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Factor 3:

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Sincerely,

Editors in Chief
Dr. Kamil ÖZERK, University of Oslo, NORWAY

IEJEE

Prospective elementary and secondary school mathematics teachers' statistical reasoning *

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Abstract

This study investigated prospective elementary (PEMTs) and secondary (PSMTs) school mathematics teachers' statistical reasoning. The study began with the adaptation of the Statistical Reasoning Assessment (Garfield, 2003) test. Then, the test was administered to 82 PEMTs and 91 PSMTs in a metropolitan city of Turkey. Results showed that both groups were equally successful in understanding independence, and understanding importance of large samples. However, results from selecting appropriate measures of center together with the misconceptions assessing the same subscales showed that both groups selected mode rather than mean as an appropriate average. This suggested their lack of attention to the categorical and interval/ratio variables while examining data. Similarly, both groups were successful in interpreting and computing probability; however, they had equiprobability bias, law of small numbers and representativeness misconceptions. The results imply a change in some questions in the Statistical Reasoning Assessment test and that teacher training programs should include statistics courses focusing on studying characteristics of samples.

Keywords: Statistical reasoning, Prospective teachers, Statistics education, SRA.

Introduction

The importance of statistical reasoning is increasing because in today's world individuals face daily issues such as participating in a debate or community action or being aware of some phenomena such as crime rates, population growth, spread of diseases, industrial production, educational achievement, employment trends etc. (NCTM, 2005; Watson & Callingham,

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2003). However, an individual's statistical reasoning is not always intuitive (NCTM, 2005); therefore, strengthening and developing individual's statistical reasoning as an outcome of schooling is necessary (Gal, 2002; Watson & Callingham, 2003; Garfield & Ben-Zvi, 2007).

In this respect it is important for prospective teachers to have statistical reasoning (Garfield, 2002) because what teachers know is what their students know (Fennema & Franke, 1992; Heaton & Mickelson, 2002). However, some small scale studies pointed to the fact that both PEMTs and PSMTs lack the reasoning necessary to determine when and why to use statistical constructs such as mean, median, variance and distribution (Canada, 2008; Groth & Bergner, 2006; Makar & Confrey, 2005; Leavy, 2006). By the same token, a study done with 66 PEMTs and PSMTs on their probability misconceptions showed that both groups had equiprobablity bias and misconception of law of small numbers (Jendraszek, 2010).

Although small scale studies provided important information about prospective teachers' existing meanings of some statistical constructs and probability misconceptions, these studies pointed to the lack of knowledge and reasoning in statistics in parts such as understanding variability (e.g., Makar & Confrey, 2005), understanding mean (e.g., Groth & Bergner, 2006) and misconceptions regarding probability, etc. (e.g.,Jendraszek , 2010). On the other hand, Garfield (2003) provided the field with a paper-and-pencil Statistical Reasoning Assessment test (SRA) to examine large number of individuals' statistical reasoning. In this regard, this study aimed at determining prospective elementary and secondary mathematics teachers' statistical reasoning types. Examining a comparatively large number of prospective teachers' statistical reasoning (N=173) with SRA test might further assist teacher preparation programs with what to focus on specifically (Shaugnessy, 2007; Bulut, 2001) due to SRA's capacity for the design of instructions since responses provide in-depth information about both correct reasoning skills and misconceptions (Sundre, 2003). Studying both PEMTs' and PSMTs' statistical reasoning types in juxtaposition to each other with participants coming from a metropolitan city of Turkey might provide a description of the knowledge repertoire of these prospective teachers with respect to the statistical concepts. Also, since both groups come from a different educational program at the university level, comparing their statistical reasoning might add to the literature the differences among these groups based on which recommendations specific to each program can be made.

Being informed by the aforementioned studies the following research questions were investigated:

I. What are the statistical reasoning types of prospective elementary school mathematics teachers?

II. What are the statistical reasoning types of prospective secondary school mathematics teachers?

III. Is there any difference between statistical reasoning types of prospective secondary school mathematics teachers and elementary school mathematics teachers?

In particular, this research study is situated in Turkey, done with Turkish prospective teachers educated in a different context than their peers in different countries. Yet, results pointed to the similarities with previous research (e.g., Jendraszek, 2010) and extended it by focusing on prospective teachers' reasoning regarding each sub-scale. In this regard, results of this study might further assist teacher preparation programs, courses for teaching statistics, to focus specifically (Shaugnessy, 2007; Bulut, 2001) on prospective teachers' knowledge of variables and sampling.

Literature Review

The outcomes of statistics education ranging from elementary school to university involve three different levels: statistical literacy, statistical reasoning and statistical thinking. Although they overlap with each other at the content level (Garfield & Ben-Zvi, 2007; Delmas, 2002; Rumsey, 2002; Chance, 2002; Garfield, 2002), Delmas (2002) pointed to the differences among these three domains in terms of the cognitive engagement they require from an individual. For instance, statistically literate person can know when to use mean, median and mode or critically evaluate the statistical statement. However, the ability to compare and contrast data, to be able to explain the add-divide procedure in finding the mean or relating the concepts with each other such as independence of an outcome and representativeness belong to statistical reasoning. On the other hand, applying the ideas to the new problems and asking questions of one's own such as choosing the best way to analyze data or diagnosing weaknesses in the statistics procedures is related to one's statistical thinking.

Table 1. *Delmas's (2002) distinction between three domains*

Basic Literacy	Reasoning	Thinking
Identify	Why?	Apply
Describe	How?	Critique
Rephrase	Explain (the process)	Evaluate
Translate		Generalize
Interpret		
Read		

Although, the differences between these three domains are blurred, researchers emphasized the development of statistical reasoning as an outcome of schooling (Gal, 2002; Watson & Callingham, 2003; Garfield & Ben-Zvi, 2007). This is especially because statistical reasoning is to understand and reason with statistical information and make interpretations based on sets of data (Garfield, 2002). Such level is important for individuals to participate in community action and be aware of such as population growth, spread of diseases, educational achievement, employment trends etc. (Watson & Callingham, 2003). In this respect, Garfield (2002) postulated correct reasoning skills learners are expected to gain and misconceptions learners should not develop in order to be counted as having statistical reasoning.

Correct Reasoning Skills, Misconceptions and Research on Teacher Education

The correct reasoning skills involve reasoning about; data, representations of data, statistical measures, uncertainty, samples, and, association. Researchers concluded that once students have these reasoning skills, they might be considered as having statistical reasoning (Garfield, 2002, 2003; Garfield & Gal, 1999). However, they also contend that for someone to be able to reason statistically, they should not have some particular misconceptions. These are; misconceptions about averages, outcome orientation, bias about good samples, the law of small numbers, representativeness misconception and equiprobability bias. In the following paragraphs, all these aspects of statistical reasoning are discussed relating to the research on teacher education.

Statistics is based on data (Moore, 1990; Garfield & Ben-Zvi, 2008) and *reasoning about data* involves examining a phenomenon identifying variables embedded in it (Mickelson & Heaton, 2004). Since data are only numbers without context (Moore, 1990), within the context, type of data-- qualitative or quantitative-- can be determined. Then inferences can be drawn based on the type of data (Garfield & Ben-Zvi, 2008). Once the type of data is determined, then one can *represent data* constructing and/or modifying graphs and *read* them

to interpret data and *recognize* the general characteristics (Garfield, 2003). While interpreting data some *statistical measures are used* such as measures of center (mean, median and mode), spread and position. While interpreting data knowing about when and how to use them is necessary (Garfield, 2003). Nevertheless, some might think that averages are the most frequent number or regard mean and median as the same. Moreover, some might argue that groups are compared according to their averages and average is calculated with add-divide procedure regardless of the outliers. Researchers stated that students should not be using these types of *(incorrect) reasoning* while analyzing statistical information (Garfield, 2002, 2003; Garfield & Gal, 1999). Nevertheless, Groth and Bergner (2006) found out that only 3 out of 46 prospective elementary mathematics teachers could think about hypothetical situations in which one of the mean, median and mode might be a better measure of center although all of them could discuss the procedures of these measures. By the same token, Makar and Confrey (2005) found out that PSMTs use of language while describing variation and distribution emerged from the shape of the distribution rather than their understanding of variation while comparing two data sets. These researchers concluded that PSMTs reasoning about measures of distribution was weak. Similarly, some other research studies focusing on PEMTs' statistical concepts in analyzing and comparing data sets showed that PEMTs were not able to take into account measures of spread (Canada, 2008; Leavy, 2006).

Reasoning about uncertainty is also an indispensable component in statistical reasoning. It refers to understanding and using the ideas of randomness, chance, and likelihood to know the ways of determining the probability of events (Garfield, 2003). Outcome of an event cannot be determined certainly even if possible outcomes are definite (Moore, 1990). At the same time, each outcome is uncertain. Thus the phenomenon under investigation is called as *random* (Moore, 1990) and its likelihood could be measured. However, one might have the tendency to decide by looking at just a single event rather than series of the events (Konold, Pollatsek, Well, Lohmeier, & Lipson, 1993). In this case *outcome orientation approach* develops. For instance, as can be seen in SRA, one who has outcome orientation sees 70% likelihood of rain in ten days as it should rain in each of the ten days (Garfield, 2003), although there is still a 30% chance of not to rain for each day. By the same token, one might also think that the likelihood of events is the same since it happens by chance (Lecoutre, 1992); concluding that they are equiprobable by nature. One who thinks this way has the *equiprobability bias* (Lecoutre, 1992). For example, when two dice are simultaneously thrown, the possibility of obtaining two fives and the possibility of obtaining one five and one six on two rolls can be seen as equally likely by someone who has this conception.

Statistical reasoning also involves r*easoning about samples* that requires being able to know the part-whole relationship between sample and population (Watson & Moritz, 2000). Sample is a subset of the population and by examining this subset; results of the sample can be generalized to population. To be able to generalize the results randomness, representativeness and bias are critical notions to be considered (Watson & Moritz, 2000). Knowing about characteristics of samples also allows individuals to interpret the relationship between variables, *the association* (Garfield, 2003). Whether there is a relationship between variables or to what degree the relationship exists are the concerning questions. Furthermore, in order to select a representative sample, members should be selected randomly (Gay et al., 2009). However just random selection does not guarantee the representativeness since sample size also effects the results (Tversky & Kahneman, 1971). Small samples even if randomly selected might not show all of the properties of the population since variability exists within the population (Watson & Moritz, 2000).On the other hand, some might think that *good samples have to represent a high percentage of the population.* That is they might think that if sample size is a large percentage of a population then it is a good sample (Garfield

& Ben-Zvi, 2008; Garfield, 2003). One who has this misconception thinks that if population size increases then sample size should also increase. However for a reliable estimation absolute size of the sample is important rather than the sample size relative to the population (Smith, 2004). A well-chosen sample can provide sound estimations even if the sample is not a high percentage of the population (Garfield & Ben-Zvi, 2008). In other words, as stated earlier, randomly chosen sufficient number of participants as a sample can provide representativeness and unbiased results. However, there is a subtle but an important issue such that randomly drawn two samples are similar to each other since they are randomly chosen. However these two samples might be different from each other since random samples varies, especially the small ones (Garfield & Ben-Zvi, 2008). Thus, one who only takes into consideration the randomness ignoring the sample size might think that randomly drawn any sample should have the same characteristics of the population without considering sample size (Tversky & Kahneman, 1971). Therefore, they might conclude that small samples resemble the populations in making inferences (Garfield, 2003) since drawn randomly. This is called as *the law of small numbers* misconception (Kahneman & Tversky, 1974). Interestingly, Jendraszek (2010) investigated PEMTs and PSMTs (N=66) probability misconceptions and found out that both groups had equiprobability bias and the law of small numbers misconception.

By the same token, one might think that the likelihood of a sample being representative depends on how it resembles to the population (Kahneman & Tversky, 1974). One who thinks this way has *representativeness misconception* because s/he tends to use heuristics instead of probability principles. For instance, as a result of flipping a fair coin 6 times, obtaining HTHTHT can be seen as less likely than obtaining HTTTHT, by those holding the representativeness misconception. Some research done with PEMTs showed that only a few of them (10 out of 54) were able to point to the characteristics of sample which is representative part of the whole (Groth & Bergner, 2005). Similarly, Heaton and Mickelson (2002) examined PEMTs' integration of statistical investigation to the elementary school curricula. They found that PEMTs ignored the representativeness of the data they used. Özen (2012) also found out that PEMTs used the sample size as the only aspect of statistics and they failed to relate it with the context.

Aforementioned research points to prospective teachers' lack of knowledge in statistical concepts such as understanding the use of mean or variability etc. Doing further research with SRA might provide detailed information on both PEMTs' and PSMTs' statistical reasoning types holistically. That is, results might further shed light on the different sub-understandings and misconceptions simultaneously and in juxtaposition to each other. This in turn might assist teacher educators to determine specific pathways to help prospective teachers to reason statistically.

Method

Research Design

Research design of the study is a descriptive research in which statistical reasoning of prospective mathematics teachers, is described with quantitative data and presented existing differences between PEMTs and PSMTs (Gay et al., 2009). Groups are established according to the grouping variable which is the teaching level of prospective mathematics teachers.

Participants

Target population of the study is senior students studying in the elementary and secondary school mathematics teaching programs in Istanbul, Turkey. Convenience sampling was used

as a sampling method. Prospective teachers who participated in the teaching methods course at the time of the data collection constituted the sample. In Turkish education system, while elementary school education covers 5th through 8th grades, secondary school education covers 9th through 12th grades. Teachers teaching at those grades are required a bachelor's degree in a related field. Unless the degree is awarded by a college of education, teachers are expected to have a teaching certificate given by college of education. The participants of this study consist of 91 PSMTs (80% of the prospective secondary sub-population) and 82 PEMTs (50% of the prospective elementary sub-population).

Table 2. *Sample*

Groups	Sample Size	%
Elementary School Level	82	50
Secondary School Level	91	80

Instrument

Researchers and teachers use different methods while assessing teaching, learning or the development of statistical reasoning such as performance assessments or interviewing. However these methods are not practical in large groups of people (Garfield, 2003; Tempelaar, 2004). Statistical Reasoning Assessment (Garfield, 2003), on the other hand, is a paper-pencil test which is easy to administer and score. Moreover, it is helpful for the design of instructions since data obtained through this test provide information about correct reasoning skills and misconceptions as well (Sundre, 2003). By the same token, the statistical reasoning types assessed in the test are covered in in the secondary and elementary school National Mathematics Curriculum. Therefore Statistical Reasoning Assessment (SRA) test was used in this study.

The test includes 20 multiple choice items about probability and statistics. Alternatives of the items are statements indicating correct reasoning, misconception or simply false instances. Some items have more than one correct alternatives and alternatives indicating misconceptions. The list of these alternatives and items are given in Table 3 and 4. Sample items from the original instrument are given in Appendix.

Scoring Procedure

According to the original scoring procedure, there are two main categories; overall correct reasoning skills score and overall misconceptions score. Since there are 8 subscales under these two main categories, 16 scores are obtained from these subscales. (See Table 3 and Table 4)

Overall correct reasoning skills score is obtained per person in the following way: Someone selecting the correct alternative (choice) gets 1 point otherwise 0 point. These scores of particular responses of the items contributing each scale are added and then divided by the number of items since each scale includes different number of responses. In this way, scores of each sub-scale change on a scale of 0 to 2. For instance the scale of Correctly Interprets Probabilities is composed by alternative d of 2nd and 3rd items. If someone answers correctly one of them and incorrectly the other, s/he gets 0.5 point for Correctly Interprets Probabilities sub-scale since (1+0)/2 equals 0.5. The other correct reasoning subscales scores are calculated in the same way. Then, after scores of each subscales generating correct reasoning skills score per person are found, they are added in order to obtain an overall correct reasoning score. This procedure is repeated in order to find each participant's score. The same procedure is applied for obtaining overall misconceptions score but at this part if someone selects the alternative signaling a misconception, then s/he gets 1 point. Therefore 0 means for

misconception part, s/he does not have the misconception. For instance the scale of Representativeness Misconception is composed by alternative a, b, d of the 9th, e of the 10th and c of the 11th items. If someone selects all of these alternatives for these items, s/he gets 1.67 point for Representativeness Misconception

Table 3. *Correct Reasoning Skills*

Correct Reasoning Skills	Items and Alternatives
Sub-scale 1: Correctly interprets probabilities	2d, 3d
Sub-scale 2: Understands how to select an appropriate average	1d, 4c, 17c
Sub-scale 3: Correctly computes probability	
a. Understands probabilities as ratios	8c
b. Uses combinatorial reasoning	13a, 18b, 19a, 20b
Sub-scale 4: Understands independence	9e, 10c-d-f, 11e
Sub-scale 5: Understands sampling variability	14b, 15d
Sub-scale 6: Distinguishes between correlation and causation	16c
Sub-scale 7: Correctly interprets two-way tables	5: 1 d
Sub-scale 8: Understands importance of large samples	6b, 12b, 7e-f

Table 4. *Misconceptions*

Misconceptions:	Items and Alternatives
Sub-scale 1: Misconceptions involving averages	
a. Averages are the most common number.	1a, 17e
b. Fails to take outliers into consideration when computing the mean	1c
c. Compares groups based on their averages	15b-f
d. Confuses mean with median	17a
Sub-scale 2: Outcome orientation misconception	2e, 3ab, 11a-b-d, 12c, 13b
Sub-scale 3: Good samples have to represent a high percentage of the population	7b-c, 16a-d
Sub-scale 4: Law of small numbers	12a, 14c
Sub-scale 5: Representativeness misconception	9a-b-d, 10e, 11c
Sub-scale 6: Correlation implies causation	16b-e
Sub-scale 7: Equiprobability bias	13c, 18a, 19d, 20d
Sub-scale 8: Groups can only be compared if they are the same size	6a

sub-scale since (1+1+1+1+1)/3 equals 1.67. The other misconceptions subscales scores are found in the same way. Then, after scores of each misconception subscales' scores are found, they are added in order to obtain an overall misconceptions score. This procedure is repeated in order to find each participant's score.

