-Olsson et al., 2008) it was revealed that the incidence of autism disorder or pervasive developmental disorder is 3 to 4 times higher among children with Somali-Swedish background than other categories of children. The incidence rate is 1 out of 143 among Somali-Swedish children and 1 in 518 among children with non-Somali-Swedish backgrounds. It is difficult to explain this difference, and more research is needed in this area.

The incidence of autism in Norway and bilingual children

We do not have many studies or statistics about the incidence of ASD in Norway, but those we do have are quite informative. Gundersen and Hem (2008) reported that about 1 in 2,000 people in the 1970s and 80s were diagnosed with autism in Norway. In the late 1990s, this ratio became 1:1000. More recently, a 2010 a survey (Isaksen, 2010) revealed that in the counties of Oppland and Hedmark (2 of Norway's 19 counties), 1 in 210 children had been diagnosed with autism. A nationwide survey in Norway (Stoltenberg et al., 2010) revealed that 6 of 1,000 children have ASD. This means that 1 in 167 children were diagnosed with autism spectrum disorder in Norway in recent years. This survey covered the period from 1999 to 2009 and included 108,500 children who were 0-10 years old in this period. Two years later, Suren et al. (2013), from the same research group, found that the prevalence of ASD among 6 to 12 year-old children born in the period 1999–2011 was 0.6%. This equates to an average of 1 in 167 children in Norway being diagnosed with ASD in 2011. On the other hand, similar to U.S. statistics, the study found differences between Norway's 19 counties with regard to the prevalence of ASD. While in one of the counties, approximately 1 in 80 children were diagnosed with ASD, this ratio was approximately 1 in 330 in another county.

Bilingual children with autism spectrum disorders in Norway

According to official statistics (SSB Population 01.01.2011), the number of children with a bilingual background, that is to say, children with another language background than Norwegian-in the age range of 0 to 19 years-old, is around 167,000. These figures include indigenous children with Sami language background, national minorities, and linguistic minorities from families with an immigrant background. On the basis of the above-mentioned prevalence of ASD among those 0-19 years-old in the entire population, we can estimate that about 1,000-1,300 children with a bilingual background have ASD in Norway.

Unlike in the U.S., the educational authorities in Norway do not have any policy in which “evidence-based programs" or “*effective models*” are identified and made mandatory for treatment, training, and the teaching of children with ASD. Children with ASD go to ordinary schools in which there is a unit for children with ASD or a unit for children with

special needs. Each school or each unit decides how they want to work with these children and what types of methods they wish to utilize.

A single case study of Video Modeling in a Norwegian contest

Within the above-described educational context, we decided to use *Video Modeling* as an intervention strategy for an 11 year-old boy—hereafter Allan—in one of the neighboring municipalities of the capital city of Oslo. Allan is a bilingual child. His parents came to Norway as immigrants when Allan was 3 years-old. Allan was enrolled in Norwegian-speaking kindergarten when he was 5 years-old. After a year in Norwegian kindergarten, he began attending a public school at the age of 6. His home language was not Norwegian. His public school was a monolingual Norwegian school. During his initial three years, the school observed that Allan struggled with learning Norwegian as a second language, as well as social communication, reading, writing, and academic learning. When Allan was 9 years-old, he was referred to educational-psychological services for assessment and then to a neurologist. He received the diagnosis of autism at the end of third grade. In fourth grade, Allan's school set up an intervention plan to help him in reading, writing, and content area subjects. For this purpose, Allan was assigned eight hours for supportive teaching. Six hours were used by a Norwegian speaking teacher and two hours by a bilingual teacher.

This initiative helped Allan to start to improve his reading skills and become more involved in academic activities, but he only communicated with his second language teacher and bilingual teacher in one-on-one situations. Despite his areas of improvement, Allan still had huge problems with social communication and establishing friendships with classmates. He did not participate in any play or other social activities during class breaks. While other children played in the school yard, Allan would circle the schoolyard alone. At the beginning of fifth grade, we were contacted by the school to discuss intervention strategies.

During the first four years of Allan's schooling, the school did not use any clear method for developing his social communication skills. The school principal and the teachers who worked with Allan informed us that they were interested in improving their competency in different intervention methods, however. After receiving consent from Allan's parents, we read the medical and educational/psychological reports about Allan and talked to his parents, the school's principal, and his teachers.

In the referral reports, the school wrote, among other things, that *"The school believes that Allan dislikes the Norwegian language and Norwegian culture"*. In our meetings, one of the sentences the principal used was: *"I have never seen Allan smiling".* At the same meeting, one of the teachers expressed herself in this way: *"We need help to help Allan".*

During this initial period of our intervention study we observed Allan in the class and in the school yard. As it was mentioned earlier in the article, Allan had huge problems with *social-communication.* We identified the following:

a) *"Giving positive response to others' initiative for playing together"* and

b) *"Taking initiative for playing together with his friends"*

as the skills that Allan needed to learn. At the same time, we picked up signals that basketball could be one of the games that Allan was interested to play. During this planning period, we also observed that Allan played chess with only one of his Norwegian teachers and not with his peers.

Initiation and implementation of Video Modeling

We decided to use *Video Modeling* and utilize single subject analysis, the most common type of research design used for treatment analysis for behavioral interventions (Cooper, Heron & Heward, 2007) and specifically for *Video Modeling*.

We discussed our plan with Allan's parents, teachers, and the principal. It was necessary for us to explain what this method is about and make a plan for training his teachers and peers (classmates) as models. 8 of his classmates (3 girls and 5 boys) were chosen as models because they expressed interested in modeling. Then we received permission from their parents, all before summer holiday. After summer holiday, the school session started in August, and we set up our single case study on *Video Modeling*. Allan was now at fifth grade.

We spent about three weeks (From mid-august to first week of September) on the training of his full-time Norwegian teacher and the eight model peers. During this period, we registered a baseline for the skills that Allan needed for learning the target behavior*: "Giving positive response to others' invitation for playing basketball and chess together"* is an example*.* We identified the following skills that he needed to learn:

Table1. *Target behavior and the skills to be learned*

TARGET BEHAVIOR:	"Giving positive response to others' invitation for playing basketball and chess together"
SKILLS TO BE LEARNED:	
1.	*Turn to a friend who invites him to play basketball*
2.	*Establish eye-contact*
3.	*Participate in play in an active manner*
4.	*Demonstrate turn-taking in play*
5.	*Participatie in play at least 20 minutes without encouragement*
6.	*Give positive feedback to the friends by using appropriate words and expressions*

As mentioned earlier, basketball and chess were two of the games that Allan was interested in. We chose basketball for teaching him the skills he needed to master the target behavior. The reason for choosing basketball to start with was twofold:

a) We observed that Allan liked to watch others playing basketball, and we interpreted this as a sign that he wished to play basketball,

b) The season was suitable for basketball, and his peers were familiar with playing basketball at the school yard.

Baseline

We spent 5 weeks (three weeks in September and two weeks in October) to establish a baseline for the above-mentioned skills in the school year 2011-2012: mid-August to mid-June. During this baseline-period, we also had to involve Allan and try out some of the video-clips. We determined that we also needed to train Allan to learn from *Video Modeling* (See Figure 2).

Intervention with Video Modeling

After the period of training Allan's teacher and his peers and the baseline-period, we started to apply *Video Modeling*. In the first phase of the intervention, two video-clips were made and shown to Allan in a group room. The video clips included all the above-mentioned six skills. The language of communication was Norwegian. At the same time, his peers took initiative and invited Allan to play basketball during the school recesses. The 'peer-initiatives' included also the six skills.

The first phase of the intervention lasted six weeks (from the first week in November to the second week in December). The training of the targeted six skills was based solely on basketball.

The second phase of the intervention was also six weeks (from the last week of February to the first week of April). In this phase, the skills-training was based on *chess.* We knew Allan was also interested in playing chess, as were his peers.

Between the third week in December and first week in February, there was a Christmas holiday. In the other weeks before we started the second phase, the teachers and the model-peers continued to the *Video Modeling* with Allan. Between the second phase and the third phase, the schools had their Easter holiday.

The results of the training with *Video Modeling* are presented in the figure 2 below:

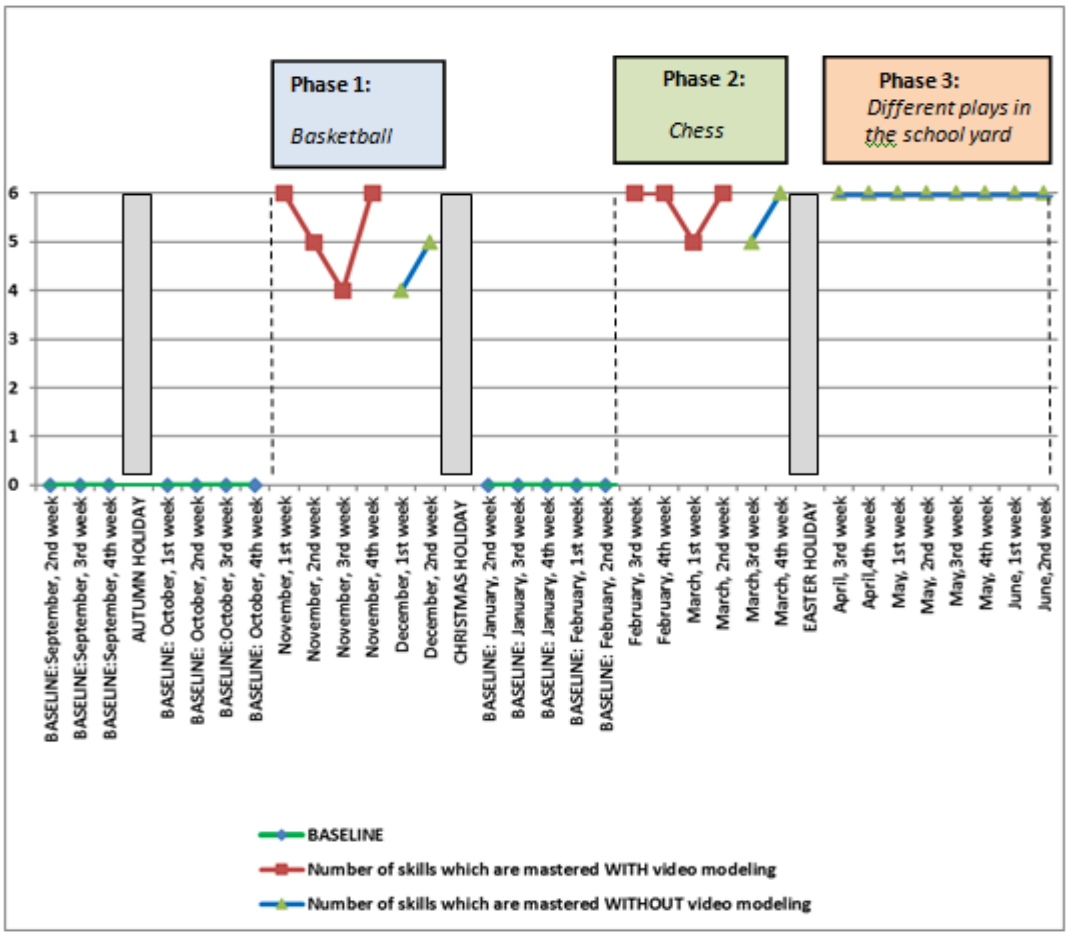

Figure 2. The results of the training with *Video Modeling*

As one can see in the figure, the overall intervention period was from the second week in September through the second week in June. During this period, there were holidays as noted (Autumn, Christmas, and Easter) and other activities at the school. Therefore systematic training with *Video Modeling* was conducted in a shorter period than ten months.

We spent seven weeks for determining an accurate baseline before *Video Modeling* related to 'Basketball' and five weeks establishing the baseline related to 'Chess'. As it is shown in the figure, Allan did not master any of the six skills he needed for social communication during the baseline, thus he could not give positive responses to his peers' initiatives for playing basketball.

Playing basketball as an arena for social skills training

It was interesting to register that Allan succeeded to use all the targeted six skills with *Video Modeling* within just the first week. When he was informed about the intervention plan and when he saw his friends' coordinated engagement to include and help him in playing basketball, he showed extraordinary effort and demonstrated that he could observe and imitate the models.

In the second and third week, we registered some retrogression. The main reason for this was that Allan seemed tired, but we could not discover why he seemed tired. The other reason was the distraction of a cat that was in the classroom, which captured his attention several times. However, in the fourth week (fourth week in November), Allan demonstrated that he could use all the six skills in basketball when he watched the skills demonstrated in the video prior to his peers' invitation. During the fifth and sixth weeks in the first phase of the intervention, Allan started to use 4 to 5 of the targeted skills related to basketball without *Video Modeling* taking place. Since Allan was also interested in chess, we decided to expand training at that point with chess.

Playing chess as arena for social skills training and transfer of skills

In the second phase of the intervention period, we covered the skills needed to play chess. During the first two weeks in this phase (3rd and 4th weeks of February), Allan could not transfer the six skills he learned in the first phase to playing chess without *Video Modeling*. In other words, he needed repeated exposure to the visual learning presentation of the same six skills by observing and imitating his peers on video. He was then given the opportunity to train more with *Video Modeling*. In the following two weeks (1st and 2nd weeks of March) he could master 5 to 6 of the targeted skills with the help of *Video Modeling*. But in the consecutive two weeks (3rd and 4th weeks of March), Allan showed significant improvement. He could demonstrate almost all six of the targeted skills without the reinforcement of *Video Modeling*. Now he could give positive response to others' initiatives for playing basketball and chess together.

The third phase and the generalization of skills to other games

The third phase of the intervention started at the 3rd week of April, after the Easter holiday. Since we had observed that Allan was able to give positive responses to others' initiatives for playing basketball and chess together without *Video Modeling*, we proposed that friends invite Allan to group games that were popular at that time at the school. We observed that along with basketball, there were three other popular ball-games: "kick the can", "the wall game" and "juggling with soccer ball".

As we were planning to make video-clips related to these games, Allan's friends took the initiative and invited Allan to participate in the mentioned games. We observed that Allan could generalize the skills he had already learned through *Video Modeling* to the new

play situations and new games. As one can see in the figure, he manages to give positive responses to his friends' initiative and play with them in eight weeks without *Video Modeling*.

The parents' experiences

During this third phase, we talked to Allan's parents to learn information about their observations of Allan at home, their experiences about the project period, and their overall views on his progress. Allan exhibited improvement in his social communication skills in communicating via his mother tongue at home. He could respond positively to other's initiatives and he himself could take the initiative for collaborative activities at home. These were skills and behaviors that he could not master prior to the project. We interpret this as transfer of the learned social skills and targeted behaviors in a second language to a first language. .

A new behavior as byproduct

As mentioned earlier in this article, the second targeted behavior was *'Taking initiative for playing together with his friends'.* Our plan was to use *Video Modeling* for teaching Allan this behavior as well. But during the third phase of the intervention, we observed that Allan himself started to take the initiative for playing with his friends. He took the initiative several times in a natural manner and received positive responses from his friends. We can therefore conclude that *Video Modeling* has the potential to create conditions for learning certain additional desired target behaviors as *byproducts.*

Other academic-related skills corresponding to improving social communication skills

Although the focus of this paper is on *Video Modeling* for teaching and learning certain core social communications skills and behaviors, we also wish to mention another aspect of Allan's situation with regard to other learning areas at the school. Since our *Video Modeling* was conducted in a school setting, we were also given some information about his situation in other areas. As mentioned earlier, Allan was allocated an extra eight hours for partially bilingual supportive teaching in reading, writing, and academic learning when he was in fourth grade. Initially, this initiative showed some positive outcomes. With the help of his two teachers, Allan began to show moderate progress in reading, but after *Video Modeling* he demonstrated significant improvement in reading, writing, and learning in content area subjects. This coincided with his developing the mentioned six skills and the target behaviors through *Video Modeling*.

Discussion

In our paper we refer to several studies, predominantly studies conducted in clinical settings, which indicate that *Video Modeling* interventions effectively facilitate the skill acquisition of many children with autism. Most existing studies of *Video Modeling* utilized single subject analysis. In our study, we did the same and registered the results of our intervention in three periods. We found that *Video Modeling* in the school setting is more challenging than when it is conducted in clinical settings. It was very challenging to registering the results during the process without disturbing the children's activities and without drawing their attention to the registration process. Many of the mentioned studies as well as our study show that the consistently rapid rate of acquisition of the targeted skills suggests that *Video Modeling* interventions may be an especially efficient means of promoting the learning of social communication skills. We suspect that this was the reason that the American expert panel defined *Video Modeling* as one of the evidence-based and established training and teaching methods (The National Autism Center's National Standards Report, 2009). We have experienced that *Video Modeling* takes advantage of the visual processing strengths of learners with ASD (Townsend & Westerfield, 2010). With

regards to bilingual children with ASD, despite the rapidly rising rates of immigration in several countries such as the US, European Union, and Scandinavian countries (equating to a corollary rapid increase of bilingual children in the school systems there), we have extremely few studies focusing on bilingual children with ASD (Seung et al., 2006). This single case study is about an eleven year-old bilingual child with ASD. Our subject had a bilingual life. He used his mother-tongue at home, but went to a school in which Norwegian was the medium of instruction and the language of communication among students. It was remarkable that the school interpreted his problems with social communication as a function of *"Dislike Norwegian language and culture".* The result of the *Video Modeling* demonstrated that Allan did not dislike his second language or the culture of his new country. He only needed help to learn the necessary words, idioms, phrases, pragmatic language skills, and ways of response in different social settings in his second language, in order to be able to give positive responses to his friends' invitations. He could not acquire these skills through natural interaction with his friends because of his ASD. He also did not develop these skills in his mother-tongue before the *Video Modeling* intervention. Extra bilingual support had a positive impact on Allan's initial learning, contributing to making communication and content comprehensible for him. At the same time, his bilingual teacher contributed to better collaboration between home and the school. On the basis of information we received from Allan's parents, we conclude that bilingual children with ASD can transfer the learned social skills and targeted behaviors in a second language to a first language.

Conclusion

Our restricted single case study with *Video Modeling* revealed that children with ASD can use their visual learning channel to acquire the necessary social communication skills they need to master behaviors which they cannot do otherwise. One of the important factors that create the condition for learning through *Video Modeling* is the teachers' interest for learning about *Video Modeling* and using it properly. The other positive factor is choosing model peers who are genuinely interested in making video clips and including their peers suffering from ASD in their games and playtimes. Another lesson that one can draw from our study is that learning targeted skills and behaviors can produce the capacity for several other desired skills and behaviors as by-products. This study showed that '*learning to take initiative for playing together with one's friends*' can be a by-product of '*learning to give positive response to friends' initiative for playing together'.* Another by-product of our *Video Modeling* was inclusion of a child with ASD in more social activities not only by his/her model peers, but also by other peers in the school. Our study of a boy with ASD also revealed that bilingual children with ASD can transfer the learned social communication skills and targeted behaviors in a second language to first language milieu. With this level of success, we feel that there is a strong need for further research in which bilingualism is not under-communicated when one designs, initiates, and conducts intervention with different models for training, treatment, and teaching of children with ASD.

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Effect of Conceptual Change Texts for Overcoming Misconceptions in "People and Management" Unit *

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Abstract

This study aimed to investigate the effects of conceptual change texts in teaching concepts in the "People and Management" Unit of a Social Studies Course. The working group of the study was composed of 4th graders in a primary school in Çorum, assigned as control (*n*= 23) and experimental (*n*= 23) groups. Non-equivalent control group design, a quasi-experimental method, was used in the study. Conceptual change texts were used in the experimental group for 4 weeks to overcome misconceptions related to "constitution, independence, republic, democracy, government/state, public opinion, centralized administration, national sovereignty, local administration" and traditional teaching approach was used in the control group. The People and Management Unit Achievement Test (PMUAT) was utilized in the study as data collection tool. Analysis of experimental and control groups' pre and post test scores pointed to significant differences in the favour of experimental group in the post test.

Keywords: Concept, Misconception, Conceptual change texts, Social studies course.

Introduction

Concepts are crucial in making sense of the world and comprise an important part of learning. If it were not possible to group objects, events and ideas based on common aspects, it would be obligatory to learn each element separately (Çeliköz, 1998). Starting at birth, people develop concepts as a result of their interactions with their environments on the one hand while learning the vocabulary related to those concepts on the other. As a result of mental connections formed among them, these learning experiments transform into new learning opportunities and make sense. This is a lifelong process that allows the

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generation of new knowledge and interpretation of existing knowledge in new ways (Yıldırım, 2010).

Concept is a term that is used to classify objects, events and processes which are similar (Cannon, 2002). Concepts that are the building blocks of knowledge and units of thought are learned by children starting from early periods in their lives. Children later classify them, form relationships among them and make sense of new information (Koray & Bal, 2002). Concepts make contributions for us to figure out the objects found in our environment and world by reducing the complexity of the environment we live in. Furthermore, they simplify the communication among people and provide the organization of knowledge in a systematic way (Driver & Erickson, 1983). Concept learning starts at birth and becomes more complicated throughout their lives. In general, children learn concepts as a result of random experimentation. Planned concept teaching starts with schooling (Ülgen, 2001).

Social Studies Courses are one of the classes in which students come across many concepts. Primary school students need to comprehend basic concepts very well in order to learn principles of the Social Studies discipline and solve the social problems they will be given. One of the goals of Social Studies primary education courses is to ensure student comprehension related to various concepts presented in units (Yazıcı & Samancı, 2003).

Social Studies classes aim to provide students with the basic knowledge, skills, attitudes and values related to social life based on selected information from social sciences disciplines in order to educate decent and responsible citizens (Öztürk & Otluoğlu, 2002). That is, Social Studies exist to understand people and their lives in all aspects. Trying to memorize a pile of information in order to understand human beings and their lives will be insufficient and meaningless. Therefore, attention should be paid to learn concepts accurately in order to make sense of the information learned in the process.