Turkish Version of the Instrument

Forward translation technique was used to translate the test from source language (English) to target language (Turkish). Then, validity and reliability evidences were collected for the Turkish version of the test. Firstly, it was translated into Turkish by a professional translator, a graduate student studying at a Mathematics Education and the researchers of this study,

independently. After translation, the first and second author revised the translated instruments independently and after reaching on agreement, final version was constructed. Then, a Turkish teacher controlled the grammar of the test. Finally four experts' opinions on equivalence of both versions were obtained and then the test was finalized.

Afterwards, in order to establish empirical evidence for linguistic equivalence, 61 university students who were competent at both languages, took firstly the original instrument and three weeks later they took the Turkish version. The number of participants should be at least 30 for this equivalence study because of the parametric analysis requirement (Gay et al., 2009). Also at least two weeks should be left between test administrations as a precaution (Aksayan & Gozum, 2002). If shorter than two weeks, participants might remember the items and higher scores might appear. Therefore, they retook the Turkish version of the instrument, three weeks later.

The equivalence of the forms was examined at the item level. Participants' responses were coded as 1 for correct answers and 0 for incorrect answers. This coding procedure was done for each correct alternative for the questions with multiple correct answers. Also blank answers were coded as 0. Since variable of interest is dichotomous, data were matched-pair and data could be represented by 2x2 table, McNemar test was used in analysis of the items (Basturk, 2010). Significant difference was not appeared in the items, except 1st, 2nd, 4th, 10th-c, 11th, 13th and 17th. Back translated versions of these items and original versions were compared by a Ph.D. candidate in mathematics education who is competent in both languages. Since no difference was recognized, cross-tables of McNemar Test were examined. According to McNemar analysis of these items, significant difference stemmed from the difference between incorrect answers in administration of original version and correct answers in administration of translated version. It was seen that most of the participants answered incorrectly in the original instrument whereas they answered correctly in Turkish version. Furthermore 1st, 4th and 17th items assess selecting an appropriate average and 2nd, 10th-c, 11th, and 13th items assess outcome orientation misconception. Since these items are related to two subjects and their answers were incorrect in the original version while correct in Turkish version, it is accounted for the data that significant difference might have resulted from participants' learning of these subjects rather than the language.

Also, correlation coefficients were examined between overall scores obtained from Turkish and English version of the test. First, normal distribution assumption was checked by Kolmogorov-Smirnov Test for both overall correct reasoning skills score and overall misconceptions scores of Turkish and English version (Buyukozturk, 2010). For both overall scores in each group, normal distribution assumption were hold ($p>.05$) and statistically significant correlation coefficients were obtained; for overall correct reasoning skills score, $r=0.639$, $p < .01$ and for overall misconceptions score, $r=0.337$, $p < .01$.

Since test-retest reliability coefficient was calculated in the original study in which the test was developed, it was calculated in this study, too. The same 61 university students took Turkish version of the SRA three weeks later. Kolmogorov-Smirnov Test for both overall scores in each administration shows that the distributions are normally distributed. Statistically significant and high Pearson correlation coefficient between results of two administrations for correct reasoning skills score [$r= 0.756$, $p < .01$] and misconceptions score, [$r= 0.627$, $p < .01$] were found. In the original study, reliability for the correct reasoning skills scale and for the misconceptions scale were found .70 and .75, respectively. So reliability results are parallel with the original study.

Procedures and Data Analysis

Data were collected during the teaching methods course of the secondary and elementary school mathematics education programs in each university. Participation to the study was voluntary.

For data analysis two sets of eight sub-scale scores and two overall scores were obtained (See *Instrument* section for how to calculate scale scores). Normal distribution assumption was checked by Kolmogorov-Smirnov Test for each sub-scale and results showed that normality assumption was failed for each of them ($p<.05$). Therefore comparison between groups was analysed by Mann Whitney U Test for all of the subscales except *distinguishes between correlation and causation* and *groups can only be compared if they are the same size* subscales. These subscales were compared by Chi-Square Test since there is only one item contributing to these subscales. At the same time, scores of both PSMTs and PEMTs were analysed descriptively for each subscale.

Results

In this section, particular subscales (types) of correct reasoning skills and misconceptions were examined for both groups. Then, statistical reasoning scores were compared across two groups.

In terms of how to select an appropriate average, both groups' mean scores were 0.454 and 0.447 and the percentages were 30.8% and 34.1% for the 1st and 46.2% and 36.6% for the 4th item in the SRA. This showed that a small portion of prospective teachers could select mean as the meaningful average. This result was also consistent with the misconceptions involving averages subscale regarding the first item such that 61.6% of PSMTs and 56.1% of PEMTs had difficulties in determining the appropriate measure of center. For instance almost half of these prospective teachers who have misconceptions chose mode in place of mean and the other half of them overlooked the outlier in the data. However, results showed that both groups of prospective teachers (around 6% for both) were successful in not confusing mean and median while choosing the appropriate average for the given data set.

As the data indicate in Table 5, there was no statistically significant difference ($U= 3676.5$; $p > .05$, $r=-.01$) between PEMTs and PSMTs' scores regarding how to select an appropriate average.

Table 5. *Mann Whitney U Test for How to select an appropriate average*

Groups	N	Mean Rank	Sum of Ranks	U	Z	p
Elementary Level	82	86.34	7079.50	3676.5	-.174	.862
Secondary Level	91	87.60	7971.50			

Results from the 8th item, understanding probabilities as ratios, showed that both groups of prospective teachers were very successful (95.6% of PSMTs, 93.9% of PEMTs) in correctly computing probabilities. On the other hand, they were unsuccessful at using combinatorial reasoning in correctly computing probabilities, although for this domain there was not a statistically significant difference between the two groups ($U= 3577$; $p > .05$, $r=-.04$) (See Table-6). In particular, the frequencies for answering correctly the items which assess use of combinatorial reasoning ranged between 11.0% and 31. 7%. These results were also consistent with the misconceptions regarding the equiprobability bias assessed by the same items. Results showed that both groups of prospective teachers thought for instance the possibility of obtaining two 5 s and the possibility of obtaining one 5 and one 6 on two rolls equally likely since these events depend on chance.

Table 6. *Mann Whitney U Test for Correctly Computes Probabilities*

Groups	N	Mean Rank	Sum of Ranks	*U*	*Z*	*p*
Elementary Level	82	88.88	7288	3577	-.538	.591
Secondary Level	91	85.31	7763			

Results from the understanding independence subscale also showed that although each group were successful in determining the equiprobability of obtaining for instance HHHTT or HTHTH for tossing a coin five times in the 9th item, they were not successful in identifying the plausible explanations for such occurrences. In particular, the explanation of "If you repeatedly flipped a coin five times, each of these sequences would occur about as often as any other sequence", was chosen by only 31.9% of the PSMTs and 35.4% of the PEMTs as an explanation for the problem situation. Similarly, relatively low percentage of them chose the c option, "Any of the sequences could occur", as an alternative explanation. On the other hand, 76.9% of the prospective secondary and 63.4% of the prospective elementary mathematics teachers identified "Every sequence of five flips has exactly the same probability of occurring" as one of the correct explanations. These results injuxtaposition to each other suggested that both groups were not able to think of the probabilities in frequencies. Interestingly, when prospective teachers' responses were examined regarding the representativeness misconception, results showed that both groups did not have this misconception.

Although these important information was gained based on the analysis from the mean values and the frequencies, the Mann Whitney U test result showed that there was no statistically significant difference between both groups of prospective teachers (*U*=3644.5; *p* > .05, *r*=-.02) for the understanding independence subscale. (See Table-7)

Table 7. *Mann Whitney U Test for Understands Independence*

Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*p*
Elementary Level	82	85.95	7047.50	3644.5	-.273	.785
Secondary Level	91	87.95	8003.50			

Results regarding the understanding sampling variability also showed no significant difference between the two groups (*U*= 3532; *p* > .05, *r*=-.06) (See Table-8). The frequencies, 5.5% and 24.2% for PSMTs and 9.8% and 14.6% for PEMTs, from the 15th and the 14th items assessing this sub-scale were very low. These aligned with the results from the sub scale assessing misconceptions regarding averages such that 70.3% of the prospective secondary and 62.2% of the prospective elementary mathematics teachers considered only mean while comparing data from two independent groups without paying attention to the groups' variances.

Table 8. *Mann Whitney U Test for Understands Sampling Variability*

Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*p*
Elementary Level	82	84.57	6935	3532	-.805	.421
Secondary Level	91	89.19	8116			

Similarly, results from the items assessing the misconception, good samples representing a high percentage of the population showed that PSMTs and PEMTs did not take into account the absolute size of the sample. Rather, they considered relative size of the sample having importance while making inferences about the population. Yet, results from the Mann Whitney U test showed no differences between these two groups (*U*=3179.5; *p* > .05, *r*=-.13). (See Table-9).

Table 9. *Mann Whitney U Test for Good Samples have to represents a high percentage of the population*

Groups	N	Mean Rank	Sum of Ranks	U	Z	p
Elementary Level	82	80.27	6582.50	3179.5	-1.763	.078
Secondary Level	91	93.06	8468.50			

Results about understanding the importance of large numbers showed that both groups were successful in answering the problems assessing this sub-scale. However, for the 7th item, frequencies of both PSMTs (41.8%) and PEMTs (41.5%) who chose "The average could be a poor estimate of the spending of all teenagers given that teenagers were not randomly chosen to fill out the questionnaire" showed that most of them did not take into account randomness in sampling.

On the other hand, results reporting on assessing prospective teachers' understanding the importance of large numbers showed that there was no statistical difference between PSMTs and PEMTs (U=3571; p > .05, r=-.03). (See Table-10)

Table 10. *Mann Whitney U Test for Understands the Importance of Large Numbers*

Groups	N	Mean Rank	Sum of Ranks	U	Z	p
Elementary Level	82	85.05	6974.50	3571.5	-.505	.614
Secondary Level	91	88.75	8076.50			

Also related with the sampling, it seemed that not many of them had law of small numbers misconception since means of PSMTs (.335) and PEMTs (.402) was relatively low. However, when the items were examined at a fine grained level, results from the 14th item showed that quite a high percentage (50.5%) of PSMTs and (61%) of PEMTs chose the option indicating law of small numbers misconception. This suggested that sample size is not a matter of fact in sampling for both PSMTs and PEMTs. Also this result aligned with their low scores in sampling variability.

Supporting high percentages of both groups in law of small number misconception, there was no statistically significant difference between PSMTs and PEMTs (U=3276; p > .05, r=-.12). (See Table-11).

Table 11. *Mann Whitney U Test for Law of Small Numbers*

Groups	N	Mean Rank	Sum of Ranks	U	Z	p
Elementary Level	82	92.55	7589	3276	-1.531	.126
Secondary Level	91	82	7462			

In terms of distinguishing between causation and correlation, results showed that relatively very small portion (31.9%) of PSMTs and (23.2%) of PEMTs were able to identify the relationship between two variables as association. At the same time the percentage of PEMTs (36.6%) and PSMTs (42.9%) who did not choose any of the alternatives indicating correlation implies causation misconception was not high. So it seemed that attributing a causal relationship between associated variables was quite common.

Chi-Square test results in terms of distinguishing between causation and correlation also showed that scores from both prospective teacher groups did not differentiate from each other (X^2=1.628; p > .05, Φ=.09). (See Table-12)

Table 12. *Chi-Square test for Distinguishes between causation and correlation*

	True	False	Total	X^2	df	p
Elementary Level	19	63	82	1.628	1	.202
Secondary Level	29	62	91			
Total	48	125	173			

Discussion

This study investigated statistical reasoning of PEMTs and PSMTs and the differences between their statistical reasoning. Although one might expect otherwise, there was no statistical difference between PEMTs' and PSMTs' statistical reasoning on any of the subscales. Jendrazsek (2010) argued that prospective mathematics teachers' success on probability and/or statistics is related with taking courses during their entire education. In this study, PSMTs' (85.7%) and PEMTs' (90.2%) took statistics courses. Also the contention is that both groups might have been educated under the same National Curricula. Therefore, aligned with the findings of Jendrazsek (2010), no statistically significant difference between these two groups' reasoning becomes meaningful.

On the other hand, results regarding different reasoning subscales both supported the earlier research results (Groth & Bergner; 2006, Canada, 2008; Leavy, 2006) and extended it by reporting on what specific pitfalls prospective teachers have in statistical reasoning.

In particular, results from selecting appropriate measures of center and understanding variability together with the misconception subscales showed that PSMTs and PEMTs selected mode rather than mean as an appropriate average. They also did not take into account outliers in the data set. These indicated that they might not have paid attention to the categorical and interval/ratio variables while examining the data. That is, their difficulties in selecting appropriate average might have stemmed from their lack of reasoning about different types of variables since use of average is determined according to the type of data (Gay et al., 2009). Although they did not have the misconception that groups can only be compared if they are the same size, they lacked reasoning about measures of spread; a high percentage of both groups did not take into account the variability in the data while comparing different groups. In terms of Garfield's (2003) statistical reasoning domains, these results indicated that both groups of prospective mathematics teachers lacked the reasoning about data and statistical measures.

Results regarding the computing probabilities and the misconceptions about equiprobability bias showed that prospective teachers were very successful in solving a problem /item, taking out a marble from a box, very similar to those they encounter in Turkish textbooks. Yet, a high percentage of them were unsuccessful in computing probabilities requiring combinatorial reasoning. This indicated that they have equiprobability bias. These results also suggested that they were not able to take into account the sample space. By the same token, results from the understanding independence subscale showed that both groups were able to determine the equiprobability of obtaining HHHTT or HTHTH from tossing a coin five times. However, a low percentage of them explained their reasoning by choosing i) "If you repeatedly flipped a coin five times, each of these sequences would occur about as often as any other sequence." and ii) "Any of the sequences could occur". Whereas, a high percentage of them chose "Every sequence of five flips has exactly the same probability of occurring". In fact, the problems/items such as tossing a coin in different number of times are also seen frequently in Turkish textbooks. In this respect, these results together with the findings from computing probabilities suggested that these prospective teachers might have known the theoretical probabilities; however, they might not have thought of constructing sample

spaces experimentally, indicating a limitation on their part in terms of using the frequency approach . Similarly, over 90 % of prospective teachers' solving these problems theoretically indicated that they did not have representativeness misconception. However, not choosing i and ii as explanatory statements for equiprobability of the given sequences might indeed be taken as evincing that the representativeness misconception could be concealed by prospective teachers' success in computing the probabilities in these items theoretically. In this regard, we propose to modify and/or change items assessing representativeness misconception in SRA.

Prospective teachers' lack of reasoning with sample space also corresponded with the results from assessing good samples represents a high percentage of the population and law of small numbers misconceptions. Neither group of prospective teachers did take into account the absolute size of the sample nor did they pay attention to the sample size. Quite a high number of them ignored the effect of small samples on results; that is, results vary more in small samples (Well, Pollatsek & Boyce, 1990). So they could not take into account variation in sampling. Similarly, both groups were successful in answering the problems assessing the understanding importance of large samples subscale. However, a low percentage of both groups of prospective teachers choosing "The average could be a poor estimate of the spending of all teenagers given that teenagers were not randomly chosen to fill out the questionnaire" suggested that prospective teachers did not take into account the importance of random choice in making inferences from samples to populations. In terms of Garfield's (2003) statistical reasoning domains, all these results injuxtaposition to each other suggested that, these prospective teachers lacked reasoning with sampling since randomness, representativeness and bias are critical notions to be considered to generalize results from samples to population (Watson & Moritz, 2000).

As literature suggests, teachers' knowledge affect students' knowledge (Heaton & Mickelson, 2002; Yolcu, 2012).Therefore, if prospective teachers have difficulties in understanding these concepts such as reasoning about data, statistical measures, sampling and combinatorial reasoning or misconceptions such as equiprobability bias and representativeness misconception students will have lack of understanding in these concepts or these misconceptions. In order to develop correct reasoning, mathematics education programs were recommended to include teaching probability and statistics courses (Bulut, 2001). However in our study 90.2% of the PEMTs took a course to teach probability and statistics. 85.7% of the PSMTs took statistics courses. So, contents of statistics courses in teacher education programs might be improved taking the results of this study into consideration. Moreover previous research showed that the more courses prospective teachers take, the higher their performance is in probability (Jendraszek, 2010). Therefore, the number of courses to teach statistics might be increased in mathematics education programs so that their correct reasoning skills might develop.

Additionally, participants of this study are PEMTs and PSMTs studying in Istanbul. Also participants were not selected randomly because of practical reasons. So the results of this study are contextual and cannot be generalized to all prospective mathematics teachers. Therefore more studies with different participants especially from other regions of Turkey need to be conducted in order to have an idea about statistical reasoning of Turkish prospective teachers.

Lastly, instrument was obtained from SRA which was not developed originally for Turkish context. There are correctly answered items by most of the participants in both groups. For instance, the 8th item which involved the context of drawing out marbles from two boxes might be replaced with new ones. Likewise, results showed that most of the participants

answered the 2nd item correctly. This item could be excluded from the test or the context of the item could be changed in order to lessen the familiarity with the problem situation. Regarding the context of Turkish education system, especially for university entrance exam, students frequently solve similar and/or much more difficult items during preparation. Therefore, prospective teachers' familiarity might result in high scores and less information about their reasoning in these items. At the same time, there are items that definitely should be kept in SRA. For instance, items like the 13th, 18th,19th or 20th could be used to determine prospective teachers' use of combinatorial reasoning in computing probabilities. Taken all these into account, a new instrument might be developed or SRA might be modified.

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APPENDIX A

Sample Items of the Statistical Reasoning Assessment (Garfield, 2003)

1. A small object was weighed on the same scale separately by nine students in a science class. The weights (in grams) recorded by each student are shown below.

    6.2 6.0 6.0 15.3 6.1 6.3 6.2 6.15 6.2

    The students want to determine as accurately as they can the actual weight of this object. Of the following methods, which would you recommend they use?
    __ a. Use the most common number, which is 6.2.
    __ b. Use the 6.15 since it is the most accurate weighing.
    __ c. Add up the 9 numbers and divide by 9.
    __ d. Throw out the 15.3, add up the other 8 numbers and divide by 8.