The Social Studies program has a broad and detailed content which points to substantiality of the concepts and hence concepts in all units should be taught and learned accurately and meaningfully. Learning of a unit or a subject is based on meaningful and permanent concept learning. Teaching concept is a task which is making the related concept to be understood in the individual's mind (Morgan, 1977). Doğanay (2005) states that concept teaching in Social Studies courses contribute to learning, facilitating memory and communication as well as increasing academic achievement.

Accurate concept learning is related to meaningful learning. Meaningful learning ensures accurate understanding of concepts and prevents misconceptions. While teaching concepts related to Social Studies, teachers should ensure accurate learning by paying attention to prior student knowledge. New information is built on existing information and assimilated by students. Teachers can ensure that by planning their lessons, using effective methods and techniques and structuring information that the students receive. Başaran (1994, p.13) draws attention to instructional planning by stating that "planned instruction is not composed of learning environments with random objects, events or thoughts".

It is only through well prepared programs that meaningful learning can be ensured. With this aim in mind and parallel to the social, cultural, economic and technological developments of the world, the Ministry of National Education introduced teaching programs in 2005 based on a constructive approach as a fundamental paradigm in the place of teaching programs that focused on behavioural approaches. The transformation experienced in all of the teaching programs is also reflected in Social Studies classes (Demir & Akengin, 2014).

According to constructivism, the basis of teaching programs in Turkey, students do not take the presented information as it is. They first compare the presented information with their prior knowledge, analyse it and structure it idiosyncratically. A constructivist approach increases achievement in education since it leads students to think, associate existing knowledge with different information and interpret the outcome (Saygın, 2003). In this process, teacher should give the students the chance to make a variety of activities and obtain the results. Moreover, tutor should guide the students to structure the new information in a meaningful way (Martin, 1997).

It is important to use methods and techniques that are based on conceptual change approach and constructivist approach which prevents the students from learning the concepts wrongly or incompletely for a meaningful learning (Aydın & Balım, 2013). One of the practices that make students active and target knowledge structuring is the conceptual change approach. Learning which means the happening of conceptual change becomes successful through achieving new data and revising the available information (Dykstra, Boyle & Monarch, 1992; Eckstein & Shemesh, 1993; Linder, 1993; Riche, 2000). Conceptual change approach represents and alternative approach that allows a passage away from misconceptions, i.e. unscientific information, to scientific knowledge. This approach is based on Piaget's principles of assimilation, accommodation and equilibrium (Wang & Andre, 1991). What is tried to mention with this is that conceptual misunderstanding must be expressed in detail for the activities that will be developed to remove conceptual misunderstandings or make real the conceptual change to be successful according to Case & Fraser (1999). It is necessary to review existing knowledge and change it in a manner that accommodates new knowledge in order to overcome misconceptions and ensure meaningful learning (Canpolat & Pınarbaşı, 2002). Conceptual misunderstandings make it difficult for obtaining new concepts and students act involuntarily to abandon old or wrong mistakes which are close to the concept to be learned (Terry, Jones & Hurford, 1985; Hewson and Hewson, 1991). One of the most effective methods to overcome student misconceptions is the use of conceptual change texts. Conceptual change texts, proposed by Roth (1985), are texts that allow students to become aware of misconceptions by presenting contradictions between scientifically accepted information and student misconceptions (Hynd & Alverman, 1986; Toka & Aşkar, 2002).

The purpose of using conceptual change texts is to explain misunderstandings (alternative ideas) and to activate them by disproving examples of misconceptions (Çakır, Geban & Yürük, 2002). Conceptual change texts start with a question and students are made aware that they lack information about the concepts in question. The dissatisfaction generated with this task creates the ground to exchange new knowledge with the inaccurate one. Accurate and inaccurate examples for the concepts are provided to reinforce learning. Therefore, alternative concepts (misconceptions) are replaced with accurate concepts. Using the previously learned experiences of students to show them that their current knowledge is insufficient and to maintain a purposeful learning is stated to be an effective application in teaching concepts (Shiland, 1999).

Although many studies exist in literature in which conceptual change texts are used, most of the studies are related to the field of Science (Altuntaş Aydın, 2011; Çaycı, 2007; Dilber, 2006; Özdemir & Dindar, 2013; Yüksel Gülçiçek, 2004). There are some studies in Social Sciences Field which utilize conceptual change texts; however, they are generally limited to teacher candidates at high school or graduate school level (Akbaş, 2008; Birinci & Konur, 2010; Kılıçoğlu, 2011; Türksever, 2013). This literature review suggests that studies on the effects of conceptual change texts at primary school level do not exist. Even though the conceptual change texts are not used, there are studies in which different

methods are used in teaching of the concepts and in which the conceptual delusions in the extent of Social Sciences lessons are revealed. In one of these studies (Jahoda, 1963), which aimed at determining how much the concepts of county and nation are developed in the minds of the students aged at 6 to 11, the students are requested to express the relation between the settlements from near to far (Glasgow, Scotland & Britain). The conclusion that the students' views about these concepts differ according to their ages was drawn out from the study. Sheridan (1968), in a study to determine the knowledge and views of 6 year old students who are the beginners of primary school about the conceptions about physical geography, concluded that their knowledge about these concepts is either insufficient or wrong. Harwood and Jackson (1993) did a study to determine the comprehension levels of a small group aged 9 to 11 about concepts related to physical environment. The comprehension levels of the students chosen from 9-11 year-olds about nine concepts that are used in the everyday language and related to physical environment (coast, sea, harbour, river, mountain, hill, ocean, cliff and valley) are observed in the study. At the end of the study, the students are found to have many misunderstandings about these concepts. After another study done by Milburn (1972), it was found that many geographical concepts (latitude, valley, basin, summit, North pole, pole, etc.) weren't understood enough by students. Moreover, there are studies carried out in the process of "People and Management" unit in which this study is carried out. For instance; Bal and Akış (2010), studied misconceptions and their causes in 4th grade Social Studies unit "People and Management". The study results presented indicate that students had misconceptions regarding national sovereignty, citizenship, independence a public opinion concept studied at class. Topcubası and Polat (2014) examined the effect of using concept cartoons in "People and Management" on student achievement. Results showed that the use of concept cartoons increased student achievement. Ocak and Küçükilhan (2014) investigated the effect of using Student Teams-Achievement Divisions Based on Cooperative Learning technique in 4th grade "People and Management" unit on academic achievement and permanence of learning. Results pointed to the success of the technique.

In addition to these studies, Doğan (2007) sought to determine student achievement levels and misconceptions -if any- related to "government/state, national sovereignty, republic, democracy, constitution, legislation, centralized administration, local administration and citizen" concepts in primary school 5th grade unit "One Nation, One Flag". Student achievement on each concept was investigated and rating of concepts from most successful to least successful was found to be: "citizen, national sovereignty, democracy, local administration, republic, government/state, constitution, central administration, legislation".

Instead of using the whole unit for study, the study in question tested the effect of conceptual change texts on specific concepts about which students have misconceptions (constitution, independence, republic, democracy, government/state, public opinion, centralized administration, national sovereignty, local administration) determined by Concept Identification Form (CIF)

Significance of the study

It important for information obtained in Social Studies classes to be scientifically sound since it will affect future learning in the field. Students bring prior information to school. Concepts that are planned be taught are not given at the desired level due to misconceptions in these prior knowledge students bring to school. Also, the methods, language, materials, and textbooks utilized in the classroom and the teachers themselves may cause misconceptions. Since concept learning is related to the connections among concepts, misconceptions may negatively affect future learning. Therefore, it is crucial to identify and overcome student misconceptions.

It is imperative to utilize methods that ensure active student participation to prevent the formation of misconceptions. The study in question utilized conceptual change texts, one of the conceptual change approaches, in order to increase student achievement in concept learning. It has been identified that studies in Turkey that focus on the use of conceptual change approach and the effects of conceptual change texts on student achievement in Social Studies are mostly limited to secondary school, high school and university levels and that studies regarding primary schools are rather few. Also, studies on the effects of using conceptual change texts are generally in the field of Science. In short, study results and suggestions are expected to improve effectiveness and productivity of Social Studies teaching and to ensure more effective concept teaching by overcoming misconceptions at an earlier point in time.

Problem statement

Problem statement of the current study is: What is the level of impact in overcoming student misconceptions as a result of teaching with conceptual change texts in primary school 4th grade Social Studies courses?

Answers to sub problems provided below were sought in this direction:

1. Are there significant differences between the pre-test scores of classrooms which utilized conceptual change texts and those which used traditional teaching methods?
2. Are there significant differences between the post test scores of classrooms which utilized conceptual change texts and those which used traditional teaching methods?
3. Are there significant differences between the pre and post-test scores of the classroom which utilized traditional teaching methods?
4. Are there significant differences between the pre and post-test scores of the classroom which utilized conceptual change texts?
5. Are there significant differences between the control and experimental groups' pre and post-test achievement scores?
6. What are the pre and post-test achievement levels of the concepts taught in control and experimental groups?

Method

Research model

The current study that examined the effect of using conceptual change texts on overcoming misconceptions related to "constitution, independence, republic, democracy, government/state, public opinion, centralized administration, national sovereignty, local administration" concepts utilized a "non-equivalent control group design quasi-experimental method". In this method, special effort is not given to have equivalent subjects as a result of random assignments but attention is paid to ensure subjects have similar qualities as much as possible. Also, control and experimental groups are randomly assigned in this design (Karasar, 1999).

Working group

Working group of the study was composed of a total of 46 students attending two different 4th grade classes a primary school in Çorum. Implementation was undertaken in the spring term of 2014-2015 academic year. One of the classes was assigned as the experimental group in which conceptual change texts were utilized (n= 23) while the

other was assigned as the control group which used traditional teaching (*n*= 23). The People and Management Unit Achievement Test (PMAT) was given to eight 4th grade classrooms as pre-test. Two classrooms whose achievement levels were found to be similar according to the pre-test were selected for the study. These classrooms were assigned as experimental and control groups randomly by casting lots.

Implementation process

Following the formation of experimental control groups, Conceptual Change Texts (CCT) which were prepared by the researchers were given to the experimental group teacher and the practice was observed. While the classes were taught in the experimental group with the help of conceptual change texts developed by the researchers, classes in the control group was taught by using the activities included in the Social Studies teaching program. The unit was completed in a 4-week implementation period.

Data collection tools

People and Management Achievement test (PMAT). Prior to test preparation, Concept Identification Form (CIF) was generated by using the concepts in the selected unit. This form was given to 40 classroom teachers that previously taught in 4th grades and they were asked to put a check the concepts which students generally find hard to learn and have misconceptions about. As a result of this process, 9 concepts (constitution, independence, republic, democracy, government/state, public opinion, centralized administration, national sovereignty, local administration) were identified and the achievement test was designed in this direction. A multiple choice achievement test of 27 items (3 items for each concept) was prepared to test the effectiveness of conceptual change texts. 4 experts in the field of measurement and evaluation were consulted during the preparation of the measurement tool and necessary arrangements were made on the test based on the feedback received from the experts. Three experts and two Social Studies teachers were consulted for content and face validity of the test and the test was finalized.

The test was first implemented to a total of 180 students (4th (*n*= 60), 5th (*n*= 60) and 6th (*n*= 60) graders). The People and Management Achievement Test (PMAT), composed of 18 questions, was finalized by taking item difficulty and discrimination levels into consideration. According to data from which were taken the first implementation, Cronbach's Alpha (*a*) reliability coefficient of the test was 0.71 average discrimination of the test was 0.43 and average difficulty was 0.41.

Conceptual Change Texts (CCT). While preparing the conceptual change texts, articles and theses that used this teaching material were examined. Theoretical information was obtained about the necessary steps in preparing and using CCTs. Also a literature review was conducted on "constitution, independence, republic, democracy, government/state, public opinion, centralized administration, national sovereignty, local administration" concepts. This review focused on misconceptions emphasized in theses, textbooks and articles and notes were taken to use in the preparation of conceptual change texts. Prepared texts were examined by two researchers who previously studied the topic. An expert in the field of Social Studies and two Social Studies teachers were consulted about the prepared CCT. Texts generated following the feedback were given to 8 4th graders to check for intelligibility. Necessary arrangements were made and CCT was finalized.

Data analysis

Quantitative data collected during the study were digitally transferred to SPSS 18.0 package program. While dependent samples t-test was used in analysing experimental and control groups' pre and post test scores, independent samples *t*-test was used for comparisons between experimental and control groups. Normality distribution pointed to

normal distribution of scores even though experimental and control groups consisted of 23 students each. Dependent samples *t*-test which compared achievement scores of experimental and control groups showed normal distribution in differences.

Findings

This section presents the results obtained from experimental and control groups.

Findings regarding the first sub problem

Table 1 presents the statistical values of experimental and control groups' pre-test scores related to the first sub problem.

Table 1. *Independent samples t-test results related to the comparison of experimental and control group pre-test scores*

Group	*N*	Mean	*sd*	*df*	*t*	*p*
Experimental	23	10.00	2.59	44	-0.272	.787
Control	23	10.22	2.83			

Table 1 presents pre-test scores of experimental and control group students. While the mean for the experimental group M_{exp}= 10.00, the mean for control group was found to be $M_{control}$= 10.22. Pre-test scores do not show meaningful differences between experimental and control group students ($t_{(44)}$= -0.272; p> 0.05). This finding may point to the fact that both groups had equivalent levels of prior information before the experiment.

Findings Regarding the Second Sub Problem

Table 2 presents the statistical values of experimental and control groups' post test scores related to the second sub problem.

Table 2. *Independent samples t-test results related to the comparison of experimental and control group post test scores*

Group	*N*	Mean	*sd*	*df*	*t*	*p*
Experimental	23	14.35	2.84	44	3.787	.000
Control	23	11.65	1.90			

Table 2 presents post-test scores of experimental and control group students. While the mean for the experimental group M_{exp}= 14.35, the mean for control group was found to be $M_{control}$= 11.65. Post-test scores show significant differences between experimental and control group students ($t_{(44)=}$ 3.787; p< 0.05). This finding points to significant differences between experimental and control groups' post test scores in favour of the experimental group. According to this result, student achievement in the group taught with the help of concept change approach generated significant difference compared to the group taught with traditional approach. In the post-test scores, the calculated size effect of meaningful difference in favour of experimental group is high level (η^2= 24.5).

Findings regarding the third sub problem

Achievement scores for control group students obtained from PMAT pre and post tests were compared with the help of t-test. Table 3 presents the obtained data.

Table 3. *Dependent samples t-test results related to the comparison of control group PMAT pre and post-test achievement scores*

Control Group	*N*	Mean	Mean Difference	*sd*	*df*	*t*	*p*
Post Test	23	11.65	1.43	1.90	22	-2.208	.038
Pre Test		10.22		2.83			

Table 3 presents control group students' mean pre-test scores as $M_{control}$= 10.22 and mean post test scores as $M_{control}$= 11.65. Difference between post and pre-test mean scores was found to be 1.43. This result points to meaningful increase for the control group students as a result of teaching via traditional methods ($t(22)$= -2.208; p< 0.05). In the post-test scores, the size effect of meaningful difference in favour of control group is middle level (η^2= 9.98).

Findings regarding the fourth sub problem

Achievement scores for experimental group students obtained from concept achievement test pre and post tests were compared with the help of t-test. Table 4 presents the obtained data.

Table 4. *Dependent samples t-test results related to the comparison of experimental group PMAT pre and post-test achievement scores*

Experimental Group	*N*	Mean	Mean Difference	*sd*	*df*	*t*	*p*
Post Test	23	14.35	4.35	2.84	22	-5.036	.000
Pre Test		10.00		2.59			

Table 4 presents experimental group students' mean pre-test scores as M_{exp}= 10.00 and mean post test scores as M_{exp}= 14.35. Difference between post and pre-test mean scores was found to be 4.35. This result points to meaningful increase for the control group students as a result of teaching via traditional methods ($t(22)$= -5.036; p< 0.05). This finding points to significant increase in achievement for experimental group students as a result of teaching with the help of conceptual change texts. In experimental group, size effect of meaningful difference is high level (η^2= 36.5).

Findings regarding the fifth sub problem

Table 5. *Independent samples t-test results related to the comparison of experimental and control group achievement scores*

Group	*N*	Post-test	Pre-test	Achievement	*sd*	*df*	*t*	*p*
Experimental	23	14.35	10.00	4.35	4.14	44	2.696	.01
Control	23	11.65	10.22	1.43	3.12			

Table 5 presents experimental group students' mean pre and post-test achievement scores as M_{achexp}=4.35 and mean post test scores as $M_{achcontrol}$=1.43. Although both groups show significant differences in post-tests, difference between the means was found to be in favour of the experimental group ($t_{(44)}$= -2.696; p< 0.01). Table 6 presents these findings that support this result. The size effect of meaningful difference in favour of experimental group between the means of differences of points of pre and post achievement test scores of experimental and control groups is high level (η^2= 14.1).

Table 6. *Percentages of frequency and difference regarding experimental and control groups' misconceptions*

Concept		Experimental Group				Control Group			
	Nr.	Pre Test	%	Post Test	%	Pre Test	%	Post Test	%
Constitution	1	21	91.3	23	100	21	91.3	17	73.9
	2	17	73.9	22	95.7	17	73.9	22	95.7
Independence	3	20	87.0	21	91.3	20	87.0	13	56.5
	4	13	56.5	18	78.3	13	56.5	15	65.2
Republic	5	6	26.1	15	65.2	6	26.1	9	39.1
	6	13	56.5	20	87.0	13	56.5	15	65.2
Democracy	7	21	91.3	20	87.0	21	91.3	21	91.3
	8	3	13.0	13	56.5	3	13.0	9	39.1
Government/State	9	6	26.1	11	47.8	6	26.1	4	17.4
	10	5	21.7	12	52.2	5	21.7	6	26.1
Public opinion	11	14	60.9	17	73.9	15	65.2	20	87.0
	12	18	78.3	23	100	18	78.3	22	95.7
Centralized administration	13	9	39.1	17	73.9	8	34.8	12	52.2
	14	10	43.5	18	78.3	11	47.8	16	69.6
National sovereignty	15	15	65.2	22	95.7	15	65.2	19	82.6
	16	14	60.9	20	87.0	14	60.9	17	73.9
Local administration	17	9	39.1	18	78.3	9	39.1	11	47.8
	18	15	65.2	18	78.3	15	65.2	16	69.6

Examination of Table 6 shows that teaching by means of conceptual change texts in the experimental group was more effective in teaching concepts of *"constitution, independence, republic, democracy, government/state, public opinion, centralized administration, national sovereignty, local administration"* compared to traditional teaching methods. Table 5 presents a significant increase in the experimental group in all items other than one question that aims to measure the concept of democracy, achievement level in the control group was lower and concepts were not sufficiently learned in some items (*republic, democracy, government/state and central administration*).

Result and discussion

The study aimed to identify the effects of conceptual change texts in teaching concepts in "People and Management" unit. The results present that in terms of learning the concepts of *constitution, independence, republic, democracy, government/state, public opinion, centralized administration, national sovereignty* and *local administration,* the experimental group that utilized conceptual change texts -one of the concept change approaches- was more successful compared to the control group that utilized traditional teaching methods developed according to constructive approach. In other words, it can be claimed that

conceptual change texts facilitate student comprehension of concepts. This finding is consistent with the results of various other studies in which conceptual change texts were used (Akbal, 2009; Akbaş, 2008; Aydın, 2007; Cerit Berber & Sarı, 2009; Çaycı, 2007; Dilber, 2006; Durmuş, 2009; Gürbüz, 2008; Sevim, 2007; Şeker, 2006; Şeker, 2012; Tamer, 2006; Ural Keleş & Aydın, 2012; Yılmaz, 2010).

Mean pre-test scores of the experimental class where conceptual change texts were used and control class were traditional methods were utilized are as follows: M_{exp}=10.00 and $M_{control}$= 10.22. Group means show no significant differences between experimental and control groups' levels prior to implementation ($t_{(22)}$=0.272; p> 0.05). Pre-test results did not point to differences between experimental and control groups and the readiness levels of both groups were found to be equivalent probably due to exposure to similar learning processes and experiences.

Following the experimental procedures of the study, mean arithmetic PMAT scores of experimental and control groups were found as follows: M_{exp}=14.35 and $M_{control}$=11.65. Group means point to significant differences in favour of experimental group in terms of post test scores ($t_{(22)}$=3.787; p< 0.05). This result presents that teaching through conceptual change approach is more effective in increasing student achievement compared to teaching with traditional methods. Conceptual change texts have a different structure than course-books and conventional texts. A more effective teaching of concepts process is carried out by giving the distinctive specifications and agreeable and disagreeable examples about the related concept in the conceptual change texts. Martorella (1998) states that some problems will be experienced in the learning process of the concepts if the definitions or teachings of the concepts the students encounter aren't done without considering their distinctive features. In the test group of this study, emphasizing the features of the concepts while teaching them may have made contribution to better understanding of these concepts.

Control group students that were taught with traditional methods obtained the following pre and post-test PMAT scores: $M_{pre\text{-}test}$= 10.22 and $M_{post\text{-}test}$= 11.65. Results of pre and post tests show meaningful differences in the control group in favour of the post-test ($t_{(22)}$=2.206; p< 0.05). This finding shows that traditional teaching was effective in increasing achievement in "The People and Management Unit". Such as the conceptual change approach used in experimental group, traditional teaching method used in the control group significantly increased post test scores of students. "The People and Management" unit was studied in the control group class and teaching was provided albeit with traditional methods. Sarı-Ay (2011) also identified increases in control group in post test scores. However, the experimental group that utilized conceptual change texts presented higher achievement levels. Similarly, the results obtained in studies where control groups also increased their achievement as a result of traditional methods are consistent with the results of the current study (Cerit, Berber & Sarı, 2009; Ural, Keleş & Aydın, 2012).