4. A teacher wants to change the seating arrangement in her class in the hope that it will increase the number of comments her students make. She first decides to see how many comments students make with the current seating arrangement. A record of the number of comments made by her 8 students during one class period is shown below.

Student Initials								
	A.A.	R.F.	A.G.	J.G.	C.K.	N.K.	J.L.	A.V.
Number of comments	0	5	2	22	3	2	1	2

    She wants to summarize this data by computing the typical number of comments made that day. Of the following methods, which would you recommend she use?
    __a. Use the most common number, which is 2.
    __b. Add up the 8 numbers and divide by 8.
    __c. Throw out the 22, add up the other 7 numbers and divide by 7.
    __ d. Throw out the 0, add up the other 7 numbers and divide by 7.

9. Which of the following sequences is most likely to result from flipping a fair coin 5 times?
    __a. H H H T T
    __b. T H H T H
    __c. T H T T T
    __d. H T H T H
    __e. All four sequences are equally likely

14. Half of all newborns are girls and half are boys. Hospital A records an average of 50 births a day. Hospital B records an average of 10 births a day. On a particular day, which hospital is more likely to record 80% or more female births?
    __ a. Hospital A (with 50 births a day)
    __ b. Hospital B (with 10 births a day)
    __ c. The two hospitals are equally likely to record such an event.

15. Forty college students participated in a study of the effect of sleep on test scores. Twenty of the students volunteered to stay up all night studying the night before the test (no-sleep group). The other

20 students (the control group) went to bed by 11:00 p.m. on the evening before the test. The test scores for each group are shown in the graphs below. Each dot on the graph represents a particular student's score. For example, the two dots above the 80 in the bottom graph indicate that two students in the sleep group scored 80 on the test.

Test Scores: No-Sleep Group

Test Scores: Sleep Group
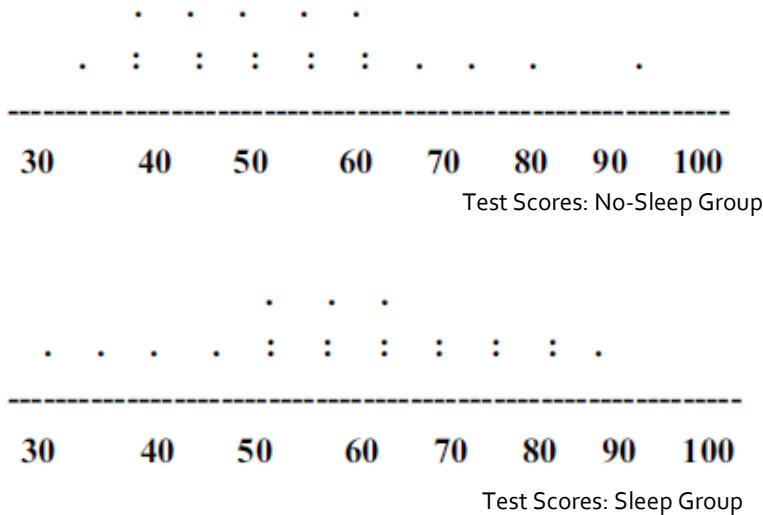
Examine the two graphs carefully. Then choose from the 6 possible conclusions listed below the one you most agree with.

__ a. The no-sleep group did better because none of these students scored below 40 and the highest score was achieved by a student in this group.

__ b. The no-sleep group did better because its average appears to be a little higher than the average of the sleep group.

__ c. There is no difference between the two groups because there is considerable overlap in the scores of the two groups.

__ d. There is no difference between the two groups because the difference between their averages is small compared to the amount of variation in the scores.

__ e. The sleep group did better because more students in this group scored 80 or above.

__ f. The sleep group did better because its average appears to be a little higher than the average of the no-sleep group.

18. When two dice are simultaneously thrown it is possible that one of the following two results occurs: *Result 1:* A 5 and a 6 are obtained. *Result 2:* A 5 is obtained twice.

Select the response that you agree with the most:

__a. The chances of obtaining each of these results is equal

__b. There is more chance of obtaining result 1.

__c. There is more chance of obtaining result 2.

__d. It is imposible to give an answer. (Please explain why)

Achievement motivation of primary mathematics education teacher candidates according to their cognitive styles and motivation styles*

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Abstract

The aim of this study is to reveal whether there is relation between achievement motivations of teacher candidates according to their cognitive styles and motivation styles or not. This study was designed as a quantitative study due to collecting quantitative data and running statistical analyses. Both comparative and correlational survey methods were used because of the fact that it was aimed to determine cognitive styles, motivation styles and achievement motivation of the teacher candidates and to investigate the relationship between these variables. Findings revealed that achievement motivations of the teacher candidates did not differ significantly in terms of gender and cognitive styles. However, it was found that achievement motivations of the teacher candidates differed significantly in terms of their grade levels and motivation styles.

Keywords: Primary mathematics teacher candidates, Field dependent-field independent cognitive styles, Achievement motivation.

Introduction

When the studies conducted in the area of education are examined, it is seen that a special interest exists towards individual differences of students and effects of these differences on success and performances of students. Differences of gender, thinking abilities, cognitive

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styles, teaching styles, areas of intelligence, motivation styles etc. can be thought as individual differences. It is seen that there are many studies about cognitive characteristics which are among these individual differences and get special interest in the area of education (Witkin, Oltman, Raskin, & Karp, 1971; Witkin, Moore, Goodenough, & Cox, 1977; Witkin & Goodenough, 1981; Bahar & Hansell, 2000; Taşar, 2001; Aydın, 2009; Karaçam & Ateş, 2010). Cognitive styles (field dependence-field independence (Witkin & Goodenough, 1981), reflectivity-impulsivity (Kagan, 1965; as cited in Dinçer, 1993), leveling- sharpening (Klein, 1954; as cited in Dinçer, 1993)) and learning styles (Kolb, 1984; Biggs, 1987) etc. take place among these cognitive characteristics. In addition to these, some researchers (Adar, 1969; Kempa & Diaz, 1990; Al-Naeme, 1991; Hofstein & Walberg, 1995; Solomon, 1996) have also focused on motivation styles of students.

Cognitive style means the methods preferred in the process of getting information, organizing, processing and storing information in memory to use it as needed (Witkin et al., 1977). Moreover, it is also defined as the ways that individuals prefer while organizing new information with existing information, interpreting new information and adapting these interpretations to their lives (Hayes & Allinson, 1998). It refers to the ways taken while achieving a purpose rather than achieving a purpose. One of these styles is the field dependent-field independent cognitive style. As a result of studies, it has emerged that characteristic differences have existed among individuals having field dependent-field independent cognitive styles (Witkin et al., 1977; Witkin & Goodenough, 1981; Riding & Cheema, 1991; Bahar, 1999; Bahar, 2003a, Ateş & Çataloğlu, 2007; Çataloğlu & Ateş, 2013). The characteristic differences belonging to this cognitive style are seen in Table 1.

Table 1. *The characteristic differences of field dependent-independent individuals*

Field Dependent	Field Independent
• Wholistic	• Analytic
• Externally-oriented	• Internally-oriented
• Social and enterprising	• Individual
• Traditional	• Experimental
• Sensitive to others	• Not addicted to others
• Accepts thoughts as presented	• Describes concepts through analyses

(Jonassen & Grabowski, 1993)

Studies have indicated that there is a significant correlation between cognitive styles and success of individuals (Al-Naeme, 1991; Bahar & Hansell, 2000; Bahar, 2003; Ateş & Çataloğlu, 2007). Moreover, another concept thought as related to success is achievement motivation. Success motivation, taking part in social learning motivation theories and produced by Atkinson (1946, as cited in Uysal ve Koğ, 2012), is the need of individuals of "escaping from failure" and "being successful". Value attributed to success by individuals can change according to various factors as age, gender, socio-cultural environment, obtained aims in life (Wigfield, Eccles, Roeser ve Schiefele, 2009).

Since need is tension occurred in individual due to feeling inadequate physically or mentally, motivation is provided if the wish of fulfilling the need is enough to change the thought into a behaviour. According to MC Clelland's (as cited in Karalar, 2006) learned needs theory, there are three needs that motivate individuals. These are success motivation, be admitted (belonging to) and need of power. Success motivation consists of going further and taking responsibility in solving problems (Karalar, 2006, p.95).

Success of a student is directly related to achievement motivation (Umay 2002). Murray (1938) defines achievement motivation as finalizing some difficult things, overcoming some obstacles, achieving a high standard, passing self and others and increase of self-esteem (as cited in Umay, 2002). If this is a feature not inherited, it is emerged as a major indicator to ensure success that individuals determine how much achievement motivation they have. Achievement motivation is that an individual targets to reach the level of excellence and always strives to improve. Individuals having this adequacy are result-oriented and they highly motivate themselves to reach their own aims and standards, take risk and set challenging purposes to themselves, always pursue information to reduce instability and look for new ways to do something better and learn how to improve their own performance (McClelland & Koestner, 1992).

Many theories related to motivation have existed. Although many of these are different than each other, two important factors appear in these theories: need and willingness. Adar (1969), known with the studies related to student motivation, states that motivation styles of students form according to their needs. These are the needs of success, satisfying curiosity, fulfilling task, having close relationship with other people. Adar has approved that there are 4 motivation styles parallel to needs of students: successful, curious, conscious and social. Moreover, many studies related to motivation styles which were based on the classification of Adar were conducted (Kempa & Diaz, 1990; Johnstone & Al-Naeme, 1995; Bahar, 2002; 2003). In all of these studies, motivation styles were thought as an important factor for effective learning and performance of students in different education environments.

When it was investigated whether there is a relationship between gender and grade level, different results appealed in the literature. Ligon (2006) investigated success motivation of 175 students from different grade levels in the study. As a result, the researcher stated that success motivation of the students differed significantly in terms of their development levels. Moreover, he found that same difference did not exists in terms of gender. Some other studies however, found significant differences between girls' and boys' success motivation and constructs related to success motivation (Linenbrink & Pintrich, 2002; Wigfield & Eccles; 2002).

It is investigated in some studies related to motivation styles that motivation style differentiation in terms of gender. In the study of Kempa and Diaz (1990), it appealed that 390 high school students condensed mostly on two motivation styles in terms of gender. It was stated that girls had mostly conscious motivation style whereas boys had successful motivation style. In the study of Trumper (1995) conducted in Israel, it was seen that the results of 944 students, ages of 14-17, resembled. Bahar (2002) stated that it was not possible to classify all students under only one motivation style; students could have other than one motivation style and exhibit one of them more dominantly in many cases. He also stated that gender had impact on motivation styles and boys mostly have success motivation although girls had conscious and curious one. Durmuş (2006) found in his study that most of the students educating at the Department of Mathematics had curious and conscious motivation style. In this study, it also appealed that gender differences influenced motivation style. Moreover, it was stated that boys and girls had curious and conscious motivation style, respectively.

In the light of studies mentioned above, it can be said that gender, cognitive styles, motivation styles and achievement motivation are among factors that affect success of individuals. Mathematics is one of the lessons that students are less successful. For increasing success in mathematics, it is required to research the factors that affect success of individuals. It is thought important that researching the relationship between gender, cognitive styles,

motivation styles and achievement motivation, among the factors affecting success of individuals, in terms of primary mathematics education teacher candidates. The aim of this study is to reveal whether there is relation between achievement motivations of teacher candidates according to their cognitive styles and motivation styles or not. For this aim, the following questions have been tried to be answered:

1. Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of gender?

2. Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of grade level?

3. Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of cognitive styles?

4. Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of motivation styles?

Method

The Research Design

This study was designed as a quantitative study due to collecting quantitative data and running statistical analyses. Both comparative and correlational survey methods were used because of the fact that it was aimed to determine cognitive styles, motivation styles and achievement motivation of the teacher candidates and to investigate the relationship between these variables (Fraenkel ve Wallen, 2006; Karasar, 1999, s.77-86).

The Participants

Accessible sampling method was used to determine the participants of the study. The study was conducted with 114 teacher candidates educating in the Department of Primary Mathematics Education of a state university. 46 (40.4 %) of the participants were males and 68 (59.6 %) of the participants were females. Of the participants, 36 were 1st grade, 32 were 2nd grade and 46 were 3rd grade. The study was conducted at the end of the spring semester of 2013-2014 academic years. Therefore the teacher candidates studying for PPSE (Public Personnel Selection Exam in Turkey) were not included in the study.

Data Collection Tools

In the study, three data collection tools were used. The Group Embedded Figure Test were given to the teacher candidates at first and it was aimed to reveal their cognitive styles while collecting data. Then the form A of the Motivation Styles Scale was given to the participants. The scores of success motivation of the teacher candidates were determined. Lastly, the form B of the Motivation Styles Scale were given to the teacher candidates and it was revealed that the motivation styles of them by eveluating two forms together

Group Embedded Figures Test

In the study, Turkish version of Group Embedded Figures Test, developed by Witkin, Moore, Goodenough ve Cox (1977), was used as data collection tool to determine the cognitive styles of teacher candidates. The test was translated into Turkish by Bahar (1999). The KR-20 coefficient of the test was calculated as 0.80. The test is about finding predetermined 8 shapes among mixed 20 shapes (See Figure 1).
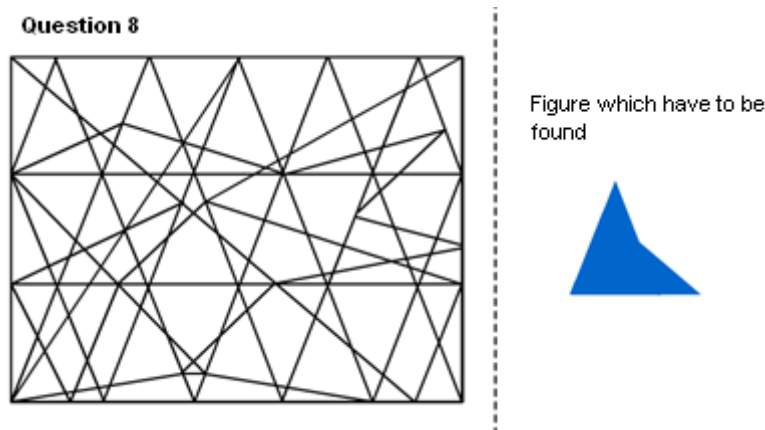
Figure 1. An example of the questions in Group Embedded Figures Test

The minimum score of the test is 0 whereas the maximum score of the test is 20. The teacher candidates were categorized as field dependent, medium and field independent according to the scores they obtained on Group Embedded Figures Test. The teacher candidates' cognitive styles were determined according to a criterion used by Case (1974), Case and Golberson (1974), Scardamalia (1977) and Alamolhodaei (1996). Teacher candidates who had a score less than $\frac{1}{4}$ standard deviation below the mean were classified as field dependent (FD < $M - \frac{1}{4}$ s), $\frac{1}{4}$ s above the mean were classified as field independent (FI > $M + \frac{1}{4}$ s) and between ($M \pm \frac{1}{4}$ s) were those who may be located between the above two styles who were labelled as field-intermediate learners (Alomolhodaei, 2002) (See Figure 2).
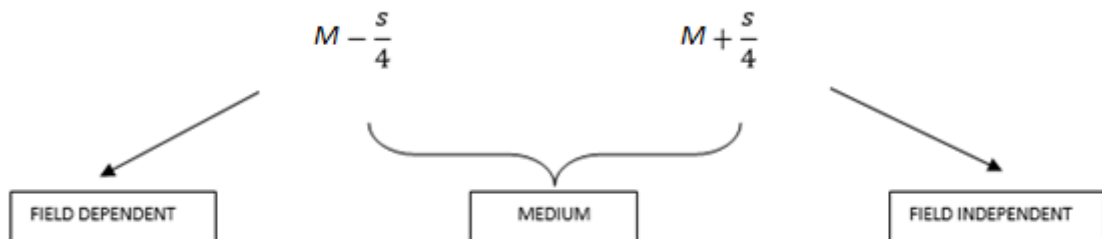
Figure 2. The formula used to determine the cognitive style categories of the teacher candidates

According to this formula, the teacher candidates whose scores were below 9.68 were categorized as "field dependent", the teacher candidates whose scores were above 11.71 were categorized as "field independent" and the teacher candidates whose scores were between these scores were categorized as "medium" (See Table 2).

Table 2. *The cognitive style categories of the teacher candidates*

Cognitive Style	f	%
Field Dependent	37	32.5
Medium	26	22.8
Field Independent	51	44.7
Total	114	100.0

The Motivation Styles Scale

A scale modified from the studies of Adar (1969) was used to determine the motivation styles of the teacher candidates. Reliability and validity studies of this version of the scale was carried out by Al-Naeme (1991) and Lyall and Johnstone (1999) and this version of the scale was used in current studies. This scale was also used in Turkey by Bahar (2002, 2003). The scale consists of expressions including girls' and boys' ideas about the process of teaching-learning. The ideas of four people was given as thought bubble for each factor and the teacher candidates were asked to choose the most appropriate one. For example;

Buğra: I enjoy hearing things that can be applied to everyday life.

Sena: It is important for me to be among ones who are the most hardworking of the class.

Ali: In class discussions, I do not declare my ideas that I am not very sure.

Elif: Support of my friends is very important for me when we have an exam

The scale consisted of form A and B. In the A form, the questions were given as 4 lines. In each line, the ideas of people given above were given as thought bubbles. They were asked to write the most appropriate name among the people having 4 ideas at the end of each line. In the B form, ideas of teacher candidates having motivation styles about classroom work, laboratory work, discovery learning and social life were gathered. The aim of giving the scale in two forms is that classifying the teacher candidates according to their motivation styles with the help of the results of the form A and supporting this result with the results of the form B. The study was hold by choosing teacher candidates having same motivation styles for both of the forms.

The motivation style of the participant is determined as "curious" if s/he chooses the views of Burak; "successful" if s/he chooses the views of Sena; "conscious" if s/he chooses the views of Ali; "social" if s/he chooses the views of Elif. It was appeared that none of the participants choose social motivation style (See Table 3).