Experimental group students obtained the following pre and post-test PMAT scores: $M_{pre\text{-}test}$= 10.00 and $M_{post\text{-}test}$= 14.35. Examination of pre and post-tests shows significant differences in the experimental group in favour of the post-test ($t_{(22)}$= 5.036; p< 0.05). This results points to the effectiveness of teaching based on change approach in increasing achievement in "The People and Management" unit.

Findings regarding the third and fourth sub problems indicate that both *conceptual change approach* and *traditional teaching* were effective in increasing student achievement about concept learning. Statistical analysis of data for both experimental and control groups presents significant level increase in favour of post-tests. This points to the

effect of teaching in the control group albeit with traditional methods. However, while pre and post-test mean achievement scores in the experimental group was M_{achexp}= 4.35, this value was found to be $M_{achcontroll}$= 1.43 in the control group. While there was a significant increase in both groups in favour of post-tests, mean achievement difference was found to be in favour of the experimental group ($t_{(44)}$= -2.696; p< 0.01). This finding demonstrates that conceptual change approach is more effective compared to traditional approach in teaching concepts. Researches show that presenting only a simple definition of a concept doesn't necessarily require the acquisition of the concept (Tennyson & Park, 1980). Table 6 presents that students in experimental group still have difficulty in learning democracy concept and control group students have difficulty with the following concepts: *republic, democracy, government/state and central administration*.

Study results demonstrate that the experimental group taught with the help of conceptual change texts, one of the conceptual change approaches, was more successful in learning the concepts in "The People and Management" unit compare to the control group taught traditionally. Some suggestions are provided in line with research results:

- This study utilized conceptual change texts to overcome misconceptions of 4th grade students regarding the concepts included in "The People and Management" unit. Various conceptual change texts can be prepared and used for different Social Studies units and topics.
- Teachers may be provided with in-service training courses geared to inform them about the preparation and implementation of conceptual change texts and the approach can be disseminated widely.
- Since teachers are the basic implementers of the conceptual change texts teacher candidates attending faculties of education can be trained about conceptual change texts.
- Social Studies textbooks may include conceptual change texts related to subject matters included in the curriculum as alternative activities in order to help overcome misconceptions

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Evaluation of Students' Mathematical Problem Solving Skills in Relation to Their Reading Levels

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Abstract

The purpose of the current study is to investigate the correlation between students' reading levels and mathematical problem solving skills. The present study was conducted in line with a qualitative research method, i.e., the phenomenological method. The study group of the current research is composed of six third grade students with different reading levels. The data of the study were collected through the reading of texts, the Ekwall/Shanker reading inventory and the problem solving think-aloud protocol. The collected data were evaluated using a descriptive analysis method. Once the study had been completed, it was concluded that problem solving skills varied according to reading level.

Keywords: Reading, reading level, mathematical problem solving

Introduction

One of the primary objectives of education is to create individuals who can read instructions in their daily lives, make decisions about issues requiring social participation, read media and are able to overcome potential problems to be encountered in future (Karataş & Güven, 2003; Özsoy & Kuruyer, 2012). In line with this objective, problem solving and reading comprehension instructions given during the education process should attach priority to imparting these skills to students and further developing them. Problem solving refers to the elimination of a problem through the use of required information and operations in cognitive processes (reasoning) (Altun, 1995). Reading

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comprehension, on the other hand, refers to the construction of meaning by the reader from context through the use of textual cues (Akyol, 2010; Duffy, 2009). Therefore, like problem solving, reading comprehension relies on the reader's recognition and perception of symbols in written language, grammar, cognitive skills and real life experiences. The most important requirement for problem solving and reading comprehension is the transfer of solutions to different situations. Just as problem solving requires more than performing operations with numbers, using four main operations and symbols, reading comprehension requires more than word recognition and the accurate vocalization of words. Problem solving and reading comprehension essentially work together in order to reach a goal and do so by utilizing different resources for this purpose. In this regard, reading comprehension skills and problem solving skills are closely interrelated (Fuentes, 1998; Jordan, Hanich & Kaplan, 2003; Vilenius-Tuohimaa, Aunola & Nurmi, 2008).

Solving a problem requires establishing a link between inputs and anticipated outcomes. Reading assigns meaning to a text by determining a suitable goal and method. No problem or text is self-expressive (Akyol, 2005). Therefore, an individual's eagerness, their interest, setting a goal and use of strategy are of great importance for problem solving and reading comprehension skills.

Evaluation of students' problem solving skills and reading comprehension skills is as important as the teaching of these skills (Karataş, 2002; Pearson & Hamm, 2005). An individual needs to activate his/her information about the use of problem solving and reading comprehension skills and effect a transfer of information between these skills. For the evaluation of whether such a transfer takes place, these two skills must be observed together, while for the development of problem solving and reading comprehension skills, they need to be observed and evaluated in the long-run.

Problems, including the comprehension of a text, bring about many difficulties for elementary school students due to the complexity of problem solving processes. Problems stated within the context of a story seem to be more complex and difficult for students than problems not embedded in a text (Mayer, Lewis & Hegarty, 1992; Nathan, Long & Alibali, 2002). It is reported that when compared to similar problems stated with numbers, students are 30% less successful in solving problems that include a story (Carpenter, Corbitt, Kepner, Lindquist & Reys, 1980). Even when they know how to solve problems that does not include a story, when they are presented with these problems embedded within a story, solving them can be more challenging, because solving problems that include a story requires the use of various cognitive processes in an integrated manner. For children that do not have an adequate knowledge base or have limited memory capacity, these tasks can be much more challenging (Jitendra, Griffin, Deatline-Buchman & Sczesniak, 2007).

When solving problems that include a story, students are required to understand the language of the problem and the concrete information presented in the problem, to properly conceptualize the problem in his/her mind based on the information given within the problem, to design and follow a plan and to make the calculations required by the solution process of the problem (Desoete, Roeyers & De Clercq, 2003). In short, solving narration problems is closely associated with understanding the relationships involved in the text and the goal stated in the problem. The results of a set of studies conducted on narration problems that included addition and subtraction operations revealed that rather than the syntax of the text, meaning or mathematic structure was viewed to be more important (Carpenter, Hiebert & Moser, 1983). Similar research findings have shown that the problems experienced by students regarding narration problems are related to an accurate comprehension of the text, rather than numbers or operations (Gökkurt & Soylu, 2013).

An examination of the literature reveals that two primary courses have been followed by research dealing with difficulties in narration problems. In one of these, research focuses on the difficulty level of solutions, based on the characteristics of problems. The problematic characteristics examined in these studies are the number of words in the text of the problem, the existence of statements pointing out the operations to be followed in the solution of the problem, as well as the magnitude of the numbers used in the problem (Briars & Larkin, 1984). The second course of research primarily focuses on the cognitive processes required for the solution of the problem (Dellarosa, 1986; Kintsch & Greeno, 1985). In this regard, it is argued that the difficulty of a problem should be explored based on the interaction between the characteristics of the problem and the cognitive capacity of the student. Within the context of this interactive approach, four focal points are proposed for receiving primary focus (Dellarosa, Weimer & Kintsch, 1985):

1. Comprehension of the problem text
    a) Comprehension of words
    b) Comprehension of the meaning of each sentence
2. Comprehension of the problem statement
    a) Activation of the word knowledge related to the problem statement
    b) Activation of the knowledge related to mathematical terms and relationships
    c) Use of the information compiled from item (1) above
3. Selection of a solution strategy based on item (2) above
4. Accurate implementation of the selected strategy

Finding the correct solution to a problem does not necessarily mean that the student has the necessary problem solving skills. Though some students may have found the correct answers, they may have followed the wrong approach to a solution; other students might develop the correct solution strategies but nonetheless reach the wrong solution due to simple calculation errors (Soylu & Soylu, 2006). This also holds true for reading comprehension. Correct pronunciation of the text and providing the correct answers to reading comprehension questions does not necessarily mean the possession of the reading comprehension skill by the student. Some students, though pronouncing text accurately and giving the correct answers to reading comprehension questions, may do this by chance and by making guesses without necessarily comprehending the text (Dufy, 2009). Therefore, while evaluating problem solving and reading comprehension skills, individual differences should be taken into consideration (Kuzgun & Deryakulu, 2006).

While evaluating problem solving skills, the steps followed by the student to reach a solution, as well as the critical behaviors expected to be exhibited while following these steps should be considered altogether, as there is no certain way of solving a problem and students may develop their own problem solving strategies (Baykul, 2009). In general, comprehension of the problem, establishment of the mathematical connections between what is given and what is required, determination of the operations to be conducted for the solution, conducting the operations and checking of the accuracy of the solution can be defined as general steps in the solution of a mathematical problem (Erden, 1994; Polya, 1998; Tertemiz & Çakmak, 2003). While following these general steps, students are expected to demonstrate critical behaviors such as writing what is given and what is required in the problem, explaining the problem in their own words, summarizing the problem, drawing a scheme of the problem, determining the operations to be conducted in the problem, predicting the results of the problem, achieving a solution by using the mathematical operations and checking the accuracy of the solution (Baykul, 2009; Polya, 1998). For reading comprehension, the critical behaviors expected from the student are the transferring of prior information into the reading environment, setting a goal for

reading, making predictions before reading, checking the correctness of the predictions after the completion of reading, selecting suitable strategies, using enhancement strategies when difficulties are experienced, making use of context to guess the meaning of unknown words, summarizing the main idea and monitoring comprehension.

When the behaviors demonstrated during problem solving and reading comprehension processes are evaluated together, it is observed that reading comprehension and problem solving skills require the execution of similar processes. For pursuing the stages of problem solving, reading level is important (Ilgın & Arslan, 2012). Reading level can be described as loud reading and reading comprehension performance. Reading levels can be evaluated under three headings: free level, teaching level and apprehension level (Shanker & Ekwall, 2000). For good readers at the free reading level, word recognition automatically occurs; they are aware of reading strategies and can use these strategies effectively during the text comprehension process (Pang, 2008). Readers who are at teaching level can read and comprehend as required with the support of a teacher or an adult (Akyol, 2010). Weak readers who are at the apprehension level experience difficulties in word recognition and in the discrimination between words; their attention is distracted throughout reading and they feel anxious, lose track when reading, start reading without making predictions and guesses about the text, do not know what to do when they do not understand the text and cannot create connections between prior and new information.

Students' success in problem solving is affected by cognitive, affective and experience factors (Haylock & Cockburn, 2014; Van de Walle, Karp & Bay-Williams, 2014). Difficulties experienced in problem solving are usually related to reading difficulties (Reikerås, 2006). According to Grauberg (1998), the problems experienced by students that have reading difficulties while learning mathematics are defined as not recognizing symbols, experiencing difficulties in organization, not being able to speak about the problem and memory. In addition, as reading difficulties directly affect learning, they may lead to problems during the course of teaching the language of mathematics and problem solving (Dowker, 2005). Moreover, it can be argued that students' different reading levels can affect their problem solving performances. The purpose of the current study is to investigate students' reading levels and mathematical problem solving skills. This study is of importance in terms of providing information about the interaction between students' reading levels and problem solving skills. The current study seeks answers to questions such as, "Do basic reading and comprehension skills affect problem solving skills as well as other academic skills?" and "Is there a significant relationship between them?" Investigating these questions will offer different opinions about the teaching of these skills.

Method

Research design

The present study was conducted in line with a qualitative research method, i.e., the phenomenological method. "The phenomenological method focuses on phenomena which we are aware of but that we do not have a deep and detailed understanding about" (Yıldırım & Şimşek, 2008, s. 72).

Study group

The study was conducted with six third grade students. Three of the students were girls and three were boys. The participants were determined by using the purposeful sampling method. For determining the study group, the criterion adopted was students having different reading levels. Third grade students were selected for the current study, as

educational attainments set in relation to mathematical problem solving skills and reading comprehension skills at this grade are different from those set for first and second grades, and are more sophisticated; thus, they were more suitable for the purpose of the current study. In order to determine the participants of the study, meetings were organized to inform the teachers and families of 60 third grade students attending an elementary school, who were randomly selected from elementary schools in the city of Aksaray. Following these meetings, 24 students whose parents approved their participation in the study and who were willing to participate in the study, were administered activities for determining their reading levels. Six students representing different reading levels were determined and included in the study. The real names of the participants were excluded for ethical reasons.

Data collection method

The current study intended to determine the relationship between the reading levels and mathematical problem solving skills of participants. The process of determination was conducted in two stages. In the first stage, the Ekwall/Shanker reading inventory, a word recognition list and reading comprehension inventory were employed to determine the reading levels of participants. In the second stage, the problem solving think-aloud protocol was used to determine the students' problem solving skills.

Data collection instruments

For the evaluation of reading level, formal and informal measurement tools can be used. Formal evaluation can be conducted using standard measurement tools and informal evaluation can be conducted using non-standard measurement tools such as word recognition lists and a reading comprehension inventory (Shanker & Ekwall, 2000; Karasu, Girgin & Uzuner, 2012). As standard measurement tools provide normal values related to reading level, they not only allow for the comparison of students with their peers, but also provide insights about the performance of students. However, they have some disadvantages in terms of collecting detailed information about reading level, because by using them, it is difficult to determine whether students have an awareness of sounds, how they vocalize words, which strategies they use to discover meaning and what mistakes they make while reading; they may also present obstacles for conducting an evaluation of students' written and oral performances by means of product files and self-assessment tools (Uzuner, 2008). In this regard, within the context of the current study, an informal word recognition list, a reading comprehension inventory and the Ekwall/Shanker reading inventory were employed for determining students' reading levels. Information about the data collection instruments employed in the current study for determining students' reading levels is provided below.

Word recognition list. A list of 60 words with different numbers of syllables (ranging from two to six syllables in length) was developed on the basis of a word list created by Karadağ (2005) for the third grade. The scope of the word recognition list covered activities requiring the vocalization of the words on the list, the construction of sentences using the words, thinking about the meanings of the words and the evaluation of the words within a specific context.

Reading comprehension inventory. The reading comprehension inventory comprised five reading comprehension questions, two of which required simple comprehension and three of which required deep comprehension. This inventory was developed by the researchers taking into account the objectives of the third grade. The reason for the use of this reading comprehension inventory was to collect detailed information about the students' reading levels.

Ekwall/Shanker reading inventory. In order to determine loud reading errors and loud reading levels, a guidance table, adapted by Akyol (2005) from Ekwall and Shanker (1988), was used. This allowed for the rapid evaluation of students' reading performance and monitoring of the loud reading process. During administration of the Ekwall/Shanker reading inventory, students were asked to read the entire text out loud to determine their loud reading performance. The researchers recorded this loud reading. While the student continued reading, areas where he/she committed mistakes and where they made corrections were marked and notes were taken about the student's reading. Students' responses to the simple and deep comprehension questions asked within the framework of the inventory were also recorded.

Reading texts. The texts used during the application process of the study were selected from third grade reading texts recommended by the Board of Education and Discipline. The text used within the framework of the Ekwall/Shanker reading inventory for determining the loud reading levels of students was composed of 170 words. The text used within the framework of the reading comprehension inventory for determining the reading comprehension levels of the students consisted of 148 words. As the application of these texts was conducted among third grade students, the length of the texts selected needed to be between 100 and 200 words (Akyol, 2005). Both of the texts were narrative texts. The texts were written using 1.5 line-spacing and a size 14 font.

Problem solving think-aloud protocol. The problem solving think-aloud protocol consisted of five problems and was developed by the researchers considering the objectives of third grade and Polya's problem solving stages. The purpose of using a think-aloud protocol was to provide detailed information about the approaches students applied during the process of problem solving.

Instructions are listed below, while details regarding the implementation of the problem solving think-aloud protocols follow immediately after.

1. What is given and required in the problem?
2. Can you briefly explain the problem?
3. Can he/she use visuals to explain the problem?
4. What operations will you perform while solving the problem and why?
5. Can you predict the result of the problem?
6. Can you tell the result of the problem?
7. Can you solve the problem in a different way?
8. If he/she solved the problem incorrectly, were they able to explain the reason for doing so?
9. Can you construct a problem similar to this one?

Data analysis

Analysis of the data can be evaluated under two headings: a) analysis of the data related to reading levels; b) analysis of the data related to mathematical problem solving skills.

Analysis of the Data Related to Reading Levels

When evaluating data related to the word recognition list, the following aspects were taken into consideration: the duration of vocalizing words on the word recognition list, whether students knew the meanings of words, their performance in terms of constructing meaningful sentences and any mistakes on their part. When evaluating the data collected via the reading comprehension inventory, students' responses to simple and more complex comprehension questions were analyzed.

Data collected using the Ekwall/ Shanker reading inventory were evaluated by considering the mistakes committed by students during their loud reading performances; this was assessed on the basis of word recognition levels and a percentage determination guideline adapted by Akyol (2005) from Ekwall and Shanker (1988). In order to detect the percentage of mistakes committed where words were concerned, the following procedure was adopted according to the guideline. Mehmet read a 170-word text within the inventory. While reading the text, he committed eight mistakes. According to the guideline, eight mistakes committed within a 166-170-word text represent word recognition of 95%. Responses to the simple and more complex comprehension questions asked within the inventory were scored as 3, 2, 1 and 0, while responses to simple comprehension questions were scored as 2, 1 and 0. The highest score to be taken from the comprehension questions was 13. In order to calculate the comprehension percentage, the sum of the scores taken was divided by the sum of the scores that were required to be taken. For example, Mehmet received eight points from the five questions in order to measure deep comprehension (8/13=0.615); that is, his comprehension percentage was 61%.

According to the Ekwall/Shanker reading inventory, students' reading levels are at free level when their word recognition percentage is 99+ and comprehension percentage is 90+; reading levels are at teaching level when word recognition percentage is 95+ and comprehension percentage is 75+, and at apprehension level when their word recognition percentage is 90-, with comprehension percentage at 50- (Shanker & Ekwall, 2000). On the basis of these evaluation criteria, Mehmet's reading level was evaluated to be at teaching level, as his word recognition percentage was 95 and his comprehension percentage was 61.

Analysis of the data obtained in relation to mathematical problem solving skills

The collected data were evaluated using a descriptive analysis method. The purpose for using this method was to present the findings in a summarized and interpreted manner to the reader. The steps followed during the analysis process are presented below.

- A framework was constructed for the data analysis within the conceptual context of the study.
- Based on the constructed framework, the data were read and organized.
- Excerpts were included to define the organized data.
- The defined data were explained and associated or compared with the obtained phenomena.

Within the theoretical framework of the study, the collected data were defined under headings pertaining to the findings related to reading level and findings related to mathematical problem solving skills. The findings related to reading comprehension and reading level was subsumed under the heading of reading level. The skills demonstrated by students while solving problems and their responses to questions were evaluated under the heading of problem solving skills. The findings are presented and supported with direct observations and quotations. In order to demonstrate how the analysis process was conducted, the think-aloud protocol, conducted with a student named Esra, is presented as an example.

Researcher: *Esra, you have read the problem. What is given and asked for in the problem?*

Esra: *I need to find [out] how much a [kilogram] of banana[s] is.*

…

Researcher: *Which operation will you use [to solve] the problem?*

Esra: *Addition.*

Researcher: Can you explain why?

Esra: *[The question] asks how much [a kilogram] is.*

Researcher: *Can you guess the result of the problem?*

Esra: *No.*

Researcher: *Go on, please.*

Esra: *Now I add 10 to 10 [and] the result is 20; now I add 20 to 5 and the result is 25; I add 25 to 2 and the result is 27 and I add 27 to 3 and the result is 30.*

Researcher: *Are you sure that the result is correct?*

Esra: *Yes.*

Researcher: *Now, let's read the problem and solve it together (with the help of the researcher the problem is solved again). Is the result that you found different from the result we found together?*

Esra: *Yes.*

Researcher: *Can you explain why the results are different?*

Esra: *Hmmm… (she thinks for a while.) No.*

By examining the skills demonstrated by the student named Esra while solving the problem and the responses given by her within the context of the think-aloud protocol, how the student solved the problem and skills demonstrated by her are presented below.

A seller buys 10 kg apples, 10 kg oranges and 5 kg bananas for the green grocery every day. One kilo of apples costs 3 liras and one kilo of oranges costs 2 liras. The seller paid 100 liras in total; thus, how much is one kilo of bananas?

Student	Student's solution to the problem	The way followed by the student while solving the problem
Esra	10+10=20 20+5=25 25+2=27 27+3=30	She defined what was required as the cost of one kilo of bananas. She summarized what was given as kilos and liras. She said that the operation to be used for the solution of the problem would be addition. She was sure of the correctness of the solution. After seeing the correct solution to the problem, she could not identify where she had made a mistake.

In order to establish reliability and validity in qualitative research, it is necessary to precisely present all the decision-making stages and strategies utilized during the study (Yıldırım, 2010). Within the current study, the data transferred into the computer environment and transcribed were evaluated by the researchers and an independent expert, in light of the literature findings and within the framework of themes in order to establish the reliability and validity of the study. While reading the data collected from each interview, all the codes and themes were systematically and repeatedly compared to the conceptual framework.

Process and setting

All the applications were conducted with students at pre-determined times outside of school time and in a quite environment. The application setting was organized in such a way as to facilitate working with each student individually. The students were made to feel relaxed during the application. The word recognition test, the reading comprehension inventory and Ekwall/Shanker reading inventory were administered in three sessions. Each session lasted nearly 25 minutes. The problem solving think-aloud protocol was implemented in a single session. Each session lasted nearly 40 minutes and was video recorded.

Findings

This section presents: (1) findings related to the reading levels of students; (2) findings related to the problems involved in the think-aloud protocol; (3) findings related to mathematical problem solving skills. The findings related to the reading levels of the students are presented in Table 1.