Table 3. *Motivation styles of the teacher candidates*

Motivation Style	f	%
Curious	42	36.8
Successful	31	27.2
Conscious	41	36.0
Social	0	0.00
Total	114	100.0

The Achievement Motivation Scale

The scale which was developed by Umay (2004) and whose Croanbach Alfa coefficient was 0.75, was used to determine the achievement motivation of the teacher candidates. The scale consisting of 14 items, is a 5-point Likert-type scale. In the scale, positive items as "1. While studying, I prefer to study things struggling me.", "5. I believe that I can be successful if I study enough." and negative items as "4. I am disappointed if I cannot find solution of a question.", "6. The idea of being unsuccessful scares me." appear. The minimum score of the scale is 0 whereas the maximum score of the scale is 98. For this study, reliability study was done and

Croanbach Alpha coefficients was found as α=0.82. Therefore, it was considered that test measurement was reliable.

Data Analysis

Obtained data was transformed to a statistical program and statistical analyses were run. Frequencies and percentages were used to determine the cognitive styles and achievement motivation of the teacher candidates. Correlation coefficient was calculated to reveal whether correlation existed between two variables or not. Independent samples t-test and one-way ANOVA were used to investigate differences in terms of gender and grade level, respectively.

Results

In this part, results obtained from data collected by data collection tools through the study take place. At first, general statistical analyses related to "The Achievement Motivation Scale" was given. Then it was given that findings obtained from all data by being organized according to the order of sub-problems.

Descriptive Results Related to the Achievement Motivation Scale

In this study aiming to investigate achievement motivation of the teacher candidates educating at the Department of Primary Education, "The Achievement Motivation Scale" developed by Umay (2002) was used. There are 14 items in the scale. Means and standard deviations of each item of the scale are seen at the Table 4.

Table 4. *Achievement motivation of the participants*

	Quest.1	Quest.2	Quest.3	Quest.4	Quest.5	Quest.6	Quest.7	
M	4,60	5,30	4,84	4,65	6,14	4,35	4,44	
df	1,57	1,52	1,77	1,62	1,53	1,79	1,68	
	Quest.8	Quest.9	Quest.10	Quest.11	Quest.12	Quest.13	Quest.14	Total
M	5,32	5,76	5,75	4,52	4,10	4,17	6,22	70,15
df	1,37	1,38	1,54	1,65	1,65	1,68	1,56	10,65

When Table 4 is examined, it is seen that the means of the items 12 and 13 are lower than the means of other items. When these items were examined, it was appeared that these were the items intended to reveal whether external authority has effect on achievement motivation as "When I am successful, my teachers appreciate me" and "I believe that my teachers like me".

It was also found that the means of the items 5 and 14 were higher than the means of other items. When these items were examined, it was emerged that these were the items mostly related to intrinsic part of success as "I believe that I can be successful if I study enough" and "I feel happy when I overcome hard works".

Achievement Motivation of the Teacher Candidates in terms of Gender

The first research question of the study is as "Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of gender". Means and standard deviations of the scores of the teacher candidates obtained from "The Achievement Motivation Scale" were calculated to test this research question (See Table 5).

Table 5. *The scores of "The Achievement Motivation Scale" according to gender*

Gender	*n*	*M*	*df*	*t*
Female	68	70.40	10.27	-.301
Male	46	69.78	11.30	

When Table 5 is examined, it is seen that mean scores of the males (69.78) are lower than that of the females (70.40). Independent samples t-test was used to find whether there was a significant difference between the scores of the teacher candidates obtained from "The Achievement Motivation Scale" in terms of gender or not. It was found that there was not a statistically significant difference.

Achievement Motivation of the Teacher Candidates in terms of Grade Level

The second research question of the study is as "Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of grade level". Means and standard deviations of the scores of the teacher candidates obtained from "The Achievement Motivation Scale" were calculated to test this research question (See Table 6).

Tablo 6. *The scores of "The Achievement Motivation Scale" according to grade level*

Grade Level	*n*	*M*	*df*
1	36	73.30	13.17
2	32	65.84	9.27
3	46	70.65	8.32
Total	114	70.15	10.65

When Table 6 is examined, it is seen that the mean (73.30) of the 1st grade teacher candidates is the highest and the mean (65.84) of the 2nd grade teacher candidates is the lowest. The mean of 3rd grade teacher candidates is 70.65. The mean of all grade levels was found as 70.15. Moreover, it is seen that standard deviations decrease when grade levels of the teacher candidates increase.

One-way ANOVA was used to find whether there was a significant difference between the scores of the teacher candidates obtained from "The Achievement Motivation Scale" in terms of grade level or not. The results of one-way ANOVA were given in Table 7.

Table 7. *The results of one-way ANOVA related to scores of "The Achievement Motivation Scale" according to grade level*

	Sum of squares	*df*	Mean Square	*F*
Between groups	969.811	2	484.906	
Within groups	11856.654	111	106.817	4.540*
Total	12826.465	113		

* p<.05

When Table 7 is examined, it is seen that achievement motivation of the teacher candidates differ significantly in terms of grade level ($F_{(2-113)}$ = 4.540, p< .05). In other words, achievement motivation of the teacher candidates differ significantly related to their grade levels. According to the result of Eta-square, it can be said that the size of the difference is moderate ($h2$=.08). The homogeneity of variances between groups was tested to determine which of the grade level/s cause(s) this difference and it was found that variance between groups was not homogeneous. Therefore, Tamhane's T2 test, one of the post-hoc tests which is used when variances are not homogeneous, was used to determine the grade level/s causing the difference. The results of Tamhane's T2 were given in Table 8.

Table 8. *The results related to Tamhane's T2 Test*

Grade Levels(I)	Grade Levels (J)	Difference of means (I-J)	Standard Error	p
1	2	7.49	2.51	.004*
	3	2.68	2.30	.246
2	3	-4.81	2.38	.046*

According to Table 7, it was found that there was a statistically significant difference between the achievement motivation of the 2nd grade teacher candidates and other teacher candidates. However, it was not found that a statistically significant difference between the 1st and 3rd teacher candidates.

Achievement Motivation of the Teacher Candidates in terms of their Cognitive Styles

The third research question of the study is as "Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of their cognitive styles". Means and standard deviations of the scores of the teacher candidates obtained from "The Achievement Motivation Scale" were calculated to test this research question (See Table 9).

Table 9. *The scores of "The Achievement Motivation Scale" according to cognitive styles*

Grade Levels	n	M	df
Field Dependent	37	69.57	12.47
Medium	26	68.81	11.15
Field Independent	51	71.25	8.94

When Table 9 is examined, it is seen that the field independent teacher candidates have the highest score (71.25) and the medium teacher candidates have the lowest score (68.81). It was also found that the score of the field dependent teacher candidates was 69.57. Moreover, it was seen that the standard deviation of the achievement motivation scores of the field independent teacher candidates were lower than that of the teacher candidates having other cognitive styles.

One-way ANOVA was used to find whether there was a significant difference between the scores of the teacher candidates obtained from "The Achievement Motivation Scale" in terms of cognitive styles or not. The results of one-way ANOVA were given in Table 10.

Table 10. *The results of one-way ANOVA related to scores of "The Achievement Motivation Scale" according to cognitive styles*

	Sum of Squares	*df*	Mean Square	*F*
Between groups	121.660	2	60.830	
Within groups	12704.806	111	114.858	.531
Total	12826.465	113		

When Table 10 is examined, it is seen that achievement motivations of the teacher candidates do not differ significantly in terms of cognitive styles ($F_{(2-113)}$ =.531, *p*> .05).

Achievement Motivation of the Teacher Candidates in terms of their Motivation Styles

The fourth research question of the study is as "Is there a significant difference between achievement motivations of the primary mathematics education teacher candidates in terms of their motivation styles". Means and standard deviations of the scores of the teacher candidates obtained from "The Achievement Motivation Scale" were calculated to test this research question (See Table 11).

Table 11. *The scores of "The Achievement Motivation Scale" according to motivation styles*

Grade Levels	*n*	*M*	*df*
Curious	42	59.74	7.55
Successful	31	69.74	1.18
Conscious	41	81.12	4.87
Social	0	0	0

When Table 11 is examined, it is seen that the teacher candidates having "conscious" motivation style have the highest score (81.12) and the teacher candidates having "curious" motivation style have the lowest score (59.74). It was also found that the score of the teacher candidates having "successful" motivation style was 69.74. Moreover, it was appeared that the standard deviation of the scores of these teacher candidates related to "The Achievement Motivation Scale" was quite low (1.18).

One-way ANOVA was used to find whether there was a significant difference between the scores of the teacher candidates obtained from "The Achievement Motivation Scale" in terms of motivation styles or not. The results of one-way ANOVA were given in Table 12.

Table 12. *The results of one-way ANOVA related to scores of "The Achievement Motivation Scale" according to motivation styles*

	Sum of quares	*df*	Mean square	*F*
Between groups	9494.020	2	4747.010	158.118
Within groups	3332,445	111	30.022	**
Total	12826,465	113		

** *p*<.01

When Table 12 is examined, it is seen that achievement motivations of the teacher candidates differ significantly in terms of motivation styles ($F_{(2-113)} = 158.118$; $p < .01$). In other words, achievement motivation of the teacher candidates differ significantly related to their motivation styles. According to the result of Eta-square, it can be said that the size of the difference is moderate ($h2 = .074$). The homogeneity of variances between groups was tested to determine which of the grade level/s cause(s) this difference and it was found that variance between groups was not homogeneous. Therefore, Tamhane's T2 test, one of the post-hoc tests which is used when variances are not homogeneous, was used to determine the grade level/s causing the difference. The results of Tamhane's T2 were given in Table 13.

Table 13. *The results related to Tamhane's T2 Test*

Grade Levels(I)	Grade Levels (J)	Difference of means (I-J)	Standard Error	p
Curious	Successful	-10.00	1.29	.000**
	Conscious	-21.38	1.20	.000**
Successful	Conscious	-11.38	1.30	.000**

** $p < .01$

As it is seen in Table 13, it was found that there was a significant difference between achievement motivations of all motivation styles.

Conclusion and Discussion

In this study, it was investigated that how achievement motivation of the teacher candidates has changed according to their cognitive styles and motivation styles. Therefore, the results of the study were categorized under four titles.

Achievement Motivation of the Teacher Candidates in terms of Gender

The findings of the study revealed that there was not a statistically significant difference between achievement motivations of the teacher candidates in terms of gender. It is seen in the literature that some studies stated that motivational structures of students differed in terms of gender (Linnenbrink & Pintrich, 2002; Wigfield & Eccles, 2002; Houtte, 2004) whereas some studies found that there was not a significant difference between these structures in terms of gender (Cokley, Bernard, Cunningham, & Motoike, 2004; Ligon, 2006; Ateş, Yıldız, Yıldız, 2012; İşigüzel, 2013). When these studies were examined, females were found to be more motivational than males. In this study, it was found that achievement motivation of the females was higher than that of the males. However, this difference was not found to be significant. Parsons et al. (1982) found in their study that perception of mathematical abilities and achievement motivation did not differ in terms of gender. This result of the study contradicts with the results of this study.

Achievement Motivation of the Teacher Candidates in terms of Grade Level

In the light of the findings, it was found that there was a statistically significant difference between achievement motivations of the teacher candidates in terms their grade levels. This difference was significant between 2nd grade teacher candidates and 1st and 3rd grade teacher candidates especially. Findings revealed that the difference was in favour of 1st and 3rd grade teacher candidates. Umay (2002) investigated the change of achievement motivation according to years and the factors effecting this change. As a result, it was found

that the levels of achievement motivation of the students increased from year to year. In this study, a result different from the study of Umay (2002) appeared. This difference may stem from the fact that Umay (2002) conducted a longitudinal study with same teacher candidates whereas this study was conducted with different teacher candidates at different grade levels in same year. In a study conducted before the mathematics curriculum was revised, Göç (2010) investigated whether achievement motivation of 6th, 7th and 8th graders differed or not, and found that achievement motivation of 6th graders was higher than that of 7th and 8th graders. It was found that achievement motivation of the students was higher at the beginning of primary school[1] than other years. This results reveals that an increase may exist in success motivation with cognitive development.

It is seen that 1st grade teacher candidates had the highest achievement motivation and they were followed by 3rd and 2nd grade teacher candidates, respectively. Many factors affecting achievement motivation of individuals exist. Among these factors; effectiveness of teacher, friends, ideas of one about school, perception of one about self, past successes and failures, importance that one give to success and manners of parents towards their children and school can be thought as important factors (Ülgen, 1994). The higher level of achievement motivation of 1st grade teacher candidates may be due to the fact that being successful at LYS and getting the chance of being a student of primary mathematics education which has been gotten interest in nowadays, since motivation levels of individuals also increase when they are successful. Moreover, 1st grade teacher candidates get courses of "General Mathematics", "Geometry" and "Abstract Mathematics" which can be thought as continuation of the course of mathematics in high school. In addition to these, they also get pedagogical and requisite "Yüksek Öğretim Kurumu-YÖK" (Higher Education Council-HEC) courses. It can be thought that being also successful at these courses may affect their achievement motivation.

When the teacher candidates become 2nd grade students, they get more mathematics courses. Getting courses as "Calculus I and II" and "Linear Algebra I and II" which can be thought more difficult than the courses of 1st grade, and "Physics I and II" which are also thought as difficult by students and getting only 3 pedagogical courses may cause decrease of achievement motivation of the teacher candidates. When the results of the study were examined, it was found that achievement motivation of 3rd grade teacher candidates were higher than that of 2nd grade teacher candidates. The reason for this result may be fact that 3rd grade teacher candidates get more pedagogical courses together with mathematics courses as "Calculus III" and "Differential Equations". Moreover, getting the courses of "Methods of Mathematics Teaching I and II" which are among the most important courses to be a mathematics teacher, may also be another reason.

Achievement Motivation of the Teacher Candidates in terms of Cognitive Styles

In the light of the findings, it was appealed that there was not a statistically significant difference between achievement motivations of the teacher candidates in terms their cognitive styles. It was stated in some studies that academic success of individuals having field independent cognitive style were better than that of individuals having field dependent cognitive style (Bahar & Hansell, 2000;.Karaçam & Ateş, 2010). Moreover, it was indicated in the literature that field independent individuals have intrinsic motivation (Fritz, 1994; Lyons-Lawrence, 1994; Reiff, 1996) whereas field dependent ones have extrinsic motivation (Liu & Reed, 1994; Lyons-Lawrence, 1994; Riding & Cheema, 1991). In this study, it was also found

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[1] Since this study was conducted before the mathematics curriculum was revised, primary education started with 6th graders, not 5th graders.

that achievement motivation of the field independent teacher candidates was higher than achievement motivation of the field dependent and medium teacher candidates. Moreover standard deviations of field independent ones were lower than that of others. This result shows that the scores of achievement motivation of the teacher candidates having field independent cognitive style were clustered close to together. However, it was found that the scores of the field dependent and medium teacher candidates did not disperse like the scores of the field independent ones.

Achievement Motivation of the Teacher Candidates in terms of Motivation Styles

In the light of findings of the study, the motivation styles of the teacher candidates were determined at first. It was found that none of the teacher candidates preferred "social" motivation style. Moreover, it appeared that nearly same number of the teacher candidates had "Curious", "Successful" and "Conscious" motivation styles. Bahar (2002) found in his study examining the motivation styles of teacher candidates educating at the Department of Primary Education that the number of teacher candidates having curious and social motivation styles were more than number of ones having successful and conscious motivation styles. In his study however, it was found that the numbers of the teacher candidates having successful and conscious motivation styles were nearly same. The reason of this difference may be the fact that participants of two studies were educating at different departments. Moreover, it appealed that there were any teacher candidates having social motivation style in this study. This result was thought as interesting because of the fact that the job of teaching requires socialization.

Findings of the study revealed that achievement motivations of the teacher candidates differ significantly in terms of motivation styles. It was found that the scores of achievement motivation according to motivation styles were 59.74, 69.74 and 81.12 for "Curious", "Successful" and "Conscious", respectively. In the study of Yaman and Umay (2008), conducted to investigate motivation styles and achievement motivation of 3rd grade primary mathematics education, primary science education and preschool education teacher candidates, it was found that "Curious" was the motivation style that got the highest score with 70.58 and "Social" was the motivation style that got the lowest score with 67.61. The reason of the contradiction of the results of Yaman and Umay (2008) and this study may be the fact that the former was conducted with teacher candidates in different departments whereas the latter was conducted with primary mathematics education teacher candidates.

Suggestions

As a result of this study, it was found that the differences between the motivations of the teacher candidates having different cognitive and motivation styles. It can be investigated why these individual differences affect achievement motivation of the teacher candidates by interviewing with them. The reason of the decrease of achievement motivation at 2nd grade can be investigated by especially having interviews with 1st and 2nd grade teacher candidates. It can be investigated whether individual differences other than cognitive styles and motivation styles also affect achievement motivation or not. In addition to this, it can also be investigated whether cognitive styles and motivation styles have effect on success and attitudes of students or not.

Materials can be prepared for students and teacher candidates having different cognitive styles and motivation styles and courses can be organized according to these. It can be mentioned to teacher candidates through their education that the important effects of cognitive styles and motivation styles on performances of students. Different teaching-

learning situations can be achieved and it can be investigated whether these situations affect achievement motivation, cognitive styles and motivation styles of students or not. This study may be conducted with teachers or teacher candidates other than primary mathematics teachers.

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The effects of computer-aided concept cartoons and outdoor science activities on light pollution

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Abstract

The purpose of this study is to create an awareness of light pollution on seventh grade students via computer aided concept cartoon applications and outdoor science activities and to help them develop solutions; and to determine student opinions on the practices carried out. The study was carried out at a middle school in Muğla province of Aegean Region in Turkey. It was single group pre test-post test model that was used in the study. The data in the study were collected via open-ended questions about light pollution and semi-structured interview questions. Open ended questions about light pollution were applied on students as a pre-test and post-test. After the post-test was applied, semi-structured interviews were carried out with students. The qualitative analysis of the data collected from the open-ended questions and semi-structured interview questions were made and student expressions were quoted. After the implementations, it was found that there was an increase in the correct answers of students on light pollution. Also, all students interviewed stated positive opinions regarding the implementations. The implementations carried out are convenient for students to develop an awareness of the ecological, astronomics and economical results of light pollution and to develop solutions for preventing light pollution.