Findings related to reading levels

Table 1. *Findings related to the reading levels of the students in the study group*

Student	Reading Level	Detailed information about reading level
Hatice:	Free Level	She can vocalize the text accurately. She can adjust her reading speed according to the text; she read the text at the correct speed and with the correct intonation. She can accurately vocalize the words involved in the word recognition test.
Leyla:	Free Level	She can vocalize the text accurately. She can adjust her reading speed according to the text; she read the text at the correct speed and with the correct intonation. She can accurately vocalize the words involved in the word recognition test.
Mehmet:	Teaching Level	He reads the text very slowly. He vocalizes the words erroneously; he spends a significant amount of time on word recognition and discrimination. He erroneously vocalizes the words involved in the word recognition test. With an increased number of syllables in words, he experiences more difficulties and spends more time vocalizing the words.
Esra:	Teaching Level	She can vocalize the text accurately. She can adjust her reading speed according to the text. She can accurately vocalize the words involved in the word recognition test.
Ömer:	Apprehension Level	He reads the text very slowly. While reading, he makes some additions, skips lines, follows text using her finger and cannot discriminate the words. He erroneously vocalizes the words involved in the word recognition test. With an increase in the number of syllables in words, he experiences more difficulties and spends more time vocalizing the words.
Mustafa:	Apprehension Level	He reads the text very slowly. He skips words and lines, follows text using his finger, spends more time on word recognition and makes some additions. He erroneously vocalizes the words involved in the word recognition test. With an increase in the number of syllables in words, he experiences more difficulties and spends more time vocalizing the words.

Findings related to the problems in the think-aloud protocol

Table 2. *Findings related to the first problem in the think-aloud protocol*

First problem. A seller buys 10 kg apples, 10 kg oranges and 5 kg bananas for the green grocery every day. One kilo of apples costs 3 liras and one kilo of oranges costs 2 liras. The seller paid 100 liras in total; thus, how much is one kilo of bananas?		
Student	Student's solution to the problem	The student's approach to solving the problem
Leyla	10+10+5+3+2=30 100-30=70	She expressed what is required as the cost of one kilo of bananas. She listed the data. After thinking for a while about a solution, she said that the result was 70. For an alternative solution, she said that she would subtract 70 from 100. She realized that she was sure of the result. After seeing the correct answer, she realized the mistakes she made while solving the problem.
Hatice	The problem was solved with help.	What is required was determined (how much is a kilo of bananas?)
Mehmet	The problem could not be solved.	What is required and given was not determined. No predictions were made about the mathematical operations to be conducted.
Esra	10+10=20 20+5=25 25+2=27 27+3=30	She defined what was required as the cost of one kilo of bananas. She summarized what was given as kilos and liras. She defined the operation to be used for a solution to the problem as addition. She was sure of the correctness of her solution. After having seen the correct solution to the problem, she could not identify where she had made a mistake.
Mustafa	10+10=20	He was not able determine what was required and given. He said that he would use addition to solve the problem and explained the reason for selecting this operation as it being an easy approach. Though He stated that he could solve the problem in another way, he did not provide any information about what this approach might be. When he saw the correct solution to the problem, he did not make explain where he had made mistakes.
Ömer	10+1=10	He read the problem statement incorrectly. He could not summarize what was given and required. He could not define the operation he would use to solve the problem. He could not determine where he committed a mistake after seeing the solution to the problem.

When the responses given to the first problem are examined, it can be argued that the students, with the exception of Esra and Leyla, were unable to determine what was required. Though Esra and Leyla were able to determine what was required, they could not find a way to solve the problem and thus, were unable to do so. When the mathematical operations conducted by the students for the problem are analyzed, it can be seen that the students preferred to add the numbers given in the problem. Only Leyla recognized the mistake she made after seeing the correct solution to the problem. Ömer read the problem statement incorrectly. Therefore, it can be argued that he was unable to develop an approach to solving the problem.

Table 3. *Findings related to the second problem in the think-aloud protocol*

Can is nine years old and Ece is seven years old; what is the sum of the ages of Can and Ece six years later?

Student	Student's solution to the problem	The student's approach to solving the problem
Leyla	9X6=54 (1st solution) 9+6=15 (2nd solution) 7+6=13 15+13=28	She defined what was required as the sum of the ages of Can and Ece six years later. She defined what was given as the ages of Can and Ece. First, she stated that she needed to conduct a multiplication operation to solve the problem. After finding a result of 54, she recognized that the result was incorrect; she then changed her approach to the solution. She was sure of the correctness of her second solution. She also stated that another solution may be to add all the numbers together.
Hatice	9+6=15 7+6=13 15+13=28	She answered that first, she would multiply 9 with 6 and then multiply 7 with 6 to solve the problem. She stated that the result of the problem could be 36 or 40. She also stated that after multiplying 9 with 6, she found a result of 54 and therefore stated that her first prediction was wrong. She then read the question again and when she was asked whether she was sure about her result, she said that she had to conduct an operation of addition instead of multiplication; she then solved the problem correctly. She could not produce any other solution.
Mehmet	9+7=16 (1st solution) 15+13=28 (2nd solution)	He defined what was required as the age of Can. He stated that he could solve the problem by using an operation of addition.
Esra	9+7=16 365+15=380	She defined what was required as how old Can and Ece would be six years later. She listed what was given as the ages of Can and Ece. She stated that the operation to be used for solving the problem would be addition. After finding the sum of the ages of Can and Ece, he tried to calculate how many days there were in six years. She did so to add 6 years to 16. As she could not do this operation, she added the sum of the ages of Can and Ece to the days in one year. She was unsure of the correctness of the result she found. She recognized where she had made a mistake after seeing the solution to the problem.
Mustafa	9+7=60 6+6=12 60+12=72	He could not determine what was given and requested. He correctly expressed how to solve the problem. However, when he added 9 to 7, he said that the result would be 16, but he wrote 60 as his result instead; thus, he could not reach the correct solution. When he checked his solution, he recognized that he had made a mistake but could not determine where he had done so.

Table 3 (Cont.). *Findings related to the second problem in the think-aloud protocol*

Ömer	9+7=16 16+13=29	He could not list what was given and requested. However, he said that he needed to use the operation of addition to find a solution to the problem. He could not guess the result of the problem. In the second stage of the solution to the problem, as he incorrectly conducted the operation of 6+6, he found an incorrect result. After seeing the correct solution to the problem, he could not explain why he had solved the problem incorrectly. When he was asked whether he could solve the problem in another way, he stated that he could use a subtraction operation.

When the responses to the second problem are examined, it can be seen that Ömer completed the first stage of the problem correctly. He tried to carry out the second stage of the problem, that is, the operation of 6+6, in his mind. As he calculated the result of this operation incorrectly, he was unable to find the correct solution. Mustafa committed a calculation error in the solution of the problem; therefore, though his approach to a solution was correct, he found the wrong result. Mustafa and Ömer were unable to solve the problem correctly. Though they were shown the correct solution, they could not determine where they had made mistakes. Mehmet first added together the ages of Can and Ece and then changed his mind; he then reached the conclusion that he needed to add the ages of Can and Ece six years later. Esra experienced a problem related to the concept of a year in the solution of this problem; he argued that since one year was 365 days, he needed to add 365 days to nine years, which prevented him from finding the correct result. Hatice and Leyla solved the problem correctly.

Table 4. *Findings related to the third problem in the think-aloud protocol*

Third Problem. Cem has 210 liras. How much does he need to add to have 500 liras?

Student	Student's solution to the problem	The student's approach to solving the problem.
Leyla	500-210=290	She defined what was requested as what was needed to make Cem's money 500 liras. She said that she needed to conduct a subtraction operation to solve the problem. She did not propose another solution. She said she was sure of the correctness of her solution.
Hatice	500-210=290	She defined what was required as, "I need to [establish] how much [money] Cem needs. I can count from 210 to 500." When she was asked to solve the problem using another approach, she said that she could subtract 210 from 500.
Mehmet	100+200=300	He read 500 as 50 100 liras. He experienced difficulties reading the problem statement. He could not list what was given and requested. He said that he would not be able to solve the problem.
Esra	500-210=390 (First solution) 500-210=290(Second solution)	She defined the problem as how much money was needed to make the amount given 500 liras. She said that she would subtract 210 from 500 liras to solve the problem. She recognized her mistake and corrected it. She was not sure of the correctness of her result. She said that she could not solve the problem in any other way.

Table 4 (Cont.). *Findings related to the third problem in the think-aloud protocol*

Mustafa	Problem could not be solved	While reading the problem, he read the number 210 as 21 01. He said that he needed to conduct an addition operation to solve the problem. He could not make any guesses about the result. He expressed what was requested as the sum of Cem's money.
Ömer	Problem could not be solved	He said that he needed to conduct an operation of addition to solve the problem. He could not make any guesses about the result.

When the responses given to the third problem are examined, it can be seen that it was correctly solved by Esra, Hatice and Leyla. Esra recognized the mistake she committed in finding a solution to the problem and corrected it. As Mustafa, Ömer and Mehmet read the numbers given in the problem statement incorrectly, they were unable to present correct solutions. Leyla was sure that she had solved the problem correctly.

Table 5. *Findings related to the fourth problem in the think-aloud protocol*

Fourth problem. The sum of two different numbers is 350. One of these numbers is 234; what is the second number?

Student	Student's solution to the problem	The student's approach to solving the problem
Leyla	350-234=116	She defined the problem as the determination of the second number. She said that she must conduct an operation of subtraction to solve the problem. She also stated that she was sure of the correctness of her solution.
Hatice	234+Δ=350 Δ=116	She did not make use of prediction strategies. She showed the known number with a box and tried to calculate the unknown number in her mind. She was sure of the correctness of her solution.
Mehmet	350+234=596	He experienced problems reading the problem. He defined what was required as the sum of two different numbers. Thus, he expressed that he had to conduct an operation of addition. After he had explained the problem and saw the correct solution, he recognized where he had made a mistake.
Esra	350-234=116	She defined what was required as the determination of the second number. She expressed the solution as the subtraction of 234 from 350. She was sure of the correctness of her solution and did not produce any other solution.
Mustafa	The problem could not be solved	He read the word Farklı as 'fatih'. He expressed the number 234 as 400 3 2. He said that all the numbers should be added together.
Ömer	The problem could not be solved	While reading the problem statement, he read the number 350 as 175. After rereading the problem statement, he said that an addition or subtraction operation should be conducted to solve the problem. When he was asked which operation should be selected for this problem, he was unable to provide an answer.

When the answers given to the fourth problem are examined, it can be seen that Mehmet, Mustafa and Ömer experienced difficulties in reading the problem statement. While Esra, Hatice and Leyla solved the problem correctly, Mustafa and Ömer were unable to find the correct answer. For the solution to this problem, Hatice made use of prediction strategies and visuals. Esra, Hatice and Leyla said that they were sure of the correctness of their solutions.

Table 6. *Findings related to the fifth problem in the think-aloud protocol*

Fifth problem. Doğa and her four girlfriends collect aluminum boxes. Six months later, they took the aluminum boxes they collected to a recycling plant and they received 50TL. They shared this money equally among them. How much did each of them get?

Student	Student's solution to the problem	The student's approach to solving the problem
Leyla	50-4=6 (First solution) 50:5=10 (Second solution)	She defined the problem as how much should be distributed to Doğa and her four friends. She said that an operation of subtraction should be conducted to solve the problem. After thinking about the problem for a while, she recognized that the operation she had conducted was wrong and then stated that she should conduct an operation of division. She was sure of the correctness of her solution. She suggested no other solution.
Hatice	50:5=10	She said that she needed to divide 50 by 4, then recognized that her prediction for a solution was wrong and said that the number of people was 5. She then found a result by conducting this division operation. She was sure of the correctness of her answer. She offered no other solution.
Mehmet	46+56	He experienced difficulties reading the problem. He could not list what was given and required. He tried to add together the numbers mentioned in the problem statement. He could not explain why he solved the problem in the way he did.
Esra	50:5=10	She could not summarize what was given. She said that first she needed to add 6 to 50 to solve the problem. After thinking for a while, she explained what was required in the problem and suggested a solution. First, she distributed the money to the people by 5 liras. She then concluded that she needed to divide 50 liras among five people. She conducted the division operation and found the result.
Mustafa	The problem could not be solved	He could not read the problem statement.
Ömer	The problem could not be solved	He could not read the problem statement correctly. He tried to add the numbers in the problem statement together in order to solve the problem.

When the students' responses given to the fifth problem are examined, it can be seen that Mehmet, Mustafa and Ömer experienced problems in reading the problem statement. Esra, Hatice and Leyla solved the problem correctly. Leyla initially made a mistake in her solution before realizing her mistake and correcting it. Only Leyla stated that she was sure of the correctness of her approach for solving the problem and the consequent result.

When the students' responses to five problems within the context of the think-aloud protocol and problem solving skills are examined, it can be argued that only Leyla and

Hatice capitalized on guessing and self-correction strategies. Esra capitalized on guessing and self-correction strategies for only one problem. Additionally, Esra, Leyla and Hatice stated that they were sure of the solutions and results of the problems. For Esra, this held true for the problems that she could not solve. When the mistakes made by Mehmet, Mustafa and Ömer are examined, it can be seen that their biggest challenge was the difficulties experienced while reading the problem statements, as well as the mistakes made in mathematical operations. When the students were asked to construct a similar problem after seeing the correct solution to the problem, it was observed that all the students, except for Leyla, were unable to construct a similar problem. In this regard, it can be maintained that the students thought that the construction of a similar problem inferred simply changing the numbers of the already given problem. Furthermore, while Leyla, Esra and Hatice were able to explain why they had made mistakes (once they saw the mistakes they had committed in the problems that they were unable to solve), Ömer, Mehmet and Mustafa were unable to recognize the mistakes they had committed.

Findings related to Mathematical Problem Solving Skills

The findings related to the students' reading comprehension levels and problem solving skills are summarized in Table 7.

Table 7. *Findings related to the students' reading levels and problem solving skills*

Student	Mathematical problem solving skills
Hatice (Free Level)	She was able to determine what was required but not what was given. She could not properly explain which operations to use. She could not make predictions about the solutions to a problem and attempted different approaches to problem-solving. Her solutions to the problems and results were correct. She was able to recognize her mistakes when the correct solutions were demonstrated.
Leyla (Free Level)	She was able to solve the problem accurately. While solving a problem, she was able to proceed in line with the problem solving stages. She was able to think about different ways of solving the problem. She made use of prediction and self-correction strategies. She was mostly sure of the correctness of her solution and its result.
Esra (Teaching Level)	She was able to determine what was required but not what was given. She was unable to properly explain which operations to use. Her solutions to the problems were incorrect. She was able to recognize her mistakes when the correct solutions were demonstrated. She was mostly sure of the correctness of her solution and its result.
Mehmet (Teaching Level)	He was unable to determine what was given and required in the problem. He was unable to summarize the problem. He solved two problems correctly.
Ömer (Apprehension Level)	He was unable to determine what was given and required in the problem. He was unable to summarize the problem. He did not know which operations to follow in order to find a solution. The approaches he followed to solve the problems and his results were false.
Mustafa (Apprehension Level)	He was unable to determine what was given and required by the problem. He was unable to summarize the problem. He did not know which operations to follow to find a solution. The approaches he followed to solve the problems and his results were incorrect.

When the problem solving skills of the Hatice and Leyla were analyzed, it was observed that they were able to determine what was given and required and correctly explained the mathematical operations required for solving the problem. It was observed that in addition to being able to predict the solution to the problem, they were able to recognize their mistakes when the correct solution to the problem was demonstrated. These students were able to think about different ways for solving the problem, checked the accuracy of the problem they solved and asked similar problems based on the solved problem. Esra and Mehmet, who were found to be at the teaching level, were able to determine what was given and required in the problem; however, they were unable to make predictions about the result of the problem or test the accuracy of the problem they had solved.

Mustafa and Ömer, who were at the apprehension level, were unable to determine what was given and required by the problem and did not know which mathematical operations to conduct in order to solve the problem. These students were unable to develop different approaches for solving the problem. When they were shown the correct way of solving the problem, they were unable to answer why they had solved the problem incorrectly. In addition, the students did not mention the difficulties they experienced when reading the problem statement while evaluating their mistakes in those problems they were unable to solve. This may have been due to the fact that they were unaware that their reading levels affected their readings of the problem statement, as well as their problem-solving approaches.

Discussion, Results and Suggestions

Basic reading skills are imparted to students in elementary school during first grade. When students proceed through higher classes, acquired skills are developed further and higher skills are inculcated in students. A similar process is followed in the inculcation of mathematical skills. Here, it should be noted that the main skill to be imparted to students, both in mathematics and in all the other academic disciplines, is that of thinking; this can be realized by means of the language used by the student. People try to understand and make sense of life and academic skills through language and transfer this information together with other skills into different contexts and situations. Both language skills and mathematical problem solving skills thrive in tandem with thinking skills that capitalize on language. In short, mathematical thinking skills have become more important for modern people than mathematical operation skills. Furthermore, thinking and language skills provide the basis for this skill.

The purpose of the present study was to investigate the relationship between reading level and problem solving skills. When the behaviors demonstrated by the students during the process of solving problems were examined, it was found that their problem solving skills varied depending on their reading level. In light of the findings of this study, it can be argued that, particularly in the case of students whose reading level is at the apprehension level, difficulties are experienced in terms of reading problem statements. These students were unable to make use of strategies during their problem solving performances. In addition, it can be argued that students were distracted while reading and solving the problem. They were not aware of the mistakes they had made while reading and problem solving. Moreover, while these students were able to solve problems that had relatively shorter problem statements, they were unable to construct original problems. The students whose reading level was at the teaching level were able to vocalize problems correctly and summarize what was given and required; however, they could not determine the operations required for solving the problem. During the solution process, they made errors and did not apply strategies. The students whose reading level was at the free level were observed to use strategies during reading and problem solving in order

to recognize their mistakes and correct them, to be sure of their answers and to be able to try different ways of solving the problem. Furthermore, regardless of reading level, students at times made errors in some problems. This was because the use of knowledge about operations and how students perceived them varied according to individual differences.

Problem solving requires reading, reading comprehension and the use of mathematical knowledge, as well as the use of mathematical operations (Bender, 2012). Students who experienced difficulties reading a problem were unable to provide correct answers. In addition, correct vocalization of the problem may not be enough for finding the correct solution to a problem, because the mathematical language involved in the problem must also be understood. There is also a need for students to develop strategies besides understanding the language of the problem and the mathematical language involved in the problem. In addition to the development of strategies, how to administer these strategies to new situations must be mastered. Strengthening teacher-student and student-student relationships is of great importance for the understanding of problems (Mercer & Sams, 2008). Therefore, reading level and the problem solving skills of students should be handled together and instructional activities should focus on the concurrent teaching of these two skills.

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Design Fixation and Cooperative Learning in Elementary Engineering Design Project: A Case Study

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Abstract

This paper presents a case study examining 3rd, 4th and 5th graders' design fixation and cooperative learning in an engineering design project. A mixed methods instrument, the Cooperative Learning Observation Protocol (CLOP), was adapted to record frequency and class observation on cooperative learning engagement through detailed field notes. Students' design journals and reflections were also analyzed for an inductive qualitative analysis. The findings indicate three major themes of design fixation: 1) fixation on common features of things; 2) fixation on popular teenage culture; 3) fixation on the first design idea. In the cooperative learning process of elementary engineering design project, although pupils had demonstrated some abilities to solve concrete problems in a logical fashion, the participants encountered a number of obstacles in the group. Dominance, social loafing, and other problems occurring in the group process might have offset certain benefits of cooperative learning. Implications of the findings are also discussed.

Keywords: Engineering design, Fixation, Cooperative learning, Elementary students, Case study.

Introduction

An important national trend in the United States is the profound inadequacies in K-12 science, mathematics, and engineering education (The National Science Board, 2003). Engineering connects math and science concepts to real-world experiences in an enjoyable way and it enables children to design and innovate things in their daily life. (Iversen, Kalyandurg & Lapeyrouse, n.d.). To this end, incorporating curricula in engineering design in elementary schools can help address American students' deficiencies in math and science achievements, and can potentially increase the pool of engineering and science specialists in the U.S. by exposing technical career opportunities to students at an earlier age (Crawford, Wood, Fowler & Norrell, 1994). As teams are essential for developing engineering competencies (Tribus, 1993), this case study focuses on the design ideas generated by 3rd-5th grade elementary school students when they adopt cooperative learning strategies in an engineering design project.

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Generating ideas at an early stage plays an important role in engineering design and thus the ability to creatively generate novel and purposeful ideas is a necessary part of solving design problems (Nicholl & McLellan, 2007). Unfortunately in the design process prior knowledge can constrain creative thinking and results in fixation, which is "a blind, and sometimes counterproductive, adherence to a limited set of ideas in the design process (Jansson & Smith, 1991, p. 4)." Smith (1995) also mentioned solving a problem is a normative cognitive process in which an individual plans a route to get to a destination. He argued when the individual does not know about a particular knowledge or technique, he meets the obstacle in the route, which ultimately leads the individual to be fixated. As elementary school students have limited prior knowledge in engineering, they are likely to encounter fixation. They would tend to use the knowledge that readily comes to their mind during the design process.

On the other hand, cooperative learning encourages students to work in groups to accomplish a common goal (Johnson, Johnson & Smith, 2006). Young learners are inherently active to investigate and share with others what they have found out (Tanner, 1997). When a child is at the end of preoperational period of cognitive development (about the age of 6 or 7) most children are able to accommodate the views of others (Wadsworth, 1971) and Piaget believed peer interactions are critical to helping children get rid of egocentric thought (Driscoll, 2005). Although aspects of Piaget's theory were not agreed by some theorists, such as the aspect of egocentrism in young children, Piagetian framework was generally accepted (O'loughlin, 1992). Therefore based on Piaget's theory introducing cooperative learning to elementary engineering design projects is in line with the cognitive development of children. As cooperative learning arrangements lead to students' more frequent generation of new ideas and solutions and ultimately promote development of higher-level reasoning and critical thinking (Johnson and Johnson, 1989; Johnson, Johnson & Holubec, 1998), this case study focuses on studying the cooperative learning in an elementary engineering design projects.