Keywords: Light pollution, Concept cartoons, Outdoor science activities

Introduction

Human is inseparable whole with its environment and should especially be a part of solutions related to human-induced environment issues. Due to rapid increase in population, over urbanization, industrialization and consequently, excessive uses of natural resources environmental issues, today, have become global issues. Light pollution, defined as the wrong utilization of light in a disturbing way, has become an important environment issue all around the world and this made environment education a necessity. Scientists around the world give light pollution levels they measured in different parts of the world in numbers and continue to create a light pollution map of the sky (Cinzano, Falchi & Elvidge, 2001; Aslan et al., 2011). However, studies towards determining the existing state of light pollution are insufficient in

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terms of preventing this pollution. Because the main way of preventing light pollution is to make educational studies on the issue and to create an awareness among individuals. The reasons and effects of light pollution have been revealed with various studied. Crawford (2001) states that wrong outdoor lighting causes light pollution. Osman, Isobe, Nawar & Morcos (2001) and Çetegen & Batman (2005) state that light pollution is a significant problem for astronomical studies, environment and economy and made some suggestions on what should be done. In their studies on the reasons, results and solutions of light pollution, Percy (2001) and Hanel (2001) found that the people are not conscious about light pollution.

In seventh class Science curriculum, various environmental issues are emphasized; yet light pollution, which is a significant issue in ecological, economic and astronomical terms, is not mentioned. In this study, the "Light Pollution" topic within "Environmental Problems and Their Effects" issue under "Human and Environment" unit in seventh grades is discussed and the aim was to help students learn the issue of light pollution via computer-aided concept cartoons and outdoor science activities. The learning outcomes of the issue are given below:

Students collect information about one of the environmental problems in our country and the world, present this information and discuss about it.

Students suggest solutions for cooperation on one of the environmental problems in our country and the world and attend to activities.

The research problem can be stated as: "what is the impact of computer-aided concept cartoons and outdoor science activities on students' learning of light pollution and what are student opinions on the practices carried out?". In this current study, the scenarios related to light pollution were supported via computer-aided concept cartoon animations in order to grab students' attention. In teaching with concept cartoons, some alternative ideas about a certain scientific fact is drawn on a working paper in the form of a cartoon. However, only one of these ideas is scientifically correct. Concept cartoon starts a discussion on the concepts between the characters in the cartoon and present it (Keogh, Naylor & Wilson, 1998; Keogh & Naylor, 1999) and thus, scientifically correct idea is worked to be achieved. In concept cartoons, it is generally the questions or ideas of three or more characters on a subject given in speech balloons; and ideas are discussed by the whole class through the characters in the cartoons.

The purpose of the study is to create an awareness of light pollution on seventh grade students via computer aided concept cartoon applications and other outdoor science activities and to help them develop solutions; and to determine student opinions on the practices carried out. Smith described outdoor education as "a learning climate for the things which can be learned best outside the classroom" (Priest, 1986). Science education in elementary schools should expand beyond the four walls of the classroom; many opportunities abound in the outdoor setting for learning about science (Carrier, 2009). Outdoor science activities include topics such as night sky brightness measurements, ecological awareness, and the taking photos about light pollution, allowing students to personally experience many learning opportunities in the outdoor setting. Within the scope of outdoor practices, the brightness of the sky at night at chosen settlements in Muğla province of Aegean Region in Turkey, at chosen dark areas and natural habitats are measured with sky quality meter. Along with numeric measures, the sky was photographed with machine that could take wide-angle photographs and the light pollution was shown in photographs. Moreover, students took photographs showing light pollution in the city and carried out studies on what could be done to remove the existing light pollution. In this study, scientific working and thinking environments, where students are active and carry out activities to solve a daily life issue,

were created. In addition, they shared the results of the observations and measurements they made and thus, they were made to understand the significance of sharing knowledge in theorizing basic science concepts. Computer animated activities enriched with concept cartoons and outdoor science activities were carried out in order to ensure meaningful learning among students and to create awareness among students on the significance of the issue and their opinions about the practices carried out were taken. Taking the results of the studies indicating the positive effects of materials prepared using animations in computer-aided teaching in student success and in removing misconceptions (Yılmaz & Saka, 2005; Rotbain, Marbach-Ad & Stavy, 2008; Çepni, 2009; Özyılmaz Akamca, Ellez & Hamurcu, 2009) into consideration, this study used animations in preparing concept cartoons on light pollution.

One of the most efficient practices to make learning more fun and interesting is computer animations (Arıcı & Dalkılıç, 2006). Combining color and movement, animations increase memorability; and make it easier to materialize abstract events or things and to visualize them (Rieber, 1990). Thus, it becomes possible to create rich learning environments for students.

In the current study which aims to create an awareness among students on light pollution during Science Education classes, scenarios on the reasons and effects of light pollution and concept cartoons were prepared considering the negative effects light pollution causes in ecological, economic and astronomical terms (Osman et al., 2001; Percy, 2001; Demircioğlu Yıldız & Yılmaz 2005). Concept cartoons were tried to be made visually interesting for students through the use of computer animations. In addition, activity work sheets prepared for each concept cartoon animation activity were implemented on students. Among the characters in concept cartoons, only one of the character's statements on light pollution is scientifically correct. In the activities prepared and developed, students were asked which character's idea they agree with among the concept cartoons in the animations and a discussion was started; thus, they were made to find the correct idea. Students worked in groups and expressed which cartoon character's idea they agreed with.

Method

Participants

Because this was an experimental study, a study group was taken instead of sample. In 2013-2014 academic year, 19 seventh grade students in a middle school in Muğla province of Aegean Region in Turkey were chosen as the study group and the experimental study lasted two weeks.

Research Design

In the current study, single group pre-test-post-test model, an experimental model, was used.

Table 1. *Research Design*

Before Experiment	Experimental Process	After Experiment
Pre-test (T1)	Computer-aided concept cartoons and teaching through outdoor science actitivies	Post-test (T1, T2)

T1; This represents open-ended questions related to light pollution,
T2; This represents semi-structured interviews related to light pollution and the practices carried out.

Data Collection

The data in the study were collected using open ended questions on light pollution and semi-structured interview questions. Expert opinions from two academics working in the field of science education were taken for the open-ended questions prepared. Organized based on the expert opinions, this assessment tool was implemented on five students to finalize it. Seven open-ended questions on light pollution were administered as a pre-test and post-test on students. Students were provided with scenarios on light pollution which include computer animated concept cartoons and in groups, they expressed which cartoon's idea given in the scenario they agree with. Besides, outdoor science activities were carried out with students (taking photos related to light pollution and night sky brightness measurements). The scientific content of the concept cartoons in computer animations were examined by two experts in science; and the draft animations were examined by experts preparing animations in flash programme. And the determined shortcomings were filled accordingly. After the post-test was administered, semi-structured interviews were carried out with five students in order to find out their opinions on light pollution and the practices carried out and these interviews were recorded with a voice recorder.

Data Analysis

The descriptive analyses of the data collected via open-ended questions were made and these informations were put in tables and student expressions were also quoted. The decodings of the semi-structured interviews recorded in the tape recorder were controlled by the two researchers to ensure the correctness of the decodings. The data from the interviews were examined by the two researchers and themes and codes of interviews were formed; and the reliability percent between the two was found as 92%. Descriptive analyses of the answers of students to semi-structured interviews were made; the data were reduced, categorized and put into tables. Besides, in order to reflect the opinions of the individuals interviewed, direct quotations were included.

Findings

The frequencies and percentages of the answers that students gave to the open-ended questions in pre-test and post-test as well as students' expressions are given in the tables below..

Table 2 shows frequencies and percentages and quotes from the answers students gave to the pollution types that could be considered as an environment problem today:

Table 2. *Frequencies and Percentages related to Question: "What are the types of pollutions that could be considered as an environment problem today?"*

Types of Pollution	Pre-test		Post-test		Students' expressions
	f	%	f	%	
Air Pollution	13	68.42	16	84.21	...air pollution... (14th student)
Water Pollution	12	63.16	14	73.68	...water pollution... (17th student).
Soil Pollution	8	42.10	9	47.37	...soil pollution... (1st student).
Sound Pollution	8	42.10	10	52.63	...sound pollution... (12th student).
Light Pollution	6	31.50	16	84.21	...light pollution... (4th student).
Nuclear Pollution	1	5.26	1	5.26	...nuclear pollution... (16th student).

When Table 2 is analyzed, it is seen that whilst 31.50% of the students labelled light pollution as an environmental issue in the pre-test, 84.21% of the students labelled it as an

environmental issue in the post-test. It is seen that computer-aided concept cartoon activities and outdoor science activities carried out had a positive effect on student answers to open-ended questions in the post-test. Table 3 shows frequencies, percentages and quotes of students' answers to the reasons of light pollution:

Table 3. *Frequencies and Percentages on Question: "What do you think are the reasons of light pollution?"*

Reasons of Pollution	Pre-test		Post-test		Students' expressions
	f	%	*f*	%	
Unnecessary/ excessive lighting	13	68.42	19	100.00	Unnecessary lighting in big cities, the lights that bars reflect on the air, excessive brightness in billboards (13th student).
Unconscious lighting	3	15.79	10	52.63	Wrong lighting in unnecessary locations (4th student).

When Table 3 is analyzed, it is seen that students think that the reasons of light pollution are unnecessary/excessive lighting and unconscious lighting; and that there is an increase in the percent of the students who gave these answers in the post-test. Table 4 shows frequencies, percentages and examples of quotes of students' answers to how to determine whether there is light pollution in a specific area:

Table 4. *Frequencies and Percentages on "Is it possible to determine whether there is light pollution in a specific area? And how?"*

Determination of light pollution	Pre-test		Post-test		Students' expressions
	f	%	*f*	%	
With a light measurement device	2	10.53	18	94.74	…with devices measuring light pollution (4th student).
With naked eye	2	10.53	1	5.26	It can be seen by looking at the sky with naked eye… (12th student).

When Table 4 is analyzed, whilst 10.53% of the students in the pre-test stated that light pollution could be determined using a light measurement device, 94.74% of them gave the same answer in the post-test. Measurement of light via sky quality meter outside the school was efficient in the increase in the percent of the correct answer to the open-ended question in the post-test.

Table 5 shows frequencies, percentages and examples of quotes of students' answers to what kind of negative effects light pollution has on environment question:

Table 5. *Frequencies and Percentages on "What kind of negative effects does light pollution have on environment?"*

Negative effects of light pollution	Pre-test		Post-test		Students' expressions
	f	%	f	%	
In terms of eye health	2	10.53	2	10.53	…Our eye health will be at risk (6th student).
In terms of astronomical observations	4	21.05	9	47.37	The lights reflected on the space makes it difficult for astronomers to examine the sky… (13th student).
Harms living things.	6	31.58	17	89.47	…It could cause to failures in natural activities of some living things (Migrant birds – sea turtles) (13th student).
Health problems	2	10.53	4	21.05	It causes to health problems in people (9th student).
Damages natural environment	-	-	5	26.32	…It damages natural balance (6th student).
Damages the economy.	-	-	1	5.26	…It causes to loss of money (12th student).

When Table 5 is analyzed, it is seen that in addition to an increase in the correct answers to the negative effects of light pollution in the post-test, there is an emphasis by the majority of the students (89.47%) on the fact that light pollution harms living things. Table 6 shows the frequencies, percentages and examples of quotes of students' answers to what should be done to prevent light pollution:

Table 6. *Frequencies and Percentages on "What is your suggestion on what should be done to prevent light pollution?"*

Things to be done to prevent light pollution	Pre-test		Post-test		Students' expressions
	f	%	f	%	
Preventing unnecessary lighting	5	26.32	10	52.63	Closing unnecessary lightings… (1st student).
Decreasing excessive lighting	5	26.32	8	42.10	…Sufficient light should be used instead of excessive light… (14th student).
Organizing informative seminars (Informing people)	4	21.05	6	31.58	Light should be used consciously, the direction and level of the light should be adjusted correctly (12th student).
Ensuring correct lighting (Conscious utilization)	2	10.53	12	63.16	…ensuring light insulation in street lamps and thus ensuring that the lamps only enlighten downwards (1st student).

When Table 6 is analyzed, it is seen that there is an increase in the percent of students making suggestions on what could be done to prevent light pollution in the post-test, and that

majority of the students (63.16%) made suggestions related to ensuring correct lighting/conscious utilization and preventing unnecessary lighting (52.63%). Table 7 shows the frequencies, percentages and examples of quotes of students' answers to what kind of benefits could prevention of light pollution have:

Table 7. *Frequencies and Percentages on "What kind of benefits, do you think, could prevention of light pollution have?*

Benefits of Preventing Light Pollution	Pre-test		Post-test		Students' expressions
	f	%	*f*	%	
Making astronomical observations	4	21.05	6	31.58	...astronomers could easily make observations... (16th students).
Preventing the damages it will cause in environment	4	21.05	8	42.10	...environment pollution will reduce ... (14th student).
Preventing visual pollution	1	5.26	3	15.79	...prevents visual pollution (9th student).
Reducing eye problems	1	5.26	3	15.79	...helps to protect people's eye health (4th student).
Energy saving	1	5.26	1	5.26	...We prevent excessive light accumulation in the atmosphere (13th student).
Preventing the damage it could cause in living things	1	5.26	10	52.63	Migrant birds could easily migrate. ...The number of sea turtles remain stable (16th student).
Preventing economic loss	-	-	3	15.79	...and helps to save (12th student).
Protecting ecological balance	-	-	3	15.79	...balance in the nature remains undamaged (5th student).
Preventing health problems	-	-	1	5.26	...has benefits for the health of living things (7th students).

According to Table 7, there is an increase in the percentages of students answers in the post-test to what the kind of benefits could preventing light pollution have; students stated that preventing light pollution will particularly stop the damages it will have on living things (52.63%) and on environment (42.10%) and will enable astronomical observations (31.58%).

The findings of the semi-structured interviews carried out with 5 students after the post-test was administered in order to identify student opinions on light pollution and the practices carried out; and examples of student expressions are given below:

Interviewed students were asked the following question: "What do you think could be the negative effects of the excessive and wrong lighting in the cities?"; 60% of the students stated that it will effect astronomical observations negatively, 40% of the students stated that it will cause migrant birds to lose their way, 10% of the students stated that it damages the economy of the country, 10% of the students stated that it negatively effects the health of the living things, 10% of the students stated that it causes to a bad view of the city.

Examples of student expressions are given below:

It could effect the life of living things negatively. It could have negative effects on our health. It could cause to a bad view of the city. It could lead to environmental problems (4th student).

Astronomical observation could be prevented. It could be dangerous for birds and swallows. Because they will go to wrong ways while migrating, celestial bodies might not be clearly seen during space research due to excessive light (1st student).

Interviewed students were asked the question given: "If you were an environment planner, what would you do to prevent wrong lighting?";

20% of the students stated that they would ensure that unnecessary lights would be closed, 40% of the students stated that they would ensure that the lamps are designed to face down, 10% of the students stated that they would ensure that necessary lighting would be made, 10% of the students stated that they would ensure that the lighting in shopping malls would be reduced, 10% of the students stated that they would ensure that photocell lamps would be used, 10% of the students stated that they would ensure that awareness is created among people.

Examples of student expressions are given below:

> You know that light scatters around. I would focus it to a certain direction. Not all around. I would close the top of the lamp and focus it down, to where it is necessary to light. I would not use much light. I would use sufficient number of lights with adequate power (6th student).

> This is a comprehensive question...I would first start with the city's street lamps. I would design in a way that they face down, in a way that they just light up its environment only (3rd student).

Interviewed students were asked the question given: "Do you think that correct and just required amount of lighting is important in cities? Why?"

All the students stated that it is important. And in addition; 60% of the students stated that it is important for the health of living things, 40% of the students stated that it is important for eye health, 10% of the students stated that it is important in economical terms, 10% of the students stated that it is important in order not to damage ecological balance, 10% of the students stated that it is important in order not to cause light pollution.

Examples of student expressions are given below:

> Yes. High electrical bills are bad for the family and the state. It is economically important. It is important for the health of living things. Birds are effected from the lights in the migration area (1st student).

> It is important. Because if it is more than necessary it causes to light pollution. If everywhere is full of lights, people might lose concentration. Not only people but also other living things such as birds, turtles could lose their ways. So we should provide necessary lighting (6th student).

Interviewed students were asked the question given: "Is it possible to determine the level of light pollution in a certain area? And if yes, how?" All of the interviewed students stated that the level of light pollution at a certain area can be determined. With regards to how it can be determined, the students said that it is possible to determine it with a light pollution measurement device.

Examples of student expressions are given below:

> Yes. It can be determined with a light pollution measurement device (5th student).

In order to identify student opinions on the activities and practices carried out, the students were asked: "Are there any differences in the way you were taught the "Light Pollution" topic that you have just learned in your Science classes from the other topics you have learned before?" and 80% of the students stated that there were differences. 20% of the students stated that they learned visually, whilst 40% of the students stated that the activities were different and fun, 20% of the students stated that the studies created awareness.

Examples of student expressions are given below:

> Teachers used to tell. Here we learned with visuals (2nd student).

We learned more. The activities were different and fun (4ᵗʰ student).

Students were asked what caught their attention most when they were taught the "Light Pollution" topic and 40% of the students stated that it was the negative effects of excessive lighting that caught their attention whilst 40% of the students stated that it was the light pollution problems and solutions and 20% of the students stated that it was animals being negatively effected from the light pollution.

Examples of student expressions are given below:

The light pollution problems caught my attention. And the solutions... (2ⁿᵈ student).

Light pollution, in order words, the results that unnecessary lighting might cause caught my attention as well as how to make necessary lighting (5ᵗʰ student).

Students were asked the given question: "What do you think about the studies and activities carried out while "Light Pollution" topic is taught in Science classes? And 60% of the students stated that the activities created awareness and 60% stated that the activities were useful.