Despite that there is plenty of literature on design fixation and cooperative learning respectively, as engineering is typically not included in elementary school curriculum in the U.S., there is very limited amount of existing research on students' design fixation or cooperative learning in elementary engineering design projects. This is where this case study hopes to make a contribution and add to what is already known.

The purpose of this study is to provide insight into an elementary engineering design project and ultimately help engineering educators to improve instructional design. The research questions are: 1) What does design fixation look like in elementary engineering education? 2) How do elementary students perform in group in a cooperative engineering design project?

Literature review

Engineering design process for children

Engineering education should emphasize engineering design process (Cunningham & Hester, 2007; Katehi, Pearson & Feder, 2009). Engineering design refers to an engineer's approach to identifying and solving a problem, which is "(1) highly iterative; (2) open to the idea that a problem may have many possible solutions; (3) a meaningful context for learning scientific, mathematical and technological concepts; and (4) a stimulus to systems thinking, modeling, and analysis (Katehi et al., 2009, p. 151)." Children have innate enthusiasm toward creating thinking, taking things apart, and figuring out how things work (Cunningham, 2009). A five-step engineering design process model for children consisting of Ask, Imagine, Plan, Create, and Improve was developed by Engineering is Elementary (EiE) program, a national program which created elementary-level

engineering units based on national science education standards. The engineering design process and the questions to be asked in each step are illustrated in the following figure:

ASK
What is the problem?
What have others done?
What are the constraints?
IMAGINE
What are some solutions?
Brainstorm ideas.
Choose the best one.
PLAN
Draw a diagram.
Make lists of materials you will need.
CREATE
Follow your plan and create it.
Test it out!
IMPROVE
Talk about what works, what doesn't, and what could work better.
Modify your design to make it better.
Test it out!

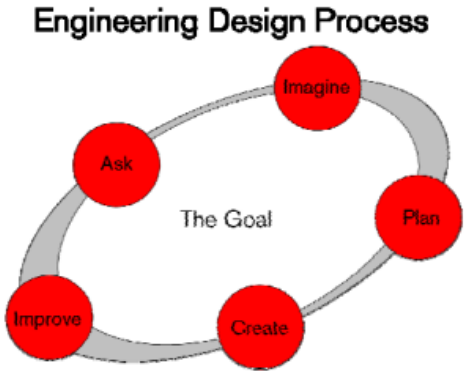

Figure 1. The Design Process developed by EiE Program (Cunningham & Hester, 2007, p. 5)

Cooperative learning strategies

Cooperative learning involves students' working together in groups to accomplish learning tasks or master subject matter content. It is a structured process in which students are actively engaged in learning activities in groups and rewarded based on group performance (Slavin, 1980). Cooperative learning includes the following five elements (Johnson, Johnson & Smith, 2006): 1) Positive interdependence: group members rely on one another to achieve the goal. Everyone suffers the consequences if any group member fails to complete their task; 2) Individual accountability: all group members are held accountable for doing their share of the work; 3) Face-to-face promotive interaction: although some of the group work may be done individually, some must be done interactively; 4) Interpersonal and small group skills: students are to develop and practice trust-building, decision-making, communication and conflict management skills; 5) Group processing: group members set group goals together, periodically reflect on what they are doing well as a team and identify improvements they need to make to work more effectively in the future.

A large amount of empirical evidence shows that cooperative learning significantly increases academic performance, achievement and has positive effects on social constructs such as peer relations and self-esteem (Johnson, Johnson & Holubec, 1998; Johnson, Johnson & Smith, 1998; Williamson & Rowe, 2002; Salkind & Rasmussen, 2008). Cognitive elaboration perspectives claim that cooperative learning enhances students' learning outcomes by involving more restructuring and elaboration when students try to explain the material to someone else. Table 1 demonstrates several cooperative learning strategies.

Table 1. *Cooperative learning strategies*

CL Strategies	Description
Think-Pair-Share (Hassard,1996)	This is a procedure where students consider a question individually, discuss their ideas with another student to form a consensus answer, and then share their results with the entire class.
The Jig Saw method (Aronson, Blaney, Stephin, Sikes, & Snapp, 1978)	Students become "experts" on a concept and are responsible for teaching it to the other group members. Groups subdivide a topic and members work together with those from other groups who have the same topic. They then return to original groups and explain the topic.
Jigsaw II (Slavin 1986)	This is an adaption of The Jigsaw method in which individual scores are combined at the end in some manner to yield a team score.
The Student Teams-Achievement-Divisions (STAD) (Slavin, 1990)	The teacher presents a lesson, and then students work within their teams to complete a set of worksheets on the lesson and make sure that all team members have mastered the lesson. Finally each student then takes a quiz on the material and the scores the students contribute to their teams are based upon the degree to which they have improved their individual past averages.
TGT (Teams-Games-Tournaments) (DeVries & Slavin, 1978)	This method is related to STAD and instead of taking quizzes the students play academic games as representatives of their teams. They compete with students having similar achievement levels and coach each other prior to the games to insure all group members are competent in the subject matter.
Learning Together (Johnson & Johnson, 1987)	This model involves students working in four- or five-member heterogeneous groups on assignments. The groups hand in a single completed assignment and receive praise and rewards based on the group product. Students are also evaluated individually.
Coop-Coop (Kagan, 1985)	Teams of students choose topics for study and then break them into subtopics. Each individual is responsible for learning and teaching about a subtopic. The team then makes a presentation on the topic to the whole class.
Group Investigation (Sharan & Sharan, 1992)	Students form their own two- to six-member groups. After choosing subtopics from a unit that the entire class is studying, the groups break their subtopics into individual tasks and carry out the activities that are necessary to prepare group reports. Each group then makes a presentation or display to communicate its findings to the entire class.

Fixation & cooperative learning in K-12 engineering design

Fixation is the result of everyday thinking being limited by a fixed set of ideas (Cunningham & Hester, 2007). Design fixation is a common phenomenon among both inexperienced and experienced designers (Lindsey, Tseng, Fu, Cagan, Wood, & Schunn, 2010). Existing knowledge can influence the generation of new ideas and this process is referred to as 'structured imagination'—"the fact that when people use their imagination to develop new ideas, those ideas are heavily structured in predictable ways by the properties of existing categories and concepts (Ward, 1995, p. 157)." Showing example solutions also can reduce the design solutions generated by a designer, and designer's solutions will have certain aspects of the example solution (Jansson & Smith, 1991; Purcell & Gero, 1996). Lindsey et. al.'s (2010) study compared a control group whom were

provided with an example solution with a defixation group whom were given an example solution along with a number of alternative solutions and materials to mitigate their design fixation. They found out the design fixation could be mitigated through providing the participants with defixation instruction. In terms of K-12 students, Nicholl & McLellan (2007) carried out a study to examine how fixation applied to the idea generation process when pupils were solving design and technology problems. The study indicated fixation was popular among the 11-16 year old pupils. Pupils' stereotypical design ideas predominantly reflected popular teenage culture and gender patterns. The study also pointed out that pupils often felt annoyed that they were asked to think of multiple ideas when they knew what they wanted to do right away. Pupils in the study tended to stick to their first design idea, which often turned out to be stereotypical design ideas. In terms of the intervention strategy, McLellan & Nicholl' (2011) argued as teachers' product analysis could lead to design fixation, teachers should select appropriate ways to introduce the design task in order to balance the explicitness and ambiguity, for example, teachers can show a different product in the beginning to make the task more open-ended.

As mentioned in the above engineering design process, in the first and second steps of Ask and Imagine, students need to consider about the questions like "What is the problem? What are some solutions?" When brainstorming ideas and choosing the best one, student needs to explain his or her ideas to peers and negotiate with them to locate the best alternative. According to the cognitive elaboration perspective (Slavin, 1996), this process would probably deepen students' understanding of the engineering design problem and accordingly improve their decision making as a group. Indeed the majority of Engineering is Elementary design activities are done in small groups, which can encourage students to generate a variety of ideas or solutions to develop the product with their group members (Cunningham & Hester, 2007).

Research methodology

Overview of design: A case study

As this research was intended to explore what design fixation looks like in elementary engineering education as well as how elementary school students perform in a cooperative engineering design project, a case study focusing on one elementary engineering design project was conducted in order to arrive at an in-depth description and understanding of the entity (Ary, Jacobs, Sorensen & Razavieh, 2006; Patton, 2002). The embedded design looking for consistent patterns of evidence across multiple units of analysis within the case (Yin, 1994) was adopted. The units of analysis included individual elementary school students, three different grade levels (3rd, 4th & 5th), and 12 cooperative learning groups (four groups per grade level).

Research setting and participants

An elementary engineering design project involving a group of 3rd, 4th and 5th graders was selected as the case study. The project was part of a pull-out engineering program carried out in a Midwestern private elementary school. The nine-week pull-out engineering program was conducted every Tuesday and Friday mornings. Within this program there was an engineering design project involving a 3-day design circle: ask and imagine; start to plan (day 1); plan and create the prototype (day 2); present the final product to clients and answer their questions (day 3). 41 students in total participated in this study, which included 12 third graders (6 boys and 6 girls), 14 fourth graders (5 boys and 9 girls), and 15 fifth graders (7 boys and 8 girls).

The students worked with their teammates in the engineering class in two-, three- and four-member groups on the group design assignment: using duct tape to design and create

a wallet, a tote bag, a water bottle holder, or a school folder. This design challenge was created by the instructor, who was a doctoral student majoring in engineering education and gifted education. The instructor had more than five years of elementary school teaching experience and was experienced in P-12 engineering teacher professional development. The instructor introduced the design challenge to the students without the aid of any examples and was intended not to provide any unnecessary information that might influence the students' behavior. It should be mentioned when the instructor briefed the challenge, a tote bag behind the teacher's desk might have been seen by the students. This study focused on the first two days of this project, during when the pupils were asked to come up with four individual design ideas first, then they chose one to be their best idea to share with the whole group. After that the group decided on one group design idea.

Instruments and data collection

As a case study, triangulation was done with multiple data sources (Yin, 1984): 1) Documents--students' design journals recording the individual designs as well as their selected final group design; students' reflections on their individual design idea generation and group design selection; instructional materials; 2) Classroom observation.

In order to systematically observe elementary students' behavior in the group engineering design project, the validated Cooperative Learning Observation Protocol (CLOP) (Kern, Moore & Akillioglu, 2007) was adapted for evaluating the elements of cooperative learning and teaming in an engineering setting to guide the observation. The CLOP is a useful mixed methods instrument recording frequency and evaluations of observed instances of cooperative learning engagement through detailed field notes (Kern et. al., 2007). The adapted CLOP was reviewed by the instructor of the elementary engineering design project to ensure its appropriateness for classroom observation. After incorporating the instructor's comments, the CLOP was used to rate participants' behavior in terms of the five corresponding elements of cooperative learning identified by Johnson, Johnson & Smith (2006): positive interdependence (P), individual accountability (I), group processing (G), social skills (S) and promotive interaction (F). Each item was allocated 10 points with the higher total score indicating a higher level of collaboration and effectiveness in cooperative learning. Observation notes were also recorded with the ratings.

The data were collected from the first day of the design project in class. At the beginning of the project, the students of each grade were divided randomly into 4 groups by the instructor and they were given roughly 15 minutes to complete their individual design journals and another 15 minutes for group discussion. The students were informed that their group design would be judged according to the following rubric: 1) Task completion (Did the team meet the task specifications? 2) Attractiveness (Would this item appeal to the public?) 3) Creativity (Was the team creative in their design?) 4) Functionality (Is the team's design functional? Can the user actually use it?) The instructor also told the students that the team with the highest score based on the above rubric would be awarded certificates for their winning design.

Role of the author

This paper is developed from a research course project. The author of this paper worked with her fellow graduate students in an advanced research methods class to come up with the overall research topic, design the methodology and select the instruments. Four of the author's fellow classmates, who were skilled in educational research, were assigned to travel to the site for conducting classroom observation using the CLOP instrument and collecting various data artifacts. The author then came up with her own specific research

questions and selected relevant data to conduct data analyses and wrote up this research paper.

Results

In this study, data were analyzed through content analysis and descriptive statistical analysis. Content analysis is broadly defined as “any technique for making inferences by objectively and systematically identifying specified characteristics of messages" (Holsti, 1969, p. 14), so the researchers applied it to analyzing participants’ design journals and the field notes of class observation. Emergent and priori coding (Stemler, 2001), categorizing of the data (Weber, 1990) were utilized to describe what design fixation looks like and recognize its patterns among the participants.

Three major themes of design fixation among pupils

Elementary school students were asked a series of questions in relation to both their individual designs and group design in the reflection: After you imagined, you choose which idea to share with the group? Why did you choose this idea? Where did you get your ideas when you were imagining your designs? Students’ answers in the reflections were examined together with the classroom observation data on design idea generation process. The data suggested that evidence of fixation was common in the elementary engineering design project though it appeared in a number of forms. The content analysis identified the following major themes of design fixation among pupils: 1) fixation on common features of things; 2) fixation on popular teenage culture; 3) fixation on the first design idea.

Fixation on common features of things. Elementary school students tended to come up with their design solutions based on commonly seen features of certain things. For example, when designing a wallet, the predominantly majority of students chose the most common shape of rectangular to be their main shape, rather than trying some more unique shapes such as circle, triangle or crescent. Moreover, 34% of the participants in the study did not explicitly explain where they got their ideas in the imagination process. Some quotations of students’ responses in the reflections are “I got my ideas from my brain”; “In my head about a folder”; “when I see bags I think that.” Some fifth graders attempted to give more reasonable but still somehow vague answers: “I saw something and changed it a little. I also thought about the constraint”; “From recent events.”

Fixation on popular teenage culture. Elementary school students’ design ideas also reflected popular teenage culture. The following are some quotations of students’ answers to the sources of their design ideas: “From Justin Biebers birthday”; “Lady Gaga because I thought out of the box in design and technique”. Some of their design ideas also reflected gender stereotypes. Girls’ designs tented to be more decorated such as using heart-shape, drawing flower patterns, emphasizing the use of colors; and adding straps/handles to the wallet design. For example, two girls mentioned that “I like the shape of the flower and when I was drawing the roses”; “I came up with this because I love flowers and I like we made it the colors of the flowers”. One girl explicitly mentioned in the reflection that she got the idea from “Vera Bradley totes,” which is a feminine brand.

Fixation on the first design idea. As aforementioned, each student was asked to choose one of their four individual design ideas to be the best idea, which would then be shared with their group. As demonstrated in Figure 2, according to students’ individual design journals, the first design idea was chosen to be participants’ favorite picture to share with the group members for 14 times, which was the most frequently chosen one out of the four design ideas. The second, third and fourth design ideas were chosen 11, 6, and 10

times respectively. The typical reason given by participants to choose the first design idea is "I chose that idea because it looked easiest."

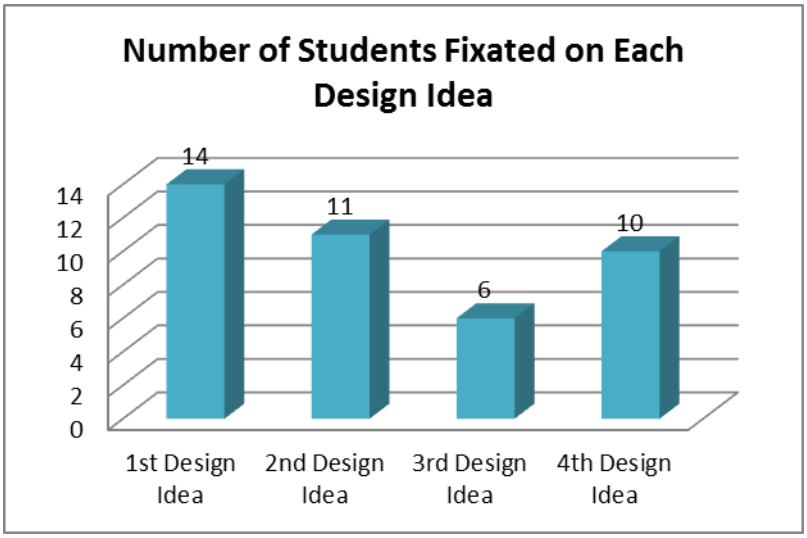

Figure 2. Number of students fixated on each design idea

The cooperative learning scores based on CLOP

Table 2 below demonstrates each group's mean score of the cooperative designing of engineering products based on the CLOP instrument. The highest mean among the five cooperative learning elements is individual accountability (Mean I= 6.33) while the lowest mean is promotive interaction (Mean F= 5.88).

Table 2. *Cooperative learning score based on CLOP*

		Positive Interdependence (P)	Indvidual Accountability (I)	Group Processing (G)	Promotive Interaction (F)	Social Skills (S)
3rd Grade	Group 1 Mean	5.00	5.00	6.00	4.00	4.50
	Group 2 Mean	4.50	4.00	4.00	7.00	6.00
	Group 3 Mean	4.00	5.50	4.00	6.00	6.00
	Group 4 Mean	7.50	8.00	8.00	6.50	6.00
4th Grade	Group 1 Mean	7.00	6.50	6.00	6.50	6.50
	Group 2 Mean	7.50	7.00	6.00	4.00	6.50
	Group 3 Mean	5.50	6.00	8.00	8.00	7.00
	Group 4 Mean	6.00	7.50	4.50	5.00	4.00

Table 2 (Cont.). *Cooperative learning score based on CLOP*

		Positive Interdependence (P)	Indvidual Accountability (I)	Group Processing (G)	Promotive Interaction (F)	Social Skills (S)
5th Grade	Group 1 Mean	4.50	5.50	5.00	4.00	5.50
	Group 2 Mean	9.00	8.50	9.00	8.50	9.50
	Group 3 Mean	6.50	7.00	5.50	6.50	6.50
	Group 4 Mean	5.00	5.50	7.00	4.50	5.00
Mean		6.00	6.33	6.08	5.88	6.08
Standard Deviation		1.52	1.32	1.64	1.57	1.40

Discussion

This case study indicated that many pupils failed to generate novel ideas in engineering design project and fixation was evident. As mentioned in the literature review, when an individual does not know about a particular knowledge or technique, he or she is likely to be fixated (Smith, 1995). Pupils often have limited prior knowledge, this may explain why pupils tended to fixate on the common features of things or the ideas that first came to their mind. On the other hand, according to Jansson & Smith (1991), prior knowledge is essential in the design process as designers can think of new ideas on the basis of what they have already known; thus it should be noted design fixation needs to be viewed differently from the designer's prior knowledge scope. Design fixation "should probably be seen only as that which prevents the consideration of all of the relevant knowledge and experience which should be brought to bear on any given problem" (p. 10). The common reliance on their personal items to generate design solutions among pupils may also be explained by Ward, Patterson, Sifonis, Dodds, & Saunders's (2002) path-of-least resistance model in the idea generation, which means the majority of people utilize the items that come to their mind more quickly as the sources for developing new ideas.

The findings from this study conform to the arguments made by Nicholl & McLellan (2007). Nicholl & McLellan argued that design fixation is the result of the subconscious, automatic and normative cognitive processes of pupils. Participants in this study showed a tendency to generate the design solutions with little self-awareness. They just vaguely knew something popped up in their head to work as the source of design solution. Besides this study also indicated pupils relied on the teenage culture that they attached to the most to derive design ideas, which is in line with Nicholl & McLellan's finding that design idea generation clearly reflects the hobbies and interests of pupils of certain age groups.

In terms of cooperative learning, the pupils in this study were informed at the beginning of this engineering design project that they would work in groups to compete in a design competition. They would present their final products to the "clients" and be awarded a certificate if they win. This instructional design stimulated the individual accountability (Mean I= 6.33, *sd*=1.32). The pupils expected each other's participation in the group work. For instance, at the beginning of the project, most groups brainstormed on which one of the four products they would like to do and then voted; and they constantly checked each other's progress when generating individual design solutions. Kern et. al. (2007) argued social skills (Mean S= 6.08, *sd*=1.40) contributing to cooperative learning include asking clarification, praising, paraphrasing, mediating conflicts and so on. The pupils in this study evidenced a number of such skills. For example, the pupils gave feedback to each other like "It's a good/cool idea"; "I like it"; "Isn't it so shiny, we did a

good job" and so on. They asked their group members for clarification such as the size requirement of the product or their work progress. When they had divergences such as the color or size selection, they negotiated through conversations. These observations are in line with the literature review that the group work can encourage students to generate more solutions in engineering design activities.

Meanwhile several problems had been observed in the cooperative learning process. Some dominant or most capable members of a group took over leadership roles at the expense of others. For instance, one pupil boasted "I'm the best fashion designer in Indianapolis and I guarantee it." On the other hand, the introverted or the less capable pupils withdrew from group discussion and this can be identified as social matching, which is a tendency to conform to peers (Asch, 1951). As the design responsibility is shared among the group members, some other pupils took the advantage of group work without working to their full potential, which was referred to as social loafing (Latane´, Williams & Harkins, 1979). These problems were likely to reduce the engagement and cohesiveness among the group in cooperative learning. This may explain why the element of positive interdependence had a relatively lower score in this study (Mean P= 6.00, *sd*= 1.52).

The 7-to11-year-old participants in this study belong to the concrete operational period (Driscoll, 2005), during when children overcome egocentrism and demonstrate logically integrated thoughts to solve concrete problems; however, they were unable to solve problems systematically or constantly reflect the group process. When finishing drawing their individual design solutions, several groups chose to make in-group presentations, nevertheless due to the above mentioned problems such as dominance, social loafing and social matching, group members did not receive much constructive feedback from their peers. These problems might have offset certain benefits of cooperative learning and even led to more fixation. For example, there were a couple of groups who fixed on one member's design idea and finally chose it as their group design solution without making any additional changes.