Examples of student expressions are given below:

I believe that it will provide me benefits and I think that I will be more conscious on this issue (3ʳᵈ student).

I did not know about light pollution. I learned it when we were taught the subject and understood how to use the light source (5ᵗʰ student).

Students were asked the given question: "Will you please tell us which activity you liked most while you were taught the "Light Pollution" issue?". 60% of the students stated that they like the sea turtles activities while 40% of the students stated that they liked the animations.

And among these students; 10% of the students said they liked the activities because they loved animals, 10% of the students said they liked the activities because it was fun, 10% of the students said they liked the activities because it created awareness, 10% of the students said they liked the activities because the fact that the sea turtles lose their ways because of artificial lighting was interesting to them.

Examples of student expressions are given below:

I liked the one about the animals. I love animals. It was good to inform animal lovers more. That the turtles' attraction is distracted and they go towards the light (1ˢᵗ student).

I was interested with the fact that turtles lose their ways. Because the artificial lights catch their attention and they go towards the light and not towards the sea (5ᵗʰ student).

Students were asked the given question: "Would you like other subjects in your Science classes to be taught in the same way as you are taught the "Light Pollution" issue?" and all the students answered this question as "yes". And as the reason 40% of the students stated that it was easier to remember this way, 40% of the students said it was fun and 20% of the students stated that it was interesting.

Examples of student expressions are given below:

Yes. Because animations make it easier to remember... (1ˢᵗ student).

Of course. It is different when all these things are taught with animations. It grabbed our attention. Of course it is better (5ᵗʰ student).

The given question was asked to the students: "Do you think that learning Science class

subjects with activities and studies similar to the ones you did in the "light pollution" subject will be good for you? And if so, why?" All the students answered this question as "yes" and as a reason, 40% of the students said it was easier to remember, 40% of the students said it created awareness, 40% of them said it was fun, 20% of the students said it enabled deep learning, 20% of them said it was enjoyable and 20% said it enabled them to be active.

Examples of student expressions are given below:

Yes. Learning with a different way was certainly better. I learned more. So, it is better. I also become conscious and I enjoyed and learned (1ˢᵗ student).

Yes. I think that I will be more conscious and I can be an example to the people around me. I think that we can learn more easily this way. We are being more active by doing such activities. I think that this was a fun work and we learned new things (4ᵗʰ student).

Students were asked: "Did you like the activities and practices outside the classroom? And if yes, why?" All the students answered this question as "yes" and as the reason behind, 20% of the students said because it was a good practice, 20% said it created awareness, 20% said it was enjoyable, 20% said it was fun, 20% said it taught where there was a light pollution, 20% said because it taught them why stars were not seen well at nights and 20% said it was the first time such a practice was carried out.

Examples of student expressions are given below:

Yes. We can not see the stars lately. I liked to learn the reason behind. The reason is the light pollution. We made measurements in the coast and in a place far from the city. There was too much light in the city. The result of the measurement outside the city was better (3ʳᵈ student).

Yes I liked. Because I like to learn new things and I also think that it was enjoyable. Measurements were made in two different places and there was a big difference between them. The first place had a lot of lighting and the second place was on a hill and it was darker. There was light pollution in the first place because of unnecessary and excessive lighting (4ᵗʰ student).

Discussion and Conclusion

Through the computer-aided concept cartoon practices and outdoor science activities carried out, the level of correct answers in open-ended questions in the post-test increased. While the number of students who stated that light pollution was an environmental problem was small in the pre-test, this number increased in the post-test. Similarly, Sadık, Çakan & Artut (2011) examined the perceptions of 206 students studying in 5th grade in three primary schools at different socio-economic backgrounds about environmental problems via the pictures students draw; and saw that 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 yet they saw that only one student drew a picture about light pollution. Taşlıdere (2013), in his study, stated that work sheets enriched with concept cartoons have positive effects on students' understanding of concepts.

Using the data collected through sky measurements in different points in Muğla province and data on light pollution, the study will create awareness about light pollution among students, will create an awareness of dark sky and encourage struggling against light pollution. The practices carried out with seventh grade students are believed to help students to develop an awareness of the ecological, astronomics and economical results of light pollution and to develop solutions for preventing light pollution. Students interviewed stated that in order to prevent wrong lighting, it is important to make necessary lighting and lamps should be correctly curtained and awareness should be created among people.

In their studies that they carried out to determine the perceptions of 8th grade students on

environmental issues via cartoons, Seçgin, Yalvaç & Çetin (2010) revealed that the number of students who expressed that light pollution, as an environmental problem, could be prevented via energy saving was very small.

All the interviewed students in the class in which computer- animated applications enriched with concept cartoons and outdoor science activities were carried out stated positive opinions about the practices. Students stated that they learned the reasons and effect of light pollution very well and that they wanted to make projects and studies towards preventing light pollution. In addition, during some of the interviews, it was observed that students could not think that light pollution gives harm to certain living things. Students stated that they enjoyed making computer-animated activities, making discussions with their friends and doing activities with their classmates outside the classroom.

Students stated that "Light Pollution" subject was taught in a different way compared to previous Science classes they had, that they made visual activities and activities that created awareness and said that they found what they learned useful. Students expressed that the problems that light pollution could cause and possible solutions to such problems grabbed their attention. Ersoy & Türkkan (2010), in their studies they carried out in order to analyze social and environmental problems via the cartoons primary school students draw, stated that one of students they interviewed said: "...I can not see the stars in the sky at night. Because high buildings open their lights. I really missed watching the sky." Similarly, in the activity carried out in this study, with regards to difficulty of seeing celestial bodies in the city, students said: "Street lights should not light up unnecessary locations but only necessary locations. And in order to see celestial bodies better it is necessary not to use excessive lighting but only required lighting."

Students stated that they enjoyed sea turtles activities and computer animations and said that such activities were fun and created awareness. All the students stated that from then on, they wanted to learn all other subjects in Science classes as they learned "Light Pollution" subject; they expressed that it was easier to remember, enjoyable, interesting, fun to learn that way and that it enabled deep learning and being active.

Students said that they did this kind of a practice for the very first time that it was a nice and the activities created awareness and were enjoyable, that they learned where there was light pollution, and they liked the activities they carried out outside the classroom.

Suggestions for the study could be as given below:

Concept cartoons, which prevent students from having misconceptions and that support them to learn by questioning, could be used both in determining misconceptions and changing them.

It is belived that emphasizing light pollution, which is not included in the environment pollution issue in Science curriculum, and its ecological, astronomical and economic importance will help to create awareness among students and thus, among future generations on the issue and to be responsive to the issue.

Using computer-aided concept cartoons in learning environments and learning science through outdoor science activities is believed to contribute to meaningful learning among students and to making the classes more attractive.

● ● ●

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APPENDIX A: Figures related to Implementations

Figure 1. Implementation of Computer-Aided Concept Cartoon Animations and Activity Worksheets in the Classroom

Figure 2. Outdoor Activity on Measuring Night Sky Brightness with a Sky Quality Meter
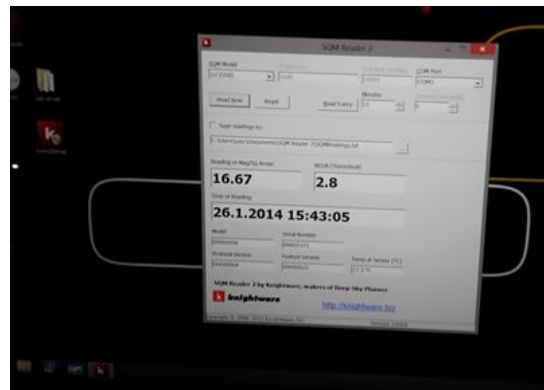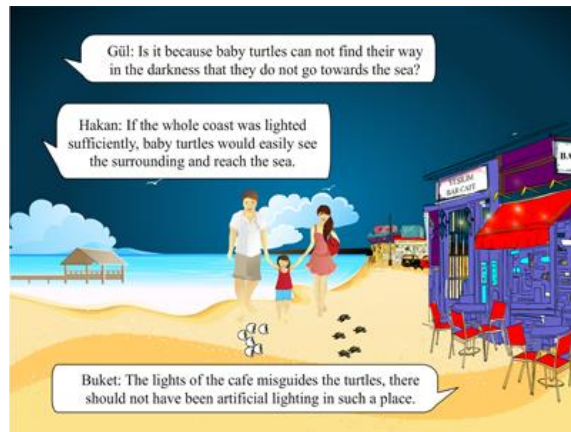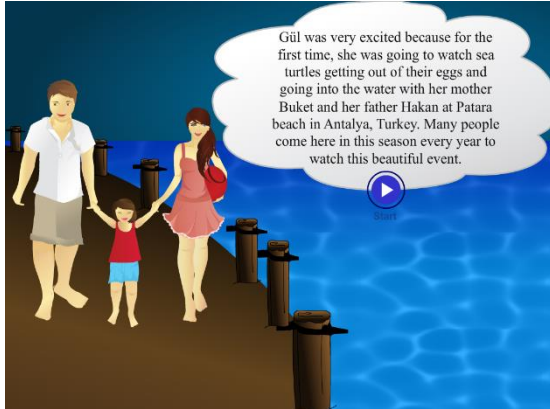
Figure 3: Night Sky Brightness Value in the City Center

APPENDIX B: An Example of Computer Animated Activity

Third grade elementary students' perception of science

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Abstract

The current study investigated which dimensions of scientific process are capitalized on by elementary school third graders to explain the concept of science at conceptual level. The study was conducted by using "Basic Qualitative Research", one of the qualitative research approaches with the participation of 225 elementary school third graders. Totally 46 codes used by the students to explain the concept of science were formed and these codes were classified under seven themes. At the end of the study, it was concluded that the students mostly used the codes classified under the theme of scientific process to explain the concept of science. The findings of the study are believed to make some important contributions to the development of the teaching program of the Science Course to be given to elementary school third grade as of 2014-2015 school year and to the implementation of this program by eliciting the current state of students.

Keywords: Elementary school, Science education, Perception of science

Introduction

Science course has been taught starting from the third grade at the elementary school in Turkey, as of 2014-2015 school year. One of the objectives of the science course given at elementary level is to help students to understand how scientists construct information, the processes followed in the construction of this information and how it is used in new research attempts (MEB, 2013).

Contrary to what is told to us by discourse makers, the structure of our society has not been shaped by science, particularly by scientific thoughts and methods (Moles, 2012). This is because individuals do not capitalize on science and scientific research process as a source of information during solution generation process. This is directly associated with the education individuals are subject to about science and scientific process as of early years of childhood. In

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this connection, Özlem (2010) defined science as an activity resorted to find solutions to problems we face in our daily life. It is a desired situation for individuals to utilize science more than other sources of information in their daily lives. Therefore, great deal of research has been conducted to understand what students think about science, scientist and scientific process and how they can be educated better about these issues. It seems that the research to elicit perceptions/views/conceptions possessed in relation to science and scientist started in 1957 (Finson, 2002). Draw A-Scientist Test has been used by many researchers since it was developed by Chambers in 1983 (Losh et. al, 2008; Mason et. al, 1991; Moseley and Norris, 1999; Rubin et. al, 2003). In this research, students' perception of science were attempted to be investigated based on their drawings. The findings about children's perceptions of scientist were investigated in terms of some variables such as gender, image and stereotype. Steinke et. al, (2007) stated that there is some research showing that many social and cultural variables affect students' perceptions of scientist.

The research focusing on perceptions/views/conceptions possessed children at different age-groups in relation to science and scientist started to be conducted in Turkey in 2000 (Buldu, 2006; Güler & Akman, 2006; Kaya et. al, 2008; Kormaz & Kavak, 2010; Leblebicioğlu et. al, 2011; Nuhoğlu & Afacan, 2011; Ozgelen, 2012; Toğrol, 2000; Türkmen, 2008) As one of the sub-dimensions of the study conducted by Ozgelen (2012) is the main goal of the current study, the current study investigated the students' responses to the question "What is science?" in more detail. The findings of these two studies are compared in the discussion section of the study.

Different findings have been reported by the research focusing on the development of children's perception of science. For instance, Schibeci and Sorenson (1983) and Chambers (1983) determined that development of children's perception of science continues up to fifth grade of elementary education. On the other hand, Lee (2010) conducted a study on first and second grade students at elementary education and maintained that the development of students' perception of science continues until second grade. Students' schemes of science formed at early childhood as a result of various experiences are affected by the education they take in their pre-school and elementary school years. Altun & Demirtaş (2013) found that "Science and Scientist" teaching program administered to 6 years old children led to improvement and change in the children's perceptions of science and scientist.

In this regard, determining what third grade students understand from the concept of science and which dimensions of scientific process they draw on to explain the concept of science essential because the findings of such an attempt are believed to contribute to the development of science education given to elementary school students.

Method

Research model, participants, data collection process and data analysis are discussed in this part.

Research Model

The study was conducted by using "Basic Qualitative Research", one of the qualitative research approaches. Much of the research in the field of education does not focus on a specific culture or aim to construct a theory. Moreover, qualitative research in the field of education does not need to be in the form of a case study aiming to investigate a specific unit or restricted case. Researchers using qualitative research approach in the field of education are in the quest of understanding and discovering a phenomenon, process and viewpoint at the basic level (Merriam, 1998). As the purpose of the current study is to explore and

comprehend how elementary school third graders explain the concept of science at conceptual level, basic qualitative research design was employed.

Participants

In a qualitative study, participants are selected through conscious and purposeful sampling strategies known as purposeful sampling method (Yin, 2011). The purposeful sampling method is grounded on the assumption that the researcher needs to work with sampling groups from which he/she can obtain rich data in line with the purpose of discovery, understanding and gaining some intuitions. In the purposeful sampling method, first the criteria to be used in the selection of the states to be investigated or participants of the study should be determined (Merriam, 1998). The basic criterion set in the current study is that the participants should be elementary school students because elementary school students' opinions about and perceptions of the concept of science and scientific process skills are shaped by Life Science course for the first time within the context of formal and compulsory education. In this regard, it was believed that working with elementary school third graders would yield rich data about the issue on the basis of what they had learned in Life Science course.

It is known that in literature, different researchers mentioned different purposeful sampling strategies. The present study preferred typical case sampling (Yıldırım & Şimşek, 2006; Patton, 2001). Typical case sampling requires working with people, states and examples that can reflect the average state of the phenomenon under investigation (Patton, 2001). In this respect, state schools with medium socio-economic level in the city of Kütahya were considered to be the typical case and from these schools, those whose directors and classroom teachers were willing to participate were selected. The study was conducted with the participation of 225 third graders from 9 different elementary schools. Of the participants, 115 are girls and 110 are boys. The participants' academic achievements in Life Science course were also obtained; yet, as no significant difference was observed in their academic achievements, this was not used as a variable.

Data Collection and Analysis

The data of the present study were collected in the spring term of 2013-2014 academic year. For this purpose, the students were asked "What do you think what science is?" and they were requested to give their responses in written form. No limit was set for the students' responses on the paper so that they could feel more relaxed and express their opinions freely. Moreover, for the students to express their opinions without feeling the anxiety of being a participant of a study, it was thought that conducting the study in an environment which they were already accustomed to would be suitable and thus, the data were collected within the course of Life Sciences.

In the analysis of the participants' responses, content analysis was employed. Content analysis method involves the collection of similar data under certain concepts and themes and arrangement and interpretation of them in such a way as to be understood by the reader (Yıldırım & Şimşek, 2006). Cohen, Manion and Morrison (2007) define content analysis as the summarization and explanation of the messages included within the collected data. Content analysis is suitable strategy for the analysis of the verbal data collected through face-to-face interviews or wide-scale visual data collected from web sites, newspapers, journals and blogs (Schreier, 2013). As the data of the currents study were collected from 225 participants, content analysis was thought to be the best means of analysis of these data due to its principle characteristics.

The stages followed in the analysis of the collected data are as follows: (1) reading the students' responses and taking notes, (2) creation of the codes based on the data and labeling of the texts, (3) conducting confirmatory activities for inter-rater agreement (4) generation of the themes on the basis of the agreed codes, (5) presentation and interpretation of the findings. Within the context of the mentioned stages of content analysis, the participants' responses were coded by the researcher; an academician specialized in the field and a classroom teacher independently from each other. Through crosswise comparisons, common codes were determined and discussions were conducted on the dissimilar codes to reach an agreement. Thus, agreement was reached on 46 codes. The codes were reclassified by the researcher under 6 themes and the relationship between the themes was modeled. At the end of the data analysis process, with the assistance of another researcher specialized on research methods, research procedure and codes were revised. As a result of this revision, total number of the themes was determined to be 7. These themes are Cognitive Dimension, Affective Dimension, Characteristic Dimension, Human Dimension, Process Dimension, Product Dimension and Scientific Fields Dimension.

Findings

In this section, firstly general findings of the study are discussed. Then the 7 themes are explained.