Conclusion

In this case study, design fixation was shown to be rife and predictable among pupils, who largely fixated on their prior knowledge of certain things and the teenage culture when designing engineering products. In the cooperative learning process of this elementary engineering design project, although pupils had demonstrated some abilities to solve concrete problems in a logical fashion, the 3rd, 4th and 5th graders encountered a number of obstacles in the group. For improving the results of cooperative learning, this case study suggests incorporating an instruction that aims at encouraging students' interaction in the group work. Instructors may establish clearly defined rules and criteria for grading individual contribution to the group work and incorporate some non-competitive, cooperative games which would enhance pupils' social skills in class. For example, they can adopt some role-play games in which pupils' skills in solving conflicts, decision making, consulting others, making observations and so on could be fostered.

This study sheds light on the understanding of design fixation in a cooperative elementary engineering design project. Meanwhile it should be noted that generalizability is a limitation associated with this study as the engineering design project was carried out among a sample of 41 pupils of 3rd, 4th and 5th grades and it was about designing four objects specifically: wallet, water bottle holder, school folder and tote bag. The design of these objects are subject to possible socially fixated concepts as the students can easily see these objects in their everyday life. In the future, research on a variety of design projects encouraging more open and risky design challenges could be studied in elementary

classrooms. With a larger sample size, further research could be carried out to quantitatively measure the effects of cooperative learning on elementary students' design fixation.

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From Research to Practice: The Effect of Multi-Component Vocabulary Instruction on Increasing Vocabulary and Comprehension Performance in Social Studies

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Abstract

This study was designed to demonstrate the effect of implementing multi-component vocabulary strategy instruction in fourth grade social studies. Curriculum was designed for a six-week period and was intended to actively engage students and reinforce retention of word meanings in isolation and in context. Teachers were randomly chosen for assignment to the intervention and/or to the comparison group. The study included 375 fourth-grade students from 3 different districts and 5 schools. The student population consisted of 29 classes taught by 23 different teachers. Two different vocabulary and comprehension measures were administered, and results were analyzed using difference score analyses and repeated measures ANOVAs. Outcomes were consistent across both administered measures. Although student scores improved in both the group receiving the intervention and the group receiving regular classroom instruction, findings indicated that the group receiving the intervention showed greater gains and persisted longer than in the comparison classrooms.

Keywords: Vocabulary, social studies, comprehension, explicit instruction, semantic feature analysis

Introduction

The 2011 report by the National Assessment of Educational Progress (NAEP, 2011) highlights the following points: (a) Among fourth graders nationally, 33% are reading below basic level, and 24% of eighth graders are reading below basic level, which means that these students cannot perform at minimum academic expectations. (b) Equally

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distressing is the observation that the percentage of children showing proficiency in handling demanding material is only 34% at both the fourth grade and eighth grade levels. Snow, Burns, and Griffin (1998) stressed the importance of reading because it is essential to succeed in our society. Further, they stated that, "In a technological society, the demands for higher literacy are ever increasing, creating more grievous consequences for those who fall short" (p. 10). This must be addressed beginning at a very early age and continuing through school with high standards for students.

Perie, Grigg, and Donahue (2005), report an alarming number of students who do not demonstrate even partial mastery of prerequisite knowledge and skills considered fundamental for proficient work at each grade. Lyon (as cited in U.S. Government Printing Office, 2001), in a report to the Subcommittee on Education Reform, reminded us, "Thirty-eight percent of fourth graders can't read well enough to understand a basic paragraph" (p. 13). According to Armbruster, Lehr, and Osborn (2003), comprehension is described as "the reason for reading. If readers can read the words but do not understand what they are reading, they are not really reading" (p. 48). In the executive summary regarding comprehension, the National Reading Panel (NRP, 2000), described several themes that emerged when examining the research. One of the themes was that "reading comprehension is a cognitive process that integrates complex skills and cannot be understood without examining the critical role of vocabulary learning and instruction and its development" (NRP, 2000, p. 41). Increasing the number of words in a person's vocabulary was determined to be a strong predictor of students' ability to comprehend text as students must work to construct meaning through a combination of the text and the reader (Anderson & Freebody, 1981; Durkin, 1993; Yildirim, Yildiz, & Ates, 2011).

According to Phythian-Sence and Wagner (2007), "acquiring the vocabulary we use for thinking and communicating is a linguistic achievement of nearly incomprehensible importance and complexity" (p.1). Multiple studies have demonstrated effective methods for teaching vocabulary words in classroom settings (Baker et. al., 1998; Blachowicz & Fisher, 2000; Coyne, McCoach, & Kapp, 2007; Foil & Alber, 2002; Nagy & Scott, 2000; Vitale & Romance, 2008). Foil and Alber (2002) described proficient reading as dependent on the development and synthesis of a complex array of critical sub-skills, in which understanding word meanings and their connection to other concepts is a critical component. To avoid the cycle of poor reading leading to limited vocabulary knowledge, perpetuating further lack of reading and development of vocabulary knowledge, they described strategies for building vocabulary (Foil & Alber, 2002). Cunningham and Zibulsky (2009) supported the need for teachers to gain knowledge and utilize effective strategies to further literacy development for all children. Knowledge of successful instruction is important for classroom knowledge and application.

Aaron, Joshi, and Quatroche (2008) described the reciprocal relationship between vocabulary and comprehension and further noted that repetition and meaning promote the retention of vocabulary. Carreker and Birsh (2005) used extensive multisensory activities for teaching basic language skills. Included in these skills was work on specific approaches to the teaching of vocabulary. Strategies are important so that a child can recognize words and/or decode, but the goal of reading is not accomplished if students are unable to connect meaning to the words (Beck, McKeown, & Kucan, 2008). Real comprehension is described by Zimmerman and Hutchins (2003) as thinking, learning, and expanding a reader's knowledge and horizons. Many students today have a clearer understanding and are able to more accurately conceptualize the meaning of a term after repeated exposure through several means (Blachowicz & Fisher, 2002). Multi-component strategies are essential in providing repeated exposure in different contexts, and successfully keeping students engaged in the learning material (Simmons et al., 2005). The

complexity of the knowledge of a word is further explained by Nagy (2009) as "knowing a word includes knowing how it can function in a sentence, what other words it is commonly used with, how it is related in meaning and form to other words, and what styles of language for which it is appropriate" (p. 48). Neuman and Dwyer (2009) emphasize this notion that connection between vocabulary and better reading ability is that vocabulary is more than words; it represents knowledge. Nation (2008) stated that "the ability to deal with words is at the very heart of reading: If an individual fails to read words, if they are slow to read words, or if they are unable to appreciate the meanings of words, comprehension will be seriously hampered" (p. 1122).

The importance of vocabulary as a critical determinant of comprehension success is further explicated by Joshi (2005), "A well-developed meaning vocabulary is a prerequisite for fluent reading, a critical link between decoding and comprehension. However, the role of vocabulary in fluent reading has received much less attention in both research and theory than have decoding and comprehension strategies" (p. 209). Thus, a number of researchers have indicated a strong need for further study on the role of vocabulary in comprehension, particularly in the content areas (Beck & Carpenter, 1986; Beck, McKeown, & Gromoll, 1989; Beck, McKeown, Sinatra & Loxterman, 1991; Hall, 2004; Harmon & Hedrick, 2005; NRP, 2000; Williams, 2005). Therefore, the researchers sought to address two primary research questions: What is the effect of multi-component social studies vocabulary instruction on comprehension, and is that difference sustained?

Method

To address these two research questions, the authors designed this study to determine the effect of multi-component vocabulary instruction in social studies in Grade 4. Social studies was selected because content area texts for this subject contain vocabulary that must be learned to comprehend the material. The opportunity to create curriculum that met the needs of the schools, teachers, and students, while addressing a much-needed area of research, opened the door for exploration of explicit instruction and the vocabulary-comprehension connection. The findings from the literature review demonstrated the gap in research for much-needed studies to address vocabulary instruction, its effect on comprehension, and active learning within the confines of real schools and authentic settings. The focus was on direct, explicit instruction of vocabulary strategies and how it impacts comprehension. Explicit instruction was utilized because it was identified in the NRP (2000) report as one of the most important methods of teaching vocabulary and would enable teachers to focus on key words that were common and recurrent (Juel & Deffes, 2004) in their social studies materials. This type of direct, explicit instruction paves the way for students to identify words and subsequently retain their meanings through repeated application of word learning strategies.

Participants

For the purpose of this study, the authors focused on three separate districts in the southwestern part of the United States. The research was conducted on five different campuses located in five different cities within approximately 30 miles of each other. Prior to the beginning of the school year, researchers met with superintendents and school administrators to engender their support. The administrators provided the names of all fourth-grade social-studies teachers on each campus. The names were then anonymized and randomly assigned to either the treatment group or comparison group. One campus had two teachers who taught all sections of social studies. The first teacher's name drawn served as the treatment group teacher for her four sections of students and the other teacher as the comparison group for her four sections of students. There were a total of 23 teachers and 29 sections of students who participated. A total of 375 fourth-grade social

studies students participated in this study, comprising 15 treatment groups and 14 comparison groups.

Intervention

At the time, the district's curriculum consisted of 300 minutes of language arts instruction per week, with no structured vocabulary component. The authors designed a six-week intervention in which treatment group teachers were asked to spend 90 minutes per week of language arts time focused on social studies vocabulary instruction. The teachers were asked to structure the additional instruction time in thirty-minute segments, three times per week, as classroom time and schedules permitted. The authors surveyed all teachers to obtain basic information regarding teaching experience, degrees, certification, ethnicity, and gender. Also included in the survey was information related to the current use of different instructional strategies in the classroom and the teacher's perception of his or her familiarity with different strategies. The researchers designed curriculum notebooks for the six weeks according to district curriculum and provided them for each of the teachers in the treatment group. A comprehensive set of materials were reviewed together and all of the teachers in the treatment group were trained in the expectations for vocabulary instructional methods prior to implementation. The training included the use of each of the following: explicit instruction; student study teams; active engagement in learning tasks; vocabulary maps; connections webs; semantic feature analysis. Students were actively involved in the learning process and the teacher facilitated activities such as games like Ready, Set, Go; Vocabulary Memory; or Jeopardy, in addition to their instruction. While students were expected to actively participate, there were multiple opportunities for different types of participation. These activities allowed for repetition and use of words in multiple contexts, which allowed students to grasp word meaning and required them to use them in more than one context. Therefore, students were able to expand their knowledge, apply the knowledge to the content area materials, and extend beyond the content with various activities.

Each of the multi-component vocabulary instructional strategies was included within the curriculum guides provided for all treatment group teachers. Additionally, treatment group teachers were provided with supplemental materials, games, and activities for implementation of the curriculum. The first two weeks of materials were also copied and placed in student folders for every student in their classes. Explanation of materials and their appropriate use were provided in the training sessions prior to implementation of the curriculum. The teachers in the treatment groups followed the lesson plans created for this study to implement the vocabulary strategies. The teachers were asked to spend a minimum of 90 minutes per week, preferably in a 30 minute three times per week format, if time and schedules permitted, to implement this intervention. The acquisition and maintenance of the content learned through vocabulary strategies was assessed through pretests, six-week posttests, and additional testing six weeks post-intervention. The types of materials that were utilized are described above and an example of a connections web is included in the appendix.

Researchers met with the participating teachers four times during the study. The first meeting was an overview of the study, and at the request of the school administrators, included teachers in both the treatment and comparison groups. Following a brief introduction, the comparison teachers were dismissed, and the treatment teachers were trained regarding the implementation of the vocabulary intervention strategies. No specific information regarding the actual study and/or implementation of strategies was discussed with the group as a whole. A second and third training session occurred with both the treatment and comparison groups to discuss testing procedures. The second session was for the first set of tests and the third was held before administration of

posttests. One final meeting prior to implementation was also held to review, answer questions, and ensure that all teachers were ready to begin at the inception of the second six weeks of the school year. These meetings were held separately in each of the three districts. Also, as the tests were delivered and picked up, individual visits with teachers were held as needed. Testing procedures were planned in each case so that each classroom was assigned a particular format for administration to vary the order in which tests were administered.

Fidelity of implementation

Observation of the treatment and comparison group teachers and their classrooms took place beginning the sixth week of the school year -- before, during, and after the study period. Observation was conducted by one of the authors and four trained data collectors. The data collectors had a number of years of experience in visiting classrooms. An original training session was held to explain the process and describe the research. Each data collector was provided with a notebook that included basic information about the study and the materials they would need as they entered each classroom. The forms were discussed in great detail and bi-weekly meetings were held to discuss any questions or concerns. The senior author also observed each of the four data collectors on two separate occasions. Regular contact with the data collectors through meetings, email, and phone calls ensured continuity of the data collection.

The data collectors observed each classroom a minimum of once each week during the social studies instructional period, using a checklist based from materials developed by the Teacher Quality grant (Simmons et al., 2005), containing six sections. The first section included the beginning and ending times of the observation, the name of the district and school, treatment vs. comparison group, maximum number of students in the classroom, and maximum number of adults in the classroom during the observation. In the second section, observers were asked to look for seven different comprehension strategies and note the level of implementation, i.e. whether a strategy was modeled, it was explained, or students practiced it. Thirdly, observers were asked to look for seven vocabulary strategies and tally how often they occurred during the class period.

Observation of the teacher providing explanations, definitions, or examples of vocabulary, and/or extension to include paraphrasing, and/or multiple meaning words and the use of visuals, facial expressions, demonstrations, the use of word learning strategies, demonstrated knowledge of words by the students with teacher responses and specific application of word learning strategies were all included. Fourthly, grouping arrangements (teacher working with: whole class, large group, small groups, pairs, individual student, no direct student contact) and text reading (supported oral reading, independent silent reading, independent oral reading, teacher reads aloud, teacher reads aloud with students following, text not used for comprehension instruction) were coded every 15 minutes during the observation. In the fifth section, observers were asked to check thirteen different possibilities of materials used during the observation, including visuals, textbooks, computers, workbook pages, chalkboards, videos, and audio tapes among others. Finally, the observers noted the implementation of intervention instruction. It was broken down into thirteen different categories, and coded as to the level of implementation being: none of the time, part of the time, or full time. The quality of implementation was rated on a 0-2 scale associated with unacceptable, acceptable, and excellent.

Teachers were cooperative about allowing visits at different times and on different days. School schedules for special days and/or activities necessitated an occasional change in observation schedules.

Measures

Three different measures were administered to all the students to address the two research questions examined in this study. The Test of Silent Contextual Reading Fluency (TOSCRF) was administered at the beginning of the study to determine students' reading ability, and assess if it was a confounding factor. To address the first research question, "What is the effect of multi-component vocabulary instruction on comprehension?," the researchers administered two tests: a Curriculum-Based Measures (CBM) test, and a Checkpoints for Content (Checkpoints) test. The CBM was strictly a vocabulary test that served as a baseline to determine if students' vocabulary performance improved during the intervention. The Checkpoints test was similar to a unit test and was designed to measure students' performance in comprehension. To address the second research question, "Is any difference sustained?," both measures were administered three times: before the intervention, at completion of the intervention, and six weeks following the conclusion of the intervention.

Test of Silent Contextual Reading Fluency (TOSCRF, 2006). According to Hammill, Wiederholt, and Allen (2006), this test: measures the speed with which students can recognize the individual words in a series of printed passages that become progressively more difficult in their content, vocabulary, and grammar. The passages that the students are given to read are adapted from passages in the Gray Oral Reading Tests-Fourth Edition (cited in Wiederholt & Bryant, 2001) and the Gray Silent Reading Tests (cited in Wiederholt & Blalock, 2000). (p. 1)

The test has a two-minute practice section, and then a three-minute exam section. The test requires knowledge of word identification, meaning, sentence structure, and comprehension. It was intended for the purposes of this study to serve as a measure of the students' reading ability. It was administered only in the beginning with the pretest measures. The TOSCRF is a timed measure in which students must recognize individual words in a series of printed passages. The passages get progressively more difficult with regard to content and vocabulary. TOSCRF was normed using a national representative sample of 1,898 individuals in 23 states and for stated purposes, it was demonstrated to be both valid and reliable.

Curriculum-Based Measure (CBM). The vocabulary matching curriculum-based measure was administered as a pretest, posttest 1 after six weeks, and posttest 2 six weeks post-intervention. The CBM was used as a fluency measure for vocabulary. The measure was timed for five minutes. It was in a matching format with 20 social studies words and their definitions. The CBM was adapted from the Teacher Quality Grant (Simmons, Rupley, Hairrell, Byrns, Vaughn, & Edmonds, 2005). It was patterned after the work of Espin, Shin, and Busch (2005), who discussed the importance of measuring change in students. Typically, measurement is at a single point in time, which is evident with achievement testing and other standardized tests measures. Curriculum-based measurement provides an ongoing data collection system that provides teachers with information on student progress, and in this case, on the progress of the intervention (Espin et al., 2005). Espin et al. (2005) completed a study to determine whether or not vocabulary-matching probes could be used as an indicator to determine student learning in social studies. Their research supported the use of these measures. The CBM created for this study was formed following their model of five-minute, group-administered, vocabulary matching probes. This measure has been supported by other researchers as well (Deno, 1985; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1994; Fuchs & Fuchs, 1998).

Checkpoints for Content (Checkpoints). Checkpoints for content was a teacher and researcher created multiple choice exam similar to a unit test. The checkpoints were

adapted from the Teacher Quality Grant materials and existing measures from the individual districts. Two fourth-grade teachers from two different districts not associated with the study assisted in preparation of the questions. The intention was to measure for comprehension of specific expository text material. There were 20 multiple choice questions derived specifically from the districts' curriculum. The checkpoints were administered as pretests, posttests 1, and posttests 2.

Analysis

Demographic information was collected and tabulated for both students and teachers participating in this study. The dependent variable in this study was the student outcomes including scores on the pretests, posttest 1 measures, and posttest 2 measures. Descriptive statistics were performed on the Fluency, CBM, and Checkpoints measures. Difference score analysis was also performed on the CBM and Checkpoints measures. Additionally, results of one-way repeated-measures analyses of variance (ANOVA) were computed using the effect for group, effect for time, and effect for group by time or interaction effect on both test measures.

Results

Demographic information on the study participants and their respective campuses is presented in Table 1. Overall, the study population very closely approximated the reference population in terms of ethnic and socioeconomic characteristics. No significant differences were observed for gender or ethnicity between the experimental and control groups.

Table 1. *Gender and ethnicity of 4th grade students in experimental and control groups.*

	Experimental (*n*= 207)		Control (*n*= 168)	
	n	*%*	*n*	*%*
Gender				
Female	118	57.0	90	53.6
Male	89	43.0	78	46.4
Ethnicity				
Asian	1	0.5	1	0.6
African-American	41	19.8	26	15.5
Hispanic	11	5.3	12	7.1
Other	2	1.0	3	1.8
White	152	73.4	126	75.0

Descriptive statistics for the Fluency measure are presented in Table 2. The experimental group scored slightly higher than the control group, but the difference was not statistically significant.

Table 2. *Results of test of silent contextual reading fluency*

Group	*n*	*M**	*sd*	*p*
Control	168	74.71	50.77	0.268
Experimental	207	79.86	39.05	

**Standardized TOSCRF scores.*

The first research question addressed in this study was, "What is the effect of multi-component vocabulary strategy on comprehension?" Two measures were used to address that question, the CBM and Checkpoints tests. Descriptive statistics for these two measures are presented in Table 3. On the Checkpoints measure, the control group had a mean of 11.00 for the pre-test and 13.38 for post-test 1. The experimental group had a

mean of 11.37 for the pre-test and 14.13 for post-test 1. On the CBM, the control group had a mean of 4.53 for the pre-test and 8.63 for post-test 1. The experimental group had a mean of 4.14 for the pre-test and 13.27 for post-test 1.

Table 3. *Means and standard deviations for checkpoints and CBM pre-, post-test 1, and post-test 2*.

Test Measures	Group	*n*	*M*[c]	*sd*
Checkpoints[a]				
Pretest	Control	134	10.99	3.604
	Experimental	196	11.32	3.528
	Entire Sample	330	11.18	3.557
Posttest 1	Control	134	13.28	3.923
	Experimental	196	14.10	3.960
	Entire Sample	330	13.76	3.959
Posttest 2	Control	134	12.86	4.276
	Experimental	196	14.35	3.690
	Entire Sample	330	13.75	4.000
CBM[b]				
Pretest	Control	143	4.59	3.349
	Experimental	193	4.11	3.222
	Entire Sample	336	4.32	3.280
Posttest 1	Control	143	8.50	5.403
	Experimental	193	13.20	5.476
	Entire Sample	336	11.20	5.914
Posttest 2	Control	143	9.02	5.795
	Experimental	193	13.15	5.669
	Entire Sample	336	11.39	6.069

a. 34 in the control group and 11 in the experimental group excluded because of incomplete Checkpoints test scores.
b. 25 in the control group and 14 in the experimental group excluded because of incomplete CBM test scores.
c. Number of items correct on each test, out of 20 items.

Difference score analysis demonstrates a significant difference between post-test 1 and pre-test for the intervention group on the CBM measure (Table 4). The mean difference on the Checkpoints measure was very similar between the two groups, and was not statistically significant.

Table 4. *Difference score analysis for pre- and post-test 1on CBM and checkpoints measures*.

Test Measure	Group	*N*	Mean Difference	*sd*	*p*
Checkpoints	Control	157	2.36	3.36	0.263
	Experimental	201	2.75	3.09	
	Total	358[a]	2.56	3.21	
CBM	Control	151	3.86	4.47	<0.001
	Experimental	196	9.03	4.38	
	Total	347[b]	6.78	5.11	

a. 11 in the control group and 6 in the experimental group excluded because of incomplete test scores.
b. 17 in the control group and 11 in the experimental group excluded because of incomplete test scores.

Research question 2

The second research question addressed in this study was, "Is any difference in comprehension sustained?" To address this question, researchers administered both the CBM and Checkpoints measures a third time, six weeks after the intervention had concluded (Table 3). Repeated measures ANOVAs were conducted on each test measure, and the results are presented in Table 5. For the Checkpoints test, the Wilks' lambda for the effect of time was 0.590, $p < 0.001$, with a partial η^2 of 0.410. The effect for group by time produced a value of 0.970, $p = 0.006$, with a partial η^2 of 0.030. For the CBM test, the Wilks' lambda for the effect of time was 0.297, $p < 0.001$, with a partial η^2 of 0.703. The effect for group by time produced a value of 0.744, $p < 0.001$, with a partial η^2 of 0.256 (Table 5).

Table 5. *Results of repeated measures ANOVAs for CBM and Checkpoints measures*.

Effect	Wilks' lambda	*p*	Partial η^2
CBM[a]			
Time	0.297	<0.001	0.703
Group*Time	0.744	<0.001	0.256
Checkpoints[b]			
Time	0.590	<0.001	0.410
Group*Time	0.970	0.006	0.030

a. 25 in the control group and 14 in the experimental group excluded because of incomplete CBM test scores.

b. 34 in the control group and 11 in the experimental group excluded because of incomplete Checkpoints test scores.

Conclusions

This study focused on the need for research in the area of vocabulary instruction. In particular, fourth grade students were selected for multi-component strategy instruction in their social studies classrooms. According to Bromley (2007), teaching vocabulary well is a key aspect of developing engaged and successful readers. Additionally, Nagy and Scott (2000) described word meanings as making up as much as 70-80% of comprehension. The importance of vocabulary was well-documented; the existence of intervention studies to support the importance of intense vocabulary instruction was not. The NRP (2000) emphasized that vocabulary learning was effective if students were actively engaged in their learning. The curriculum for this study was designed to actively engage students and to reinforce retention of word meanings in isolation as well as in context.

The first question to be addressed in this study was: "What is the effect of multi-component vocabulary instruction on fourth grade students' social studies vocabulary and comprehension performance during a six-week period?" The CBM test, consisting of 20 items (words and definitions) in a matching format, strictly measured vocabulary performance. A sample question from the CBM required students to match the term "livestock" with the definition of "animals that are kept or raised for use and profit." The Checkpoints test, however, was designed as a multiple-choice unit test covering the same material the students were learning, but sourced from a separate curriculum. A sample Checkpoints question was "If you went on a field trip to view livestock, you would probably see _____," and required the students to select from the following four options: "a. corn, wheat, grain; b. hay, fertilizer, irrigation; c. cows, sheep, turkeys; and d. tractors, barbed wire, wheel barrows."

It would be expected that the increased vocabulary instruction in the experimental group would result in improved scores on the CBM, which is a strict vocabulary measure. However, if vocabulary instruction also impacts comprehension, then scores on the Checkpoints measure should improve as well. Table 4 shows the mean difference between the pre-test and post-test 1 was greater for the experimental group in both measures than for the control group. However, the difference for the CBM was statistically significant, while the difference for the Checkpoints measure failed to achieve statistical significance.

In contrast, when looking at the results from all three pre-test, post-test 1, and post-test 2 scores to answer the second research question, if any difference is maintained, both CBM and Checkpoints measures show a statistically significant interaction for group by time. However, the partial η^2 for the CBM measure is much larger (0.256) than for the Checkpoints measure (0.030). This would indicate that the vocabulary intervention had a greater impact on the CBM measure (strict vocabulary measure), while a smaller, but still significant impact on the Checkpoints measure (comprehension measure).

It is interesting that no significant difference for the Checkpoints measure was observed in the first six weeks, but a difference did emerge at the 12-week follow-up point. This may be due to the fact that both groups scored higher initially on the Checkpoints pre-test (overall mean = 11.18 / 20) as compared to the CBM pre-test (overall mean = 4.32 / 20). The higher pre-test scores on the Checkpoints test would mean there is less room for improvement as compared to the CBM test. Additionally, after the intervention, scores on the Checkpoints measure fell slightly for the control group, while they continued to improve for the experimental group. This may indicate that the effect of vocabulary instruction on improved comprehension performance may be prolonged past the duration of the intervention. Finally, the Fluency scores for the experimental group were slightly higher than those of the control group. While the difference was not statistically significant, we would expect such a result to bias the results of the Checkpoints measure toward the null.

One of the challenges of this study design was the implementation of the vocabulary intervention. While teachers were receptive to participating in the study, they did have two primary concerns. One was associated with the lack of time to complete the instructional strategies provided, and the other concern was whether or not the focus on vocabulary was allowing them to be inclusive enough with the content in the textbook. The study was intended to combine vocabulary and content and demonstrate that teaching content with students who do not understand the vocabulary could be futile and certainly would not contribute to long-term retention of content knowledge. However, the teachers wanted more time to read and focus on the material in the text, in addition to the vocabulary focus. Therefore, time was a factor.

Additionally, no assessment was made as to the level of baseline vocabulary instruction that occurred during the study period among the control teachers. While teachers in the experimental group were asked to spend ninety minutes each week on the vocabulary strategies, it is possible that some of the control teachers were independently covering the same material as well. However, since the teachers were randomly assigned to either the control group or experimental group, we would not expect any difference in teaching methodology between the two groups. Furthermore, if the control teachers were independently using similar vocabulary strategies, we would expect the results to be biased towards the null.

One of the strengths of this study was the positive reception from the teachers involved. On a post-study survey, almost all of teachers agreed that their personal instructional practices had changed as a result of participating. Additionally, they also

agreed that their students were gaining knowledge as a result of the intervention. Teachers in the classroom face many varied demands for their time and attention. Implementing an intervention that not only demonstrated statistically significant improvement in comprehension, but also was of practical significance and value to the teachers themselves increases the potential benefit to other teachers. Finally, the instruments used in this study were demonstrated to have high levels of internal reliability. Reliability analyses of the Checkpoints and CBM measures were conducted, with both measures revealing an alpha greater than 0.7, the standard for internal consistency set out by Pallant (2005).

The teachers from this study initially self-reported that they were unable to spend the time on vocabulary. However, careful instruction requires that in order to convey content, students must have an understanding of the vocabulary (Anderson & Freebody, 1981; Durkin, 1993; Yildirim, Yildiz, & Ates, 2011). Experimenting with practices to determine their effectiveness is critical for improving our classroom instruction (Cunningham and Zibulsky, 2009). As demonstrated in this study, multi-component vocabulary instruction in 4th grade social studies improved performance in both vocabulary and comprehension areas. Retention of that improvement was demonstrated as well. While addressing vocabulary can be a time-consuming process, its contribution to success in comprehension of content cannot be underestimated, particularly in helping those who might otherwise fall into the group of those who fall short in terms of literacy development (Nation, 2008). Further research studies should be conducted in classrooms over other content areas to broaden our understanding of vocabulary instruction and the resulting effect on comprehension for all students. Several teachers and administrators also noted that this instruction would be beneficial in ESL classrooms. Regardless of the setting or content area, literacy development is crucial, and multi-component vocabulary strategies have been shown to be a key part of that process (Simmons et al., 2005).

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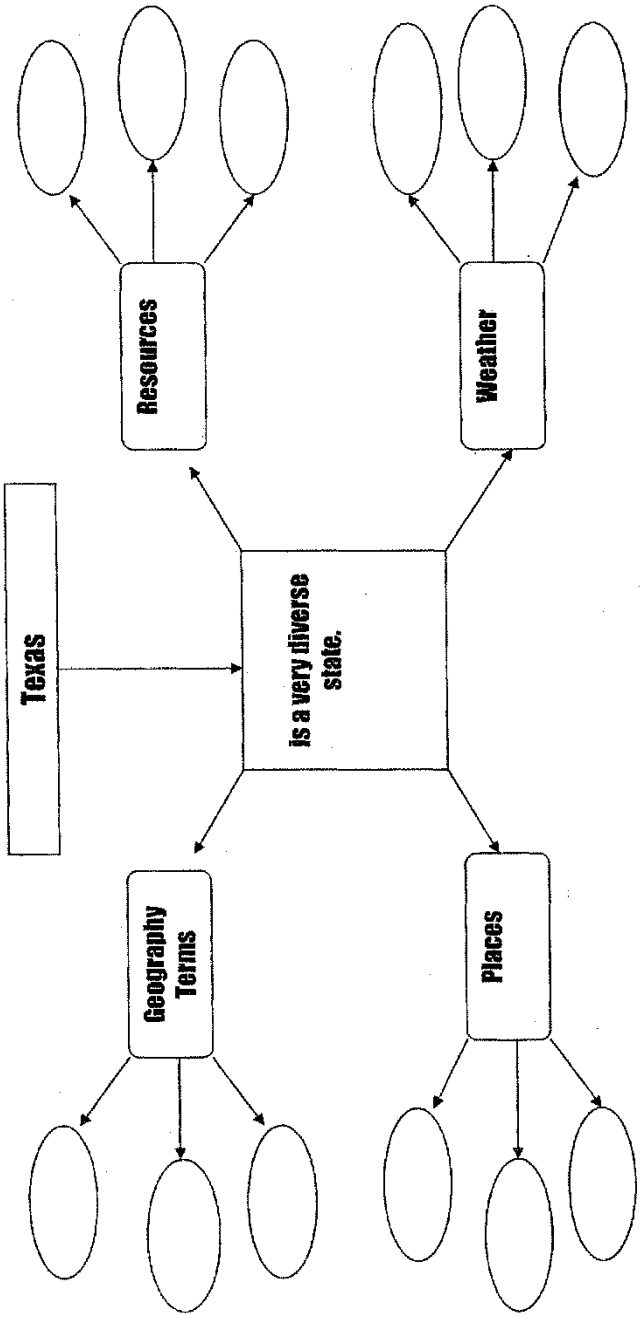
APPENDIX - A



Connections Web – Week 6, Lesson 1

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The Right to be Included: Homeschoolers Combat the Structural Discrimination Embodied in Their Lawful Protection in the Czech Republic

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Abstract

There is a 240-year tradition of compulsory school attendance in the Czech Republic. To many, compulsory school attendance is synonymous with the right to be educated. After the collapse of communism in 1989, along with the democratization of the government, the education system was slowly opened to alternatives, including the right to educate children at home, expressed in Act no. 561/2004. This inclusive law has had exclusionary consequences for many families who wish to choose this mode of education. The situation reveals a clear struggle over various forms of capital in the field of education, as famously described by Bourdieu (1998). The article, based on a longitudinal ethnographic study of homeschooling families, maps the structural discriminative dimension of the law and displays the strategies that the actors have adopted in order to combat them.

Keywords: Homeschooling, Structural discrimination, Education, Difference.

Introduction

Over the past two hundred years, nation states and their societies have become increasingly technocratic, secular, and meritocratic. One powerful tool enabling this shift is a centralized, compulsory, state-run education (Lancy, 2010). In Europe, education is now a fully institutionalized process. Professional teachers and state-run schools are the children's chief educators. Neither of them is questioned by the majority population. As classics of identity theory have pointed out, although the process of schooling is presented as natural, it is always marked by ideological conflicts and power struggles characteristic of the time in which the schooling occurs (Anderson, 1983; Bourdieu & Passeron, 1990; Berger & Luckmann, 2001).

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Modes of compulsory school education and the necessity for reforms have been the subjects of ongoing debates among parents, government officials, and school representatives for quite a while now throughout Europe, including in the Czech Republic. Alternatives to state schooling have an inconsistent tradition in the Czech Republic. During the communist era (1949-1989), church and private schools were closed and the public sector was sentenced to meaningless activities promoting life in a socialist country, while being closely watched by the state officials. After the Velvet Revolution in 1989, the situation changed. New modes of schooling were introduced, including renewed private and church schools and new styles of learning, including Montessori, Waldorf, Dalton, and Step-By-Step educational methods. Most current school reforms concern the content of learning and pedagogical methods without touching upon the very idea of centralized, universal, state-run education and specialized professionals as educators. However, an increasing number of parents, without questioning the right to and the need for education, strive for a different mode of transmitting knowledge and information outside the presence and intervention of a centralized system. They wish to homeschool their own children.

The paper describes the quest for this option. The political vision of inclusive education in the Czech Republic allows for only a one-sided approach: all children, regardless of their abilities or wishes, ought to be integrated into school, the only place where education can happen (Bartoňová & Vítková, 2013). Homeschooling in praxis questions this right, which over time turned into a requirement, bringing to light subtle forms of discrimination, disguised behind the label of inclusion, that create obstacles on the path to education.

Since 2005, Education Act no. 561/2004 § 40-41 Coll. (*Zákon o předškolním, základním, středním, vyšším odborném a jiném vzdělávání*) allows for a child to be homeschooled in the Czech Republic at the primary school level. Seemingly inclusive, discriminatory devices are nevertheless built into the conditions that homeschooling families must fulfill in order to be able to homeschool. My main interest here is to map, describe, and analyze their struggle for a chance to homeschool a child who has no special needs or disabilities and does not otherwise fall into a category of special conditions. I propose that homeschooling ought to be seen not as a reaction to growing dissatisfaction with the present mainstream, state-run school system in the Czech Republic, but rather as a natural enactment of an alternative worldview or ethos, built upon different ideas about learning, teaching, education, and schooling. As such, homeschool challenges the inclusivity of the school system in the same way as any other cultural, social, or religious tradition.

My particular interest is in the subjective evaluation of learning in childhood by homeschool families and in their current options for homeschooling within the legal framework of the Czech Republic. The process of developing the legal status of homeschooling, from a dismissed alternative to a possible legal right, provides an inseparable background to this debate. I also aim to comment on the relationships among the various forms of capital (Bourdieu, 1998) owned and manipulated by various families and their decisions to opt for homeschooling.

Notes on methodology

The data introduced below represent part of my longitudinal ethnographic research into alternative teaching and learning methods of primary and secondary school-age children, as well as the life strategies of their families, all situated in the Czech Republic. For two years, I interviewed families (parents and children) who opted for homeschooling as an alternative to mainstream state-run education. At the same time, I conducted interviews

with teachers and directors of the index schools[1] that enroll homeschooling children and act as examining boards in their compulsory periodic examination. I also regularly participated in the daily homeschooling routines of six families, observing the learning processes of the children and the teaching methods of the parents, spending time with them and attending their extra-curricular activities. In conjunction with these observations and interviews, I was a member of two of the most frequented online homeschooling forums (svobodauceni.cz; domaciskola.cz). I actively participated in self-educating activities for homeschooling families (conferences, workshops, and informal gatherings) and included written publications in my analysis. In keeping with the idea of ethnographic research, I pooled data from several sources in order to find as much as possible about a narrow sector of human interaction.

Although separate, all of these data-gathering methods are interconnected. Most of the interviews with homeschooling families were conducted in their homes, where I was also able observe the learning environment and family interactions. As the homeschooling families lived scattered across the whole country, I often had to stay several days in order to conduct the interviews with all of the family members. That extended and prolonged my opportunities for observation. The information gathered through the interviews could then be cross-checked with the data gathered through observation in the families, thus capturing the dynamics of learning and teaching, and of social and family interactions, all at the same time. On several occasions, I was able to follow these families to their index schools for mid-term or final examinations, thus gaining yet another opportunity to add to the data gathered in their homes. When possible, I interviewed all the members of a homeschooling unit: the children, the parents, and the other educators involved.

The written data used for my analysis here came mainly from online debates and publications either by homeschooling parents themselves (through blogging or online magazines on the topic) or by teachers/directors of the index schools. The written data provided a wider context that served as a field of reference for my own findings. It also represents a conscious image or self-presentation of the homeschoolers to the rest of the society. It is the shop window they use to inform, attract, and draw in others.

Data analysis is not the final chapter of the research, but a process that intersects with the whole research period, including data gathering (Hammersley & Atkinson, 1995). In the course of research, a scientist makes several decisions that consequently influence the future analysis, such as whom to interview, what to ask, and what to amend. Such choices are an internal part of the interpretation of studied phenomenon (Ezzy, 2002). The same was true for my research. Interpretations that are part of this study were focused around the key question, "What does education mean to homeschooling families and how do they implement this meaning in practice in a society that does not share their views?" In order to answer this question, I concentrated on the meanings and interpretations given by the homeschoolers themselves. Their emic interpretations are set against the wider socio-cultural context, to mirror the generally accepted patterns of education cosmology represented by mainstream schooling. Judging from the rising number of readers of on-line homeschooling forums, as well as the increasing number of homeschoolers nationwide, it is fair to estimate that similar cognitive, cultural, and social processes are taking place in other families across the country.

[1] An index school is any state-registered school where a child is enrolled for compulsory education and which takes responsibility for that child's periodic examination. Success in passing these examinations is a prerequisite for the right to remain in the homeschooling regime. For a child at the primary education level (6-11 years), any state-registered school in the country may act as an index school. For children in the lower secondary education level (12-16), only a few schools in the country, chosen by the Ministry of Education, may fulfil this role.

Childhood learning theories and homeschooling in the Czech Republic

From a cultural perspective, the issues of learning in childhood have been part of socio-cultural anthropology since its early days (Malinowski, 1929; Mead, 1928, 1930). Attention has been paid to culture-dependent presumptions and generalizations about psychological determinants of social interaction between adults and children. Studies have demonstrated the diversity of the ways in children are brought up and taught around the world, as well as the sense they make of their experiences (Lancy, 2010). Ethnographies from around the world point to a model of village learning in which a child receives a guided acquisition of cultural practices. In such a setting, children learn on their own, at their own speed, anything the children presume to be important for their lives under the instruction of any adult around. This model serves pre-industrialized societies well, but to what extent is it sustainable in urban communities? Formal compulsory schooling brought major changes to the real lives of people and the way that learning and education are perceived was dramatically altered.

Anthropological literature has provided a theoretically informed appreciation of innumerable culture-dependent adaptive paths of childhood learning and has shown how difficult, if not impossible, it is to transfer a village-learning model into a school curriculum (Lancy, Bock & Gaskins, 2010). Lancy asserted (2010) that what works well for transmitting culture does not necessarily work for transmitting school knowledge. While the village-learning model requires a child's independence and non-interference in learning, formal schooling expects the opposite: uniformity in daily preparation for classes and standardized systematic curricula-shaped learning and knowledge, certified by uniform testing.

Every culture applies two main methods in order to shape people into desired forms: socialization and education (Cohen, 2000; Rival, 2000). Socialization is carried out by kin and encompasses personal feelings. It labels the behaviours through which the basic cognitive models of society are learned. These models allow us to navigate through daily events and interactions with others. Through socialization, children acquire what Lancy (2008) calls *sense*, which is a prerequisite for successful acceptance by others, as well as for successful learning processes. Education, in contrast, is about acquiring standardized knowledge, abilities, and values. It takes place in a standardized and prescribed way, administered by a person without any affection necessary (Cohen, 2000). Learning factual knowledge is only a small part of the goal of education. The processes of thinking and the structure of relations that are taught to the students are much more important (Williamson, 1979). Several authors noted the loss of illusions that schooling brought to rural communities (Bledsoe, 2000; Ogbu, 2000; Rival, 2000; Reed-Danahay, 2000). The status quo of current schooling does not seem to work also for the culture of its origin, the urban industrial society (Stahl, 2015). A kind of combination of the compulsory schooling model and the village-learning model has been sought (Holt, 1997; Ricci, 2012; Kašparová, 2014).

Within the Czech scientific and pedagogical contexts, homeschooling is a side issue, explored only by a few (Kostelecká, 2003, 2005; Kašparová, 2012; 2014; 2015). The law pronounces compulsory school attendance for children, rather than any compulsory form of education. Education in the Czech context has historically been strongly connected to schools and other educational institutions (Kostelecká, 2005, 2010). Rooted in the socialist era, learning at home has been traditionally associated, in the broader Czech view as well as in scientific discourse, with various forms of handicaps or differences that cannot be integrated into the mainstream school system (Bartoňová & Vítková, 2013).

Sociologist of education Karen Chapman (1986) identified two basic approaches to education: functionalist and conflictualist. Functionalists believe the goal of the education system to be to select individuals according to their abilities and to allocate appropriate posts and positions to them. Conflictualists see education as a battleground for several interest groups (economic, social, political, and other), where the winners formulate the curricula that is later taught to all, until another victorious group takes over. In other words, the winners decide what, when, how, and why everyone else is to learn and which cultural capital is vital for succeeding in the education system (Bourdieu, 1998; Bourdieu & Passeron, 1990).

Among Czech homeschoolers, the conflictualist line of understanding prevails. Homeschoolers perceive themselves as promoters of a different cultural capital in the terms Bourdieu (1998) so famously described. They clearly recognize the political and philosophical dimensions of the issue and see their activities as a challenge to the inclusive system of schooling: *"Of course I believe each child needs an education but I do not believe the current school system offers the best option. It is too uniform; it does not respect differences in children and because of that it manages to kill the hunger for education in many children before it has ripened and borne fruit. Every child learns at their own speed with a different method. Only such methods make their desire for knowledge sustainable or even stronger. I believe I can provide such an environment for them at home. I want my children to be educated this way. I don't think just because the state decides something, that it must be the right decision. Look at our communist past, it is the best example of how things can go wrong" (Helena,[2] commenting on reasons to homeschool).*

Helena described the inequalities and differences, and the causal mechanisms which allow for them, which she believes exist between homeschooling and state-run schools. She used generalized and over-simplified expressions describing two opposing fields. Homeschool and state education were presented as two mutually exclusive homogeneous systems. This was a frequent approach and argument that homeschoolers used in their initial self-explanation. Since homeschooling is unusual in the Czech Republic, homeschoolers are challenged rather frequently, and they have to constantly defend themselves against a differently-minded majority. Such superficial declarations often suffice for this defense. Should the inquirer prove to be more deeply interested in the reasons for homeschool, the very core of the argument that recognizes education as a means of control (Williamson, 1979) can be seen in this statement by Daniela.