The analysis of the data revealed 46 codes delineating the concept of science. These codes were classified under 7 themes by the researcher. The themes and relational illustration of these themes are as follows:
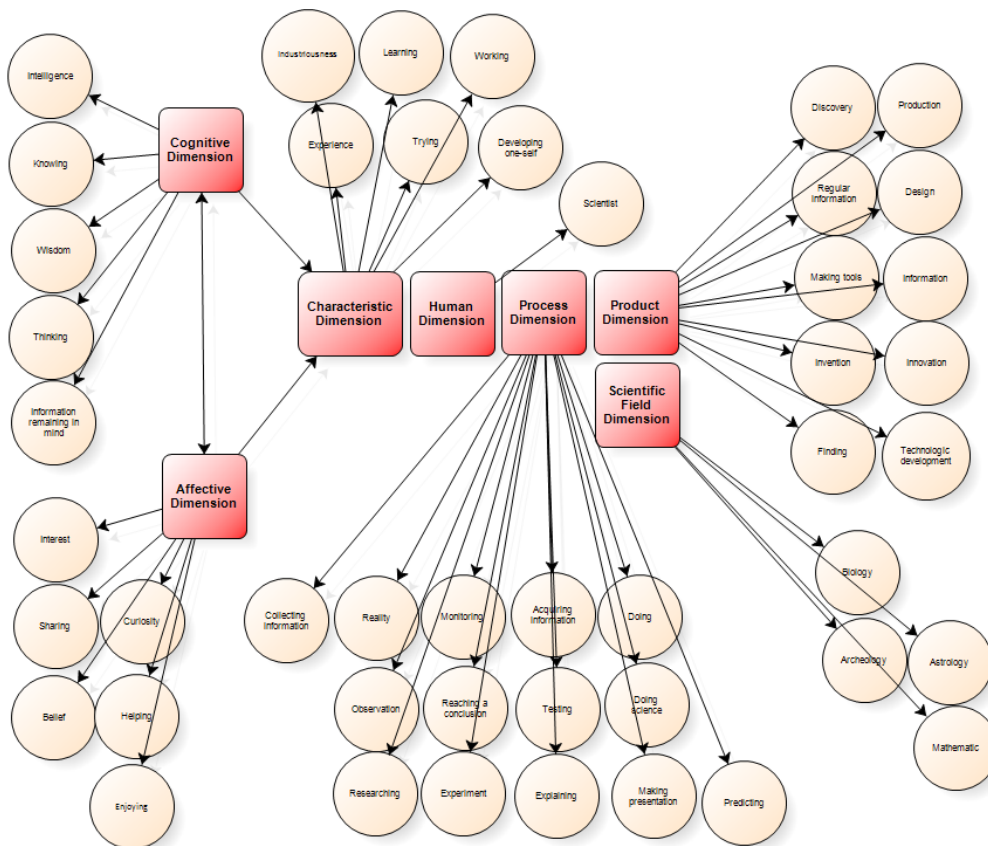

Figure 1. The Map of Themes and Codes

As can be seen in Figure 1, there are no relationships among the themes of human, process, product and scientific disciplines. On the other hand, the themes of cognitive and affective dimensions are associated with each other and effect the theme of characteristics.

Finding 1. Cognitive Dimension

The concepts used by the students trying to explain the concept of science over the characteristics to be possessed by a scientist were subsumed under the theme of cognitive dimensions. There are totally five codes under the theme of cognitive dimension that are wisdom, knowing, thinking, intelligence and information remaining in mind. The frequencies and percentages of these codes are presented in Table 1.

Table 1. *Frequencies of the codes collected under the theme of cognitive dimension*

	Codes	Frequency (*f*)	Percentage (%)
	Wisdom	2	6.66
	Knowing	20	66.66
Cognitive dimension	Thinking	1	3.33
	Intelligence	6	20
	Information remaining in mind	1	3.33
	Total	30	100

When Table 1 is examined, it is seen that the most frequently recurring code in the theme of cognitive dimension is "knowing" (*n*=20, 66%) and the least frequently recurring code is "thinking" (*n*=1, 3%).

While some of the students defining the concept of science under the theme of cognitive dimension emphasized only cognitive dimension, some others mentioned other codes classified under the remaining six themes shown in Figure 1 in addition to those collected under the theme of cognitive dimension. For instance, some of the students emphasizing only the cognitive dimension explained the concept of science as follows;

> **S36** *Science: "is learning and knowing."*

> **S217** *Science: "means intelligence, wisdom."*

On the other hand, the students emphasizing the other dimensions besides the cognitive dimension defined the concept of science as follows;

> **S5** "*Science means intelligence, research, experience and developing oneself.*"

> **S182** "*Science is the information remaining in mind, conducting experiments and making presentations.*"

As can be seen above, some students adopt a uni-dimensional approach to the definition of the concept of science; some others have multi-dimensional conception of the concept.

Finding 2. Affective Dimension

The affective dimension includes six codes that are interest, belief, curiosity, sharing, helping and enjoying. The frequencies and percentages of these codes are presented in Table 2.

Table 2.*Frequencies of the codes classified under the theme of affective dimension*

	Codes	Frequency (*f*)	Percentage (%)
Affective dimension	Interest	1	8.33
	Belief	2	16.66
	Curiosity	3	25
	Sharing	2	16.66
	Helping	3	25
	Enjoying	1	8.33
	Total	12	100

When Table 2 is examined, it is seen that the most frequently recurring code in the theme of affective dimension is "helping" (*n*=3, 25%) and the least frequently recurring code is "enjoying" (*n*=1, 8%).

All of the students defining the concept of science primarily through the codes classified under the theme of affective dimension also mentioned the codes collected under the other themes in their definitions. Some definitions provided by the students emphasizing the other dimensions besides the affective dimension are as follows.

> **S56** *"Science means collecting information and sharing it with other people or inventing something. For instance, Graham Bell invented the telephone."*

> **S24** *"Science means conducting an experiment about an issue. It means feeling curious about something and then conducting research on it."*

As can be seen above, the students adopting an affective approach to the definition of the concept of science seem to have multi-dimensional perception of the concept.

Finding 3.Characteristics Dimension

There are 6 codes involved in the characteristics dimension that are industriousness, working, trying, experience, developing one-self and learning. Frequencies and percentages of these codes are presented in Table 3.

Table 3. *Frequencies of the codes classified under the theme of characteristics*

	Codes	Frequency (f)	Percentage (%)
Characteristics dimension	Industriousness	1	2.77
	Working	2	5.55
	Trying	7	19.44
	Experience	2	5.55
	Developing one-self	1	2.77
	Learning	23	63.88
	Total	36	100

When Table 3 is examined, it is seen that the most frequently recurring code in the theme of characteristics dimension is "learning" (*n*=23, 64%) and the least frequently recurring codes are "industriousness" (*n*=1, 3%) and "developing one-self" (*n*=1, 3%).

While some of the students defining the concept of science under the theme of characteristics dimension emphasized only characteristics dimension, some others also mentioned other codes classified under the remaining six themes. Some of the students focusing only on the characteristics dimension explained the concept of science as follows;

> **S12** *"Science means trying something."*
>
> **S83** *"Science means learning something."*

On the other hand, the students emphasizing the other dimensions besides the characteristics dimension defined the concept of science as follows;

> **S4** *"Science means trying and researching something. Science means experience to me."*
>
> **S13** *"Science means collecting information about something and working on it and thus finding a solution."*

As can be seen above, while some students adopt uni-dimensional approach to the conception of the concept of science, some others adopt multi-dimensional approach to it. The codes classified under the themes of cognitive dimension and affective dimension are mostly related to the cognitive and affective qualifications to be possessed by a person to do science. These two themes can be classified under the theme of characteristics or as in the current study, can be presented under a relational scheme.

Finding 4. Human Dimension

The concepts used by the students trying to explain the concept of science over the human dimension are classified under this theme. Under this theme, there is only one code that is "scientist"(n=15). As in the other dimensions, here, while some of the students emphasized only human dimension, some others also mentioned other codes classified under the remaining six themes. Some of the definitions proposed by the students only emphasizing the human dimension are as follows;

> **S96** *"Science means being a scientist."*
>
> **S99** *"Science means being a professor etc."*

Those putting emphasis more than one dimension;

> **S183** *"I think science means scientists' conducting research."*
>
> **S219** *"Science is an invention or a scientist."*

Finding 5. Process Dimension

The process dimension includes totally 14 codes that are explaining, researching, acquiring information, collecting information, doing science, monitoring, experiment, reality, observation, reaching conclusion, making presentation, predicting, testing and doing. Frequencies and percentages of these codes are presented in Table 4.

Table 4. Frequencies of the codes classified under the theme of process dimension

	Codes	Frequency (*f*)	Percentage (%)
	Explaining	1	0.94
	Researching	62	58.49
	Acquiring information	3	2.83
	Collecting information	3	2.83
	Doing science	3	2.83
	Monitoring	1	0.94
Process Dimension	Experiment	20	18.86
	Reality	1	0.94
	Observation	2	1.88
	Reaching a conclusion	1	0.94
	Making presentation	1	0.94
	Predicting	2	1.88
	Testing	1	0.94
	Doing	5	4.71
	TOTAL	106	100

When Table 4 is examined, it is seen that the most frequently recurring codes in the theme of process dimension is "researching" (*n*=62, 58%) and "experiment" (*n*=20, 19%)and the least frequently recurring codes are "explaining" (*n*=1, 0.94%), "monitoring" (*n*=1, 0.94%), "reality" (n=1; 0,94%), "reaching a conclusion" (*n*=1; 0,94%), "making presentation" (*n*=1, 0.94%) and "testing" (*n*=1, 0.94%).

The fifth finding is different from the other findings in terms of two aspects. First, it is seen that there are more codes derived from the analysis of the statements of the students defining the concept of science under the process dimension. The second, the terms used by the students in explaining the concept of science is the indicators of some of the scientific process skills to be acquired by these students (making observation, making prediction, classifying and measuring) during their elementary education.

For instance;

S32 *"Science means knowing what will happen today or tomorrow."*

S120 *"Science means making observations."*

The students making references to the codes classified under the other themes besides the theme of process dimension defined the concept of science as follows;

S31 *"Science means wondering about something and then researching and discovering it. It means finding and inventing something."*

S182 *"Science is the information remaining in mind and conducting experiment and making presentation."*

Finding 6. Product Dimension

The statements of students including the codes such as discovery, invention, information and production in the explanation of the concept of science are collected under the theme of "product". There are totally 10 codes under this theme that are making tools, information, finding, regular information, invention, discovery, design, technologic development, production and innovation. Frequencies and percentages of these codes are presented in Table 5.

Table 5. *Frequencies of the codes classified under the theme of product dimension*

	Codes	Frequency (*f*)	Coverage (%)
	Making tools	2	1.86
	Information	14	13.08
	Finding	37	34.57
	Regular information	3	2.80
	Invention	32	29.90
Product Dimension	Discovery	6	5.60
	Design	2	1.86
	Technologic development	2	1.86
	Production	7	6.54
	Innovation	2	1.86
	TOTAL	107	100

When Table 5 is examined, it is seen that the most frequently recurring codes in the theme of product dimension is "finding" (*n*=37, 35%) and "invention" (*n*=32; 30%)and the least frequently recurring codes are "making tools" (*n*=2, 2%), "design" (*n*=2, 2%), "technologic

development" (*n*=2, 2%) and "innovation" (*n*=2, 2%). Here, it is seen that the students try to explain the concept of science on the basis of the products to be created by science. The distribution of the codes gathered under the theme of product is given in Table 5. As can be seen in the table above, given the cognitive development level of the students, it is a remarkable finding that the students try to explain the concept of science by using the codes such as technology and design as well as the codes such as discovery, invention and finding that can be used interchangeably. The codes collected under this theme are used individually and/or together with the codes from other themes to explain the concept of science.

Some definitions based on the single theme are as follows;

S133   *"Science means making tools."*

S18   *"Science means designing something."*

Some definitions made through references to more than one theme are as follows;

S3   *"Science means discovering and presenting this discovery to others."*

S169   *"Science is information, learning, researching and working."*

Finding 7. Scientific Field Dimension

Finally, the disciplines capitalized on by the students to explain the concept of science such as biology, astronomy and mathematics are collected under the theme of scientific field dimension. The codes collected under this theme were stated by two students. Thus, frequencies and percentages of the codes collected under the theme of scientific field dimension are not presented. These two students defined the science as follows;

S53   *"Science includes disciplines such as astrology, archeology and biology."*

S55   *"Science is done through mathematical inventions."*

When the definition of S53 is considered, it is seen that the student defines astrology as a science. This shows that the student has a conceptual fallacy about the concept of science. Though this is a conceptual fallacy, given the age group of the students, it is still important for them to try to define the concept of science on the basis of disciplines.

Discussion

In light of the data of the current study, the codes driven from the statements used by the students to explain the concept of science were subsumed under 7 themes. This is believed to result from the students' attempts to explain the concept of science from different viewpoints. Türkmen (2007), Chambers (1983), Barman (1999), Finson (2002), Solomon, Scott and Duveen (1996), Newton and Newton (1992) conducted studies on children from different age groups focusing on their perceptions of scientist. They tried to analyze the students' perception of scientist based on their drawings and statements. In these studies, the children's perceptions of scientist were classified according to ethnic origin, race, gender and clothing. In the current study; on the other hand, it is seen that the students trying to explain the concept of science on the basis of the scientist both used the term "science man" and "science human". However, as the main focus of the current study is to determine the students' perceptions of and opinions about the concept of science, the statements used to define the scientist were not examined in terms of gender and other variables.

Güler and Akman (2006) maintained that the basic factor leading children aged 6 to the discovery of the concept of science is curiosity and effort to understand their environment. In the same study, the children tried to define science through the codes of researching and investigating and this concurs with the findings of the current study. Thus, it can be argued

that both pre-school children and elementary school students mostly try to explain the concept of science on the basis of the process dimension of science. This shows that the third grade elementary school students' perception of science starts to shape during pre-school years.

The current study demonstrates some similarities to the study by Ozgelen (2012) in terms of the study group and the question asked "What is science?" In both of the studies, the students' responses to the question "What is science?" include similar codes. Yet, Ozgelen collected the codes related to each other under the heading of KIDS. The other codes are similar to the codes of discovery, finding, information, technology and curiosity gathered under the themes of "product" and "affective" dimensions of the current study. Due to the nature of qualitative research, the codes were classified under different themes in these two studies.

The codes used by the sixth, seventh and eighth graders students to define "scientist" in the study by Kaya et al. (2013) overlap with the statements of the students explaining the concept of science through the codes classified under the theme of "characteristics" and its related themes of "cognitive and affective dimensions" in the present study. Given that the study group of the current research consists of third grade students, it is notable that their statements are similar to those of sixth, seventh and eighth graders. The reason for this similarity seems to support the study conducted by Lee (2010) because as mentioned above, Lee (2010) reported that the development of children's perception of science continues up to the second grade at elementary education. This also reveals that factors such as pre-school education, media and family are influential on the formation of children's perception of science.

Results

Classification of the codes used by the students to define the concept of science under 7 different themes is of great importance given the cognitive development of the children. Though the frequencies of some codes are notably higher than those of others, wide variety of the codes used in the current study to explain the concept of science is quite promising. Since 2014-2015 school-year, science course has been taught as of elementary school third grade. In this connection, an important finding of the current study is that the students try to explain the concept of science over scientific process skills and the codes subsumed under the theme of scientific process considering that one of the objectives of science teaching is to impart inquiry skills to students.

Implication

Future research to deal with children's perceptions/views/conceptions of science may focus on variables such as the socio-economic and socio-cultural backgrounds of students, education level of their parents, media and pre-school education. Moreover, integration of pre-school education program with elementary school program can make great contributions to the understanding of the concept of science by children.

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Non-challenging education and teacher control as factors for marginalization of students in diverse settings

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Abstract

This article discusses teachers' attitudes towards immigrant students in poor settings and the effect these attitudes have on organization of education on classroom level. It draws on results from two ethnographic studies where some primary school classes in Sweden were followed with participant observation and interviews as main research methods. The article focuses on classroom activities and teachers' attitudes towards immigrant students and students with low socio-economic status. In the article is argued for the importance of presenting students in poor settings with demanding tasks and challenging education. In these cases, intellectually undemanding tasks in combination with little room for students' own initiatives resulted in low enthusiasm among students regarding schoolwork and accordingly low learning, while classroom work that demanded active involvement by students in combination with high level of students' influence on what took place in classrooms resulted in high level of students' engagement and high outcome.

Keywords: Challenging education, Immigrant students, Diverse settings, Teacher attitudes, Deficiencies

Introduction

In this article teachers' attitudes towards immigrant students in poor settings is investigated, and also the effect these attitudes have on organization of education on classroom level. During my years in teacher education in Sweden, I have been struck by the fact that so many teacher students seem to view children as vulnerable, neglected and in need of intense teacher supervision. It might be that children are perceived as legitimate objects for goodwill and nurturing, but I find it problematic when they are perceived as representing a collection of deficiencies. This seems particularly to be the case in many contexts involving children with immigrant backgrounds; Runfors (2003) claims that they are made to represent "a minuskultur," a culture of deficit. Runfors shows how teachers in Sweden have constructed "immigrants" based on assumptions about defects and marginalization. Teachers in her study

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emphasized the need to teach Swedish to students with immigrant backgrounds and to compensate for their lack of contact with the Swedish society. They focused on the experiences the students lacked, not on those they possessed. Cases where teachers have tended to treat students with multilingual, immigrant or socio-economically disadvantaged backgrounds as less able have also been shown by Knapp et al. (1995), Lahdenperä (1997), Parszyk (1999), Queensland School Reform Longitudinal Study (2001) and Johnston and Hayes (2008).

Although students with immigrant and/or multilingual backgrounds do not constitute a homogenous group, general academic results within these groups in Sweden are below those achieved among students with monolingual Swedish backgrounds. In 2005/06, 14 % of the students in the nine-year compulsory school in Sweden had immigrant backgrounds, that is, they were either born abroad or both of their parents were born abroad (Skolverket 2009). Of these, 28 % did not pass the final exams in grade nine, while the figure for students with Swedish backgrounds who did not pass was 16 %. Of students with Swedish backgrounds, 2.4 % did not receive a final grade at all, while the figure for students with foreign backgrounds was 8 %. One out of five students with foreign backgrounds did not qualify for a national program at the Swedish gymnasium (upper secondary school, equivalent to form four to six) while the rate for students with Swedish backgrounds was one out of ten. Among students with Swedish backgrounds who took their exam in grade nine, the final year of compulsory school in Sweden, 6.4 % did not pass Mathematics and 4.4 % did not pass English in 2008. The figures for students with foreign backgrounds were 14.9 % for Mathematics and 13.6 % for English (Skolverket 2009). This means that the failing rate is more than double for students with foreign backgrounds. The educational gap between the groups is slowly widening. In Sweden, as in many Western countries, the majority of immigrants are relatively isolated, living in suburbs whose populations are largely made up of immigrants and people of low socio-economic status. This means that schools with a majority of students for whom Swedish is a second language are also schools in which many students are from low income backgrounds. In this article I will refer to this type of setting as "diverse". The reasons for the widening gaps are many and in this article I will focus on one possible reason: teachers' attitudes towards students in diverse settings and the effect these attitudes have on the organization of education at the classroom level. The article draws on the results from two case studies in Sweden on language and learning in classrooms in diverse settings.

2. Diverse classrooms and challenging education

Many teachers seem to support the "deficiency theory" regarding students in diverse settings, and this tends to marginalize these students. In her study, Runfors (2003) found that students who were denoted as immigrant children tended to be kept apart, side-stepped and subordinated in ways that diminished their range of personal initiative. Through her study in three different types of schools, she showed that students in a middle-class school in Sweden, in which students came mainly from monolingual Swedish backgrounds, were offered more opportunities to engage in individual initiatives in which the teacher acted more as a supervisor. In a mixed school, teachers often pointed out problems with immigrant students, and Runfors established that the students in question were segregated. She talks about immigrant fatigue among these teachers. In a third school, in which few students had Swedish as their mother tongue, Runfors found both teachers and students to be more enthusiastic and more engaged. While, in these immigrant-dense schools, students helped each other and immigrant students frequently asked for help, she found that, in the mixed school, immigrant students tended to hide any lack of knowledge. From this study, one may infer that the risk of teachers focusing on the lack of Swedish-language ability among immigrant students is

particularly high in a mixed setting. In a study of "programs for measures to be taken" (Sw. åtgärdsprogram) for students with immigrant backgrounds, Lahdenperä (1997) found that teachers focused on deficiencies and also that they held a compensatory view particularly towards parents with immigrant backgrounds.

Studies by Johnston & Hayes (2008) and Knapp et al. (1995) revealed a pattern of low educational demand resulting in poor academic results in schools in similar settings. According to Knapp et al., in linguistically and culturally diverse classrooms in low-income areas, what teachers perceive as "good" education tends to have students working along a linear study path, progressing from basic to more advance levels. However, while teachers focused on the basics, they seldom reached the more advanced levels. Johnston & Hayes analysed implicit classroom practices in diverse classrooms in Australia, what they called "taken-for-granted classroom practices", and found that conventions and practices in classrooms were restricting students' opportunities to learn. Their findings showed that teachers practised a high level of control in class and assigned intellectually unchallenging tasks, which together resulted in low student engagement. Johnston & Hayes (2008) characterized this mode of teaching as a "survival mode".

Johnston & Hayes (2008) were surprised to find similarities in classroom patterns in all four schools in their study. Similarities included minimal literacy demands, intellectually undemanding tasks, teachers asking questions on procedural levels that required a one- or two-word response and the lack of choice given to learners regarding what they could learn, and when and where they could learn it. They reported that if students were not constantly re-engaged they lost interest in the lesson "game" and instead occupied themselves with activities such as chatting among themselves, moving around, listening to iPods, and daydreaming. Johnston & Hayes also argued that in this way teachers create "zone(s) of relative comfort" while actually restricting the learning environment. Newmann & Associates (1988) argued that students in what they call disadvantaged schools are often disadvantaged by the absence of demanding education. Also, Parszyk (1999) found teachers and students talking about undemanding teachers.

In an American study of high-poverty classrooms, Knapp et al. (1995) found similar practices, although in their study teachers sometimes offered students a greater variety of routines and strategies. They noted that on these occasions students showed more enthusiasm. They reported that teachers who tried to connect what happened in school to students' earlier experiences also used more meaning-oriented approaches in their teaching. They also found that in classrooms where teachers exerted slightly less control and also offered a wider range of routines and varied instructional strategies, students showed greater enthusiasm for school work.

In a longitudinal school study in Australia (the Queensland School Reform Longitudinal Study, QSRLS, 2001) teachers rated basic literacy and numeracy skills as the most important in school, while intellectual engagement and demand were rated least important. It was determined that constructivist views of learning were rarely implemented for students from traditionally marginalized groups and that some teachers avoided high intellectual quality and referred to behaviorist pedagogy instead. The conclusions in the QSRLS were that levels of intellectual demand and social support both have significant statistical correlations with improved productive performance and, hence, improved student outcomes. The study highlighted the need for a shift in teachers' focus, from basic skills to higher-order thinking, problematic knowledge and sustained conversations, ranging from minimal to higher levels of expectation and demand. The study concluded that schools provided supportive environments and that teachers identified students' social needs. However, appropriate and

effective interventions were not developed for students from diverse backgrounds nor were interventions developed to effectively improve these students' performance. Some teachers perceived making greater intellectual demands and providing social support as alternatives while the research emphasized the importance of both.

The importance of providing intellectually challenging education for second-language learners (L2 learners) in combination with high support and the explicit teaching of language has been emphasized by, among others, Cummins (1984, 2000), Cummins and Early (2011), Gibbons (2006, 2008), Hammond (2006, 2008), Schechter and Cummins (2003), and Author (2010a). These researchers oppose the tradition of modifying the curriculum for L2 learners by claiming the importance of offering students intellectually undemanding tasks. Gibbons (1998) warns that a simplified approach towards L2 learners can lead to a reductionist curriculum that works against successful second-language learning and "provides an insufficient basis for the development of a language-for-learning in school" (1998:100). Cummins (1996, 2000) shows the relation between these factors in his well-known coordinate system with two intersecting continua. One of the continua represents the degree of contextual support, where one extreme stands for context-embedded and one for context-reduced. The other shows the degree of cognitive demands in the language use or activity. This axis has at its extremes cognitively demanding and undemanding language. If the students' knowledge and experience of the topic is high, the language use has been automatized and the linguistic challenge is minimal. In the opposite case, if the students' knowledge is low, then the linguistic challenge becomes high. Teaching in a second language should, according to Cummins, start at the less demanding and concrete end but proceed through to the more highly demanding end, although still dealing with concrete tasks. Cummins (2000) uses the terms BICS and CALP for these types of language respectively, with BICS denoting conventional everyday language and CALP denoting language that is age-relevant in academic school settings. He draws attention to the difference in the amount of time required to learn BICS (1 to 2 years) and CALP (5 to 7 years). Thus, he stresses the need to provide L2 learners with age-relevant education at the same time as they receive language teaching and linguistic support to enable them to elaborate on curricular knowledge. Cummins' model has been criticized for being too simplified to describe such a complex and dynamic process as second-language acquisition (see for example Baker, 2006). However, I find that it may serve as a model for educational planning for students whose ability to communicate in Swedish as a second language has not yet reached the level that is required in school.

Gibbons (2008) argues that a high level of challenge and support favours all students, while low demands give rise to self-fulfilling prophecies. Newmann & Associates (1996) argue that all students regardless of background become more engaged when classroom activities grow more demanding. Thus all students reach higher levels in an intellectually challenging environment and justice gaps diminish within this educational format. Also, Hammond (2006, 2008) stresses the importance of providing an intellectually challenging education to L2 learners to promote the development of higher-order thinking. These scholars all stress the importance of a linguistically supportive curriculum of knowledge in combination with high-quality teaching. Gibbons (2008) gives the following examples of challenging education: students are offered opportunities to participate in higher-order thinking, transformation of information, and exploration-based activities, and they construct their own understanding by taking part in real conversations with others. These examples challenge earlier-mentioned traditions for education in diverse settings, in which the curriculum has been reduced and simplified.

By drawing on two case studies I aim to show how teachers' attitudes and the way that they organize education in their classrooms in diverse settings may affect students' opportunities for learning.

3. Two Swedish cases

In the two studies I followed a number of primary school classes. The studies took an ethnographic approach and aimed at visualizing relations between students' language development and their knowledge of school subjects, with a focus on students with immigrant and/or multilingual backgrounds. Particular aims were to understand teachers' and students' assumptions and understandings about language and learning.

The classes were observed during ordinary school days and the observations were spread over different times of day and during different types of activities. I particularly tried to find occasions where knowledge of typical school subjects was presented or dealt with, such as knowledge related to mathematics, reading and writing, science and social science. As a participant observer I did not intervene in what happened in class but responded when teachers or students addressed me. Students sometimes asked me to help them or initiated conversations with me, to which I responded. Teachers sometimes approached me and commented on what was going on in the classroom and shared their plans and reflections. Apart from keeping field notes, I also collected written materials and students' written texts.

In the first study, in North School, about 350 hours were spent in two classes over a period of three years, and about half of the time was recorded. A tape recorder was placed visibly, usually near to where I sat and sometimes on particular students' desks or in the teacher's pocket. When students asked if they could listen, I arranged so that they could listen to parts where they themselves had been recorded. Students and teachers were interviewed every year. In the second study, in South School, the study focused on two classrooms in which grades three and five were taught. In these classrooms video recordings were used instead of tape recordings. In both studies teachers were interviewed at the end of each school year.

3.1 The case of North School

The school where the first study was carried out is located in a medium-sized town in Sweden. The school is small, with just over 100 students from pre-school to grade six, consisting of students from six to thirteen years of age. Most of the students in this school lived in apartments and came from relatively low-income backgrounds, while some lived in private houses. About half of the students had immigrant backgrounds, which means that one or both parents were born abroad, and most of these students lived in the apartments. Some of the parents could be considered middle class, while some were unemployed and relied on support from the welfare system.

The students with immigrant backgrounds in this school constituted a heterogeneous group. Some were born in Sweden and some abroad. Some had one parent with Swedish as the mother tongue and Swedish as the main language in the home, while some rarely spoke any Swedish with adults except in school. Some (but not all) students who did not know any Swedish were placed in a preparatory class for some months before being placed in the class where only Swedish was used. In some cases students were placed a grade below their own age level. Swedish as a second language was taught through a "pull-out model" (Thomas & Collier 1997), which means that students were taught Swedish separated from their class for some of the lessons. This only applied to newcomers or low-performing students. Some of the multilingual students also received weekly lessons in their mother-tongue.

3.1.1 Teacher attitudes

All of the teachers who taught these two classes were experienced teachers who qualified in the 1970s or early 1980s. None of the teachers had special education in the role of language in learning, nor in the learning conditions required by students being educated through a language they have not yet mastered. Some of the teachers had education in special needs but none had training in teaching Swedish as a second language.

The teachers who were responsible for the main part of education in the two studied classes were asked about their students and the classes in the interview. The teachers were Maria, responsible for the class that was followed from pre-school to grade three, and John, who taught the class that was followed from grades three to six. Both focused mainly on the needs they perceived some of their students to have. They showed concern about the students they perceived as low performing. They also showed social concerns about the students, particularly as a group. Maria described her class in grade-three as "a great team", "positive" but also as "socially unstable" and she stressed the necessity to "weld the group together and make them respect each other". She stressed that mathematics was difficult for some of them and that "the Swedish-two boys" will have a tough time higher up in school". When she talked about individual students she said that they "are on their way", have to "polish some skills" and to "pick up one thing after the other" and she also said about some of them that they "hardly get anything done".

When John talked about his class in grade six he said that many of them had lost a great deal of time and that they "need a lot". He said that many of them had difficulty performing at all and that it "takes a lot of push and pull" (to make them do any of the assigned work). When talking about individual students he used expressions such as "does not have time to consolidate new information", "it takes time to pull an answer put of him, "he hasn't got his own motor" and "it's hard to get anything out of him".

Concerning the high-performing students, John and Maria did not say much other than that they were "linguistically enormously developed", "made progress" and worked "terribly well".

3.1.2 Organization at the classroom level

The way that Maria and John perceived their students' needs affected what happened in their classrooms. The main concerns that they expressed were about the needs of the low-performing students and about social needs. They did not express concerns regarding what was taught, teaching methods or level of education or whether what they were teaching suited the students. They did not express much concern about the high-performing students, which shows that they were more focused on what they perceived as problems.

There were many patterns in these two classrooms that resembled the results shown by Johnston & Hayes (2008). The atmosphere was very friendly and inclusive. Newly arrived students were welcomed and included in peer groups, and students who had recently come to Sweden and had only begun to learn Swedish were supported by teachers and peers. The tasks they were occupied with resembled those described by Johnston & Hayes (2008) in that they were largely procedural tasks and behaviourist types of exercises with little scope for arriving at individual solutions. In the lower grades, tasks were commonly related to reading, writing and mathematics and consisted mainly of drawing lines, colouring and filling in single numbers, letters or words.

The talk in class was dominated by what can be characterized as small talk or chat. Discussions about school subjects were rare, as were occasions when anyone, teacher or

student, was engaged in expressing abstract, complex thoughts. Most of the time students worked individually or in small groups while they chatted with each other, and the teacher walked around the classroom assisting those who called for help. As a result, the main part of the classroom interaction consisted of dialogues with fragmented speech, overlapping speech, frequent repairs and interruptions (see Author 2008, 2010a, 2010b, 2011).

One example of work that followed a behaviourist pedagogy, and that did not promote or demand complex language use, was a study kit that was used in all classes in this school, and hence also in the two classes in this study. The study kit, named *Pilen* (The Arrow), was used from the second term in grade one to the end of grade six, and its importance was emphasized by all teachers. Teachers and the study kit's producers claimed that the kit developed students' linguistic skills, although in reality it was limited to written Swedish. The study kit consisted of cards and worksheets that students were supposed to work through following a fixed order. I never observed a teacher initiating a change in this pre-planned order. There was little or no room for students to use creative language in the tasks, and opportunities to make individual choices were minimal. When students happened to do a task out of its planned order, this was corrected by the teacher. The exercises trained discrete skills out of context, such as changing nouns from singular to plural or joining different given morphemes to form words. Reading and writing consisted of single words or short sentences, and the writing mainly entailed copying from the cards. The work was for the most part done individually, except when students were required to play a game. A game could be a competition where the one who first reached a certain goal, such as getting five dots, won. Students were not explicitly required to talk during these activities, but as they usually sat in pairs during work they chatted and asked each other about different tasks.

The tasks were not cognitively demanding and, as they were of a type that mainly tested students' skills, they did not give students many chances to produce language of their own, apart from the small talk they engaged in. One example from grade three of how the work was carried out involves an immigrant boy working with a sheet with a number of nouns, each preceded by a line on which he was expected to fill in en or att (indefinite article in singular). He came to the noun *barr* (needles), which he seemed not to know. Then he asked his classmate sitting next to him: "Vad ska det vara här?" (What should it be here?) and received the answer: "ett", which he wrote on the line. Thus he did not learn the meaning of the word but solved the task by writing down the word given by his classmate.

Some high-performing students quickly developed fluency in reading and writing and they used some of the time in class reading and writing extended texts. Others were late in developing literacy skills and were observed to mainly read and write single words or sentences right up into the higher grades. Most of the immigrant students were among this group. Some of the immigrant students were barely observed to read anything even in grade six, only writing texts of a few lines and only with great support from a teacher.

In the higher grades students were sometimes arranged in groups to work on various projects. Here students had some opportunity to choose tasks, such as what part of Sweden to focus on or whom to work with. However, within the project groups, those students who had reached high proficiency in reading and writing were the ones who did the reading and writing for their groups, while others mainly occupied themselves with activities such as throwing things at each other, tilting their chairs or daydreaming (Author 2010a). Consequently, low-performing students were observed to read and write very little during class time. It may be noted that, regarding reading, some of the low-performing students said in interviews that they never read outside school while some of the more proficient readers claimed that they preferred to read at home and not in school as they found the school

environment not good for reading. This means that, although the low performers in reading and writing did not engage in much reading and writing in school, it may be the case that they did even less outside school.

The following is one example of a conversation during science lessons. It is from grade four, where a group of six students are looking for information about the Swedish island Öland. One of them, Malin, is doing the writing while Lena reads from a book about the island. This is supposed to be presented to the class afterwards.

Swedish	English
1 LENA: Em … (läser) högsta höjd XXX 57	LENA: Um … (reads) the highest point XXX 57
2 XXX m …ee största bredden på Öland är cirka	XXX um … ee the greatest breadth of Öland is
3 20… kilometer och Ölands största längd	about 20 … kilometres and the greatest
4 är 130 km	length of Öland is 130 kilometres
5 MARIA: Antal invånare	MARIA: Number of inhabitants
6 MALIN: Den den största höjden på Öland	MALIN: The-the highest point of Öland
7 MARIA: Största höjden?	MARIA: Highest point?
8 MALIN: Ja	MALIN: Yes
9 MARIA: Den störs em …	MARIA: The highest um …
10 LOVE: Em … kan inte nån utav oss skriva em 11 … frågor	LOVE: Um … can't one of us write um questions
12 (Tjut i bakgrunden)	(a howl in the background)
13 MALIN: Så	MALIN: So
14 LENA: Men det gör vi hela tiden	LENA: But that's what we do all the time
15 MARIA: Mm	MARIA: Um
16 (Tjut)	(A howl)
17 MALIN: Mm där var det störs höjd	MALIN: Um there it was the highest point
18 LENA: Ja em … den största höjden är …	LENA: Yes um … the highest point is
18 MALIN: 57	MALIN: 57
19 LENA: Ja 57,4	LENA: Yes 57.4
20 MALIN: (skriver) komma 4 meter över havet 21	MALIN: (writes) dot four metres above the sea level
22 LENA: Ja em … punkt ö	LENA: Yes um … dot a
23 MARIA: Em … punkt ö punkt h punkt happ	MARIA: Um … dot a dot h dot well
24 LOVE: Em … antal invånare XXX ja	LOVE: Um … number of inhabitants XXX yes
25 men det där har vi XXX	but that we have XXX
26 AMIR: Kalmar e de e	AMIR: Kalmar is that is
27 MALIN: E … deras län är Kalm Kalmar	MALIN: Um … their county is Kalm Kalmar
28 LENA: Öland Ölands län … vänta …	LENA: Öland the county of Öland … wait …
29 Ölands största län landskap … vänta …	the greatest county landscape of Öland …
30 Ölands största län	wait … the greatest county of Öland
31 AMIR: Ja	AMIR: Yes
32 MALIN: Nej vänta Ölands län	MALIN: No wait the county of Öland
33 LENA: Ölands län heter Kalmar	LENA: The county of Öland is called Kalmar
31 MALIN: Ja det blir bra	MALIN: Yes that'll be fine

In this example we see that the main work is done by Lena and Malin, the two high-performing girls. Maria also contributes to the work, but she is a slow reader and throughout the work she is usually one step behind, such as in the beginning