"Think of the logic. We are living in a free country, you can have as many children as possible and nobody asks you if you will have money to support them. You can make major decisions about their bodies – for example you can decide about their vaccinations, reject them altogether or on the contrary buy many more[3]. But once you wish to influence their minds through the stuff they are learning, suddenly there is a problem. Why should you challenge the state authority on a universal curricula? Who are you to decide what is best for

[2] Unless otherwise stated, all the data presented here comes from my own research, described in the Notes on Methodology section. Names and places have been altered to ensure anonymity.

[3] The respondent is referring to a dispute between a group of parents and the Czech state about the possibility of abstaining from the compulsory child vaccination program. In this legal case, a group of parents raised a concern about human rights violations, in which individuals are forced by law to be vaccinated against their will. In the meantime, these parents did not have their children vaccinated. This resulted in the fact that these children were not admitted to state-run school institutions. The issue was debated in the media and occasionally the parents were fined. The case was finally resolved at the beginning of 2015 by the constitutional court of law, which confirmed the earlier decisions of the lower courts and dismissed the possibility of a human rights violation. However, this result was not known to the respondent when the data was collected.

your child?" (Daniela, commenting on reasons to homeschool). Knowledge becomes an objective quality, verified and certified by the state. Its uniformity supports the authority of those in charge, while divergence brings about danger, which may take the form of an ideological or economic revolution (Illich, 1971).

Homeschooling constitutes an alternative platform,[4] where education, in the general understanding of the word, is being tested. It represents much of Bourdieu's (1998) reconciliation of the objective (the field) and the subjective (habitus), running along the conflictualist paradigm mentioned above (Chapman, 1986). The habitus is here represented by the homeschoolers, who mirror the objective field represented by mainstream state-run education. Mutual negotiations between the two display the power struggle and control over the various forms of capital (Bourdieu, 1998).

Like any other urban society, the Czech state provides a ready-made framework for combining family and working life. This model includes working parents and state-run care for children. Under this model, in general terms, the mother stays at home with a child during the whole period of her maternity and parental leave, lasting from the birth of the child up to three years of age. At the age of three, the child is placed in full-time day care, and the mother returns full time to her former profession, while continuing to perform her caring and homemaking activities. Thus, the mother ends up having two jobs, or two shifts at least. The father continues uninterruptedly with his career. The model often results in lasting inner stress and personal unhappiness on the part of those women who have opted for it – especially when the children are of young school age and a substantial proportion of care is still necessary (Kašparová, 2012).

Homeschooling families do not accept this model: *"We do not understand the logic of family policy at all. You are encouraged to care for your children for three years during the parental leave day and night, without any help or relief from the state, and then, overnight, just as the children are getting some sense, you are expected to place them in full-time care and go another way, working nine to five, seeing them awake for two hours a day and weekends, placing their upbringing into the hands of strangers. They do not see their parents, they do not see their siblings all day long. This is not a healthy model. This is not what we wanted," (Katka, commenting on reasons for homeschooling).* Katka was commenting on the normative actions of the state, which definitively assigns the role of the parent with its policy incentive: no intrusion or state support up to the age of three, voluntary co-operation via kindergarten activities from the ages of three to six, and obligatory care from the age of six onwards.

The different primary socialization of homeschooling children, with all its consequences, tests the validity, rigidity, and flexibility of the educational system in the Czech Republic. Bourdieu's concepts of habitus and cultural capital are closely connected with the process of homeschooling, since "cultural capital that is effectively transmitted within the family itself depends not only on the quantity of cultural capital, itself accumulated by spending time, that the domestic group possess, but also on the usable time (particularly in the form of the mother's free time) available to it." (Bourdieu, 1986: 253). Bourdieu's conceptual framework is placed at the center of attention here, since it illustrates in detail how the operationalization of social differentiation in schooling is tied to individual people's activities.

[4] The paradox remains that although internally fairly different, homeschoolers are perceived by the majority as a homogeneous community. Social networks and on-line images contribute a great deal to such understanding.

Structural discrimination of homeschoolers: five occasions

A growing parental lobby calling for the accommodation of alternative approaches to education resulted in a revised political attitude, and Act no. 561/2004 § 40-41 was passed in 2005. This law ensures that each child at the primary school level has the option to be educated at home, providing several conditions are satisfied. These conditions include: 1) The educator must hold at least a high school diploma, 2) the homeschooling family must find a school willing to act as a guarantor and examiner for regular compulsory testing of the child, 3) the homeschooling family must provide a letter of explanation as to why homeschooling should occur, 4) the homeschooling family must provide a written declaration that it has sufficient material means to educate the child, and 5) the homeschooling family must provide a letter of opinion from a Pedagogical-Psychological Advisory Bureau. Although everybody has the right to apply, there is no lawful demand for successful approval, since the option to homeschool is conditioned by several subjective requirements, as illustrated below.

The requirement concerning the qualification of educators brings two issues into the foreground. The first issue operates on philosophical grounds, questioning the need for this condition in the first place: *"In primary school, children learn reading, writing, and basic math. In fact, this is the stuff and the level most of the population uses all their life, regardless of their future profession. Unless you are an accountant or a scientist, you do not need much of the lower secondary school level math in your life. Sometimes a person without high school is a much better teacher than a university graduate. A degree does not say anything about the ability to be a good teacher. I see this condition as completely unnecessary," (headmaster of Kletná School, commenting on homeschooling conditions).*

This issue reflects the philosophical nature of the problem. It is created by the use of symbolic power: the educated are the gatekeepers of their trade. In order to remain so, they have to maintain their difference, certified by formal education. Another dimension is opened by the necessity of having a high school diploma: the structural discrimination intrinsically built into the requirement. The social and political history of the Czech Republic includes periods of open discrimination against selected groups of inhabitants (e.g. the educated proletariat, the bourgeoisie, and kulaks), preventing them from participating in some aspects of life, including education. As late as the 1970s, it was a common practice of the communist regime to influence educational strategies and restrict the educational options of certain families. If there were no workers in a family, the options for the children's further education were diminished due to their "unsuitable origin". If one child chose to study a subject considered undesirable by the regime, such as philosophy or especially theology, that child's siblings had no choice but to enroll into an apprenticeship, learn a trade, or work in agriculture – i.e. to usefully serve the regime[5]. Likewise, members of national minorities (especially Roma) whose children were placed in special schools were, by the nature of these schools, prohibited from continuing in further education and were thus destined to perform unqualified manual work or to learn a trade without a high school diploma. Members of these groups thus had no real chance for success in formal education during the communist era, which may yet have direct consequences in their current lives. *"Julie is taught by my mother, her grandmother. She is retired now and they spend a great deal of time together, most of it outside. My mother had many professions, she worked most of her life with children, in kindergarten, in afterschool activities, too. But after the war, she was not able to study, her family was of bourgeois*

[5] Personal family history of the author. For a further description of the period, see: Kárník, Z. 2004. *Bolševismus, komunismus a radikální socialismus v Československu.* Praha: Ústav pro soudobé dějiny AV ČR, 2004

origin, so the communists did not allow her to go to school, so she had to train to be a tailor. She does not have a high school diploma. So officially on paper, I am Julie's teacher. In practice, it is my mother," (Jana, commenting on homeschooling conditions). The case of Julie and her family shows a maneuvering strategy around the borders of the law in question. Having lifelong experience with teaching children is insufficient if it is not supported by a legal document; this forces the family to bend the law and expose themselves to consequent punishment.

To fulfil the second condition of the law in order to homeschool, the family has to find a school willing to enroll a homeschooler and to provide for regular testing. Although the law says the parent can choose any primary school, indicating that any primary school ought to consider accepting a homeschooler, the conditions and rules of co-operation between the homeschooling family and the school are within the competence of the school to decide. The research shows the schools differ greatly, from support and acceptance to obstacles and difficulties: "*We were the first homeschooling family in the former school. It was all new to the director, who was afraid of it all. She was very pedantic about all the paperwork that accompanied the change and did not pay attention to anything that I was saying to her. She ignored the fact that we decided to do a project-centered education and thus could not cover all the topics they did at school, while the ones we did cover we would do in much more depth. At the end of the school year, she was examining Danny in front of the whole class on all the stuff they covered in the whole last semester. As if it were a punishment for his having this option to be different. It was very stressful for both of us: for him, because he thought he was stupid for not remembering the difference between a rabbit and a hare after birth, which was one of the 60 questions from biology, and for me, because I could see the whole time and the whole way through the examination how very unfair and pointless such testing was. So we searched for a different school where they would be more understanding of our methods. And we found one. The director is trusting; they are interested in our project work and make Danny talk about it. In fact they are really evaluating his work, rather than testing silly encyclopedic knowledge as they were doing at the former school," (Irena, commenting upon their choice of index school).*

The attitude of the director is a key factor in homeschooling application success. The director is the gatekeeper who, in the end, makes the sole decision about this possibility. At the same time, each family, if they are rejected by one school, are free to turn elsewhere. This in praxis leads to the migration of homeschooling families towards welcoming directors and their schools. For this reason, specialized homeschooling schools are forming within Czech educational institutions. This is a paradox, since the intention of Act no. 561/2004 § 40-41 was to enable the opportunity of inclusion for homeschooling children in any primary school in the country, rather than setting them aside into specialized institutions.

The third condition, the provision of a written explanation of why homeschooling should occur, reveals the puzzle of Act no. 561/2004 § 40-41 in all its complexity. In order to apply, parents must state their motives for homeschooling. In order to be successful, motives have to be approved by the index school director. Although parents have the right to apply for homeschooling, there is no legal right to be granted it in the Czech Republic. Depending on the institution and the belief of its director, fulfilling this condition may require a high standard in literacy, debate, or even legal training: *"We wrote this motivation letter two or three times. The director kept returning it to me with notes, like I was her student or something. I was getting desperate," (Vlasta, commenting upon the conditions for homeschooling).* Returning the homeschooling topic once again to the philosophical level, there is no such thing as the equity of an alternative to the state-run education and schooling. Each case is evaluated individually; the authority to decide is

placed once again in the hands of the state, personified by the director of the school. In practice, therefore, homeschoolers are indirectly motivated to choose a homeschool-friendly index school, thus deepening the exclusion of homeschooling from the mainstream system. "*We have several schools in the neighborhood, but my friend who also homeschools recommended a school about 25 km away, in Rodnov. We know there are several homeschooling families there and the director does not make a big deal out of it. Here in the local school we would be the first family to homeschool," (Iveta, commenting upon the choice of school).* This selection takes away the burden of being a homeschooling pioneer in the local school, but it raises the cost of homeschooling due to necessary commuting. Most importantly, it discourages homeschoolers from forging ties with local communities, which traditionally center around schools. Rather, they seek alternatives and support via various other interest groups and/or social networks.

The fourth condition deals with financial matters. Parents have to declare in writing that they can provide adequate space and material conditions for the education of their child. This does not entitle them to financial support from the state, reallocated from taxpayer money, for the education of their children. The allocated amount goes to the index school where the child is enrolled and tested. Administratively, a homeschooler brings the same amount of money to the school as any other pupil. Enrolling homeschooling pupils can thus be a survival or developmental strategy for some schools, especially geographically isolated schools, where there are few other pupils.[6]

It is a big financial decision for a family to homeschool. A Czech school traditionally covers most of the equipment necessary for learning (textbooks, microscopes, computers, software, gymnastic equipment, etc.) from taxpayer money. In addition to material equipment, schools offer other benefits, such as subsidized meals and extra-curricular activities. The law does not specify how many of these advantages the index school must offer to homeschoolers. Although the schools usually offer textbooks and consultations, the availability of other material and services vary greatly. Due to the geographic distance that most homeschoolers have from their index schools, subsidized meals and after-school activities are not realistic options, and even borrowing other equipment is problematic. The system does not offer any means of compensation, and thus the financial burden of education and schooling falls almost entirely on the homeschooling family. Since most homeschooling families, in order to spend time with the children, often have only a single full-time (or two part-time) breadwinner(s), the decision to homeschool naturally hinders lower-income and single-parent families. *"I know we can afford to homeschool only because of my husband's job and also because we have opted for voluntary modesty in our lifestyle. We buy most stuff second hand, we try to grow a lot of our food, so we have to buy cheap, low-quality food as little as possible. After-school activities are very costly and since we have four children, we had to limit it to two per child. We have no more money to pay for it," (Jarka on managing their homeschool financially).*

For all the families that managed to jump through the hoops of homeschool enrollment so far, the final condition is usually the most difficult and feared. They have to provide a document presenting the opinion of a state-run institution called the Pedagogical-Psychological Advisory Bureau. This institution has several competencies. Among others, it deals with children who are different in some way, be it in their IQ, abilities, or behavior. The difference is determined by various measures and tests, labelling the child accordingly. Both the parents and the state can order an evaluation of a child, should they feel the need. Usually only children with learning or behavioral difficulties are required by

[6] One example of this phenomenon is ZŠ Březová – see http://www.zsbrezova.eu/index.php/o-nas/napsali-o-nas/474-skola-pro-cely-svet, /accessed 15.9.2015/

the order of the state (represented by a school director) to undergo tests here. On the basis of these tests, children with special needs are then integrated into the school system in a variety of ways, ranging from full classroom integration with various on-the-spot adjustments, e.g. longer time for written tests, to seclusion at home, e.g. due to a long term illness (McDonald & Lopes, 2014; Bartoňová & Vítková, 2013).

"We came there [to the Pedagogical-Psychological Advisory Bureau] and the lady in charge told us straightaway that she would not write the letter of recommendation for us, because she believes children at home are not socialized properly, that we were going to make his life miserable without friends and why would we want to do it, that he is healthy, without any handicap, so why would we not let him go with others. Perhaps she would not be so difficult about this if he had learning difficulties or some kind of long-term illness. I thought we would go somewhere else, but then she started to ask us questions, like why we wanted to do it, why we didn't like our former school, and so on. It was rather a long talk. She talked only to us, not to our son. It was like a political debate on TV. But she did not write a letter for us in the end. So we went to a different Bureau, where Mr. Alvin was in charge. I knew about him from the social forums chats – he supports homeschooling – he sent us a letter via e-mail, we did not even have to go to see him,"(Mira, on her Bureau visit). A similar reaction to the bureau officials was given by a different respondent: *"The director told us: You have a healthy child? Then homeschooling is out of the question. I do not believe this exclusion is good for anybody," (Daniela, on her Bureau visit).* This echoes the formal political regime, where the idea of inclusion in the education system was totally dependent on the health of the child. While healthy children were prohibited from being educated anywhere but in a state institution, the home education of children with different needs was tolerated, since they were considered second-class citizens without much potential use for the regime.[7] As a result of past attitudes, homeschooling continues to be seen by many officials and administrators as a symbol of discrimination – an undesirable practice that ought to be erased, using the means and tools given to them by the state. At the philosophical level, the homeschooling parents thus face their toughest opponents here, with a body whose job it is and has historically been to both define and diagnose differences. The paradox remains that although the law does not list the favorable opinion of the Bureau among the necessary conditions for an application's approval, in practice, the school directors require it, citing it in order to distribute the burden of deciding. Failure to provide a positive opinion may thus serve as a justification for homeschool rejection.

Parents trying to formalize homeschool are thus challenged in five steps by discriminatory measures. Overcoming these challenges requires a high degree of social, cultural, and economic capital, substantially limiting those interested in this model of learning. What started off as a project of connection between the immediate human and natural environment is transformed via obscure state measures into an exclusive scheme for the educated, resourceful, and wealthy. The conditions open a space where the right of parents to educate their children at home is severely hindered by institutional discrimination.

[7] As an example of the approach of the communist ideology to handicapped children, see "Children with hearing disabilities are deprived of impulses that develop speech …or other higher principles, including passion for work and the love of a collective of co-workers and socialistic community" (translation of the author). In Další rozvoj československé výchovně vzdělávací soustavy**, Svazek 2,** Czech Socialist Republic (Czechoslovakia). Ministerstvo školství, Slovak Socialist Republic (Czechoslovakia). Ministerstvo školstva SPN, 1970 , str. 59

The law itself does not guarantee the right to homeschool. It is not enough to simply provide all the documents required by the law (such as a written application, a description of material conditions, a list of textbooks to be used, and certificates of qualification). In order for the application to be successful, all of these materials have to be approved by the director of the index school. The subjective decision of the director is hidden behind seemingly objective documents and materials, provided (or not) by the parents. Since not all directors are open to the possibility of homeschooling, this rules out the possibility of enrolling the child into homeschooling in any Czech primary school. Rather, schools that specialize in homeschooling seem to be forming in many regions, and homeschooling families cluster around them.

The disapproving attitude of the state towards homeschooling is fully revealed at the lower secondary school level (ages 12 to 16), the second and last part of compulsory education in the Czech Republic. It is traditionally perceived by all the stakeholders (teachers, children, parents, directors, and government officials) as the most problematic period of compulsory learning. Teachers report a tremendous loss of interest on the part of the pupils, children report increasing boredom at school and a loss of sense in all the facts they have to learn, directors report growing difficulties in managing the behavior of the pupils (all three, see Straková, Spilková & Simonová, 2013), parents express fears for their children's future and pressure to send them to better schools,[8] and government officials report falling positions in European testing surveys.[9]

Lower secondary school level education is loaded with factual knowledge from many fields of interest: chemistry, physics, math, history, biology, home economics, music, art, literature, Czech language, two foreign languages, geography, physical exercise, civic education, IT, and manual training. Looking at the list of subjects, it is tempting to say that Williamson (1979) was wrong; it seems that acquiring factual knowledge *is* the goal of education at this level after all. My data show that to many Czech parents, the quantity of information, rather than any processes of thinking, is still synonymous with *education.*

This commonly held belief is reflected in the current government's stance towards homeschooling at the lower secondary level. Lower secondary level children whose parents wish to educate them at home must apply to one of the few pilot index schools where the Ministry of Education is monitoring the process. Depending on the will of the officials and the ministers in office, the experiment can be stopped at any time.

As such, homeschooling at the lower secondary level has an ambivalent status: neither impossible nor accepted. Families who decide on this method of learning and living have to face the uncertainty of the very near future, living from one year to the next. Financial demands multiply and circumstances divert them further away from their formal schools towards those that are centrally selected to implement the experiment. This status at the lower secondary level persists despite positive results submitted from all of the pilot index schools to the Ministry for almost 10 years now.

Concluding remarks

Anthropology of education is not yet firmly established in the Czech Republic, and the tracking of anthropology of learning is virtually non-existent. This is partially due to the ongoing beliefs of both academics and research boards that topics connected with pedagogy and education are the domain of research teams associated with pedagogical faculties; another reason is that the legacy of communist uniformity continues to dominate the minds and imaginations of many, including social science academics (Illich, 1971).

[8] See http://ceskomluvi.cz/diskutujte-o-budoucnosti-viceletych-gymnazii, accessed 18.7.2014
[9] See PISA survey 2012 on (http://www.pisa2012.cz/?a=vystupy, accessed 19.9.2014

After all, they are themselves the products of a uniform education system, and thus have difficulties imagining otherwise. It is mainly due to culturally creative thinkers that educational alternatives came into existence worldwide, and as such became of interest to social scientists. In the Czech Republic, the research that connects social science with pedagogy mainly concerns minorities (Kašparová & Souralová, 2013; Nekorjak, Souralová, Vomastková, 2011) or gender (Jarkovská, 2013). The outcomes of this research are similar to others throughout the world – namely that education strives to reduce ethnocentrism, while at the same time it is shaped by it and inevitably also reproduces it (Kašparová & Souralová 2013; Meeusen, de Vroome & Hooghe, 2013).

The emic encounters described in this paper confirm several important facts associated with education and schooling. Although these findings have to be read within the legal context of the Czech law, they represent a navigation of personal strategies similar to the situation elsewhere in the world (Ricci, 2012).

First, there is an unresolved ongoing philosophical social and political debate on the meaning of education and schooling. The state, the guardian of the metacapital (Bourdieu, 1998), has the final decisive power to accept or reject alternatives. However, the legal guarantee of a right is not in itself a token of acceptance or inclusion. As is the case in the Czech Republic, the law can contain discriminatory conditions that transform a universal right into a right for a select few.

Second, parents who opt to homeschool often change their professions so as to accommodate for changes, or share educational responsibilities in order to be able to sustain their professions. As such, homeschooling is practiced by families throughout the whole spectra of society, being functionally adopted by single parents as well as by large two-parent families, living in urban as well as rural settings. What connects the families is that their desire for change relates to their early childhood experience (not necessarily negative), motivating them to be able to imagine and to fight for a difference both for themselves and for their children. Despite their own education and training, they are able to step aside, envision an alternative, and assemble agency to make it happen. Nevertheless, a homeschooling parent is never free from ties to the formal school and state system. Structural adjustments ensure at least a partial penetration of the formal system by the parent into the teaching and learning of the children. It is not an accident that the greatest challenge described by homeschooling parents is to deschool themselves.

Third, since in homeschooling families there is little or no spatial and institutional division between family life and learning, most homeschoolers do not differentiate between socialization and learning, as described by Cohen (2000) and Rival (2000). As such, homeschooling resembles the learning strategies of pre-industrialized societies: sibling learning and responsibility, stress upon observation, practice oriented, and the child as an initiator of its own progress (Lancy, 2008). Yet the resemblance fails in one of the major aspects of the village-learning model: the immediate society does not play the role of a teacher, since usually it does not share the same values. Homeschoolers are frequently too different, and are thus excluded from local schools as well as some local (mostly rural) communities; they are forced to create virtual communities via social networks. However, it is difficult to draw conclusions about the development of the issue. There is not enough data within this geographical context yet. In a decade or two, follow-up studies will be possible and we will be able to tell how the fusion of education and socialization will project itself into the lives of both homeschoolers and the broader society. At the moment, homeschooling opens a world of alternatives for those who seek it actively enough and challenges the practices of post-socialist inclusive education.

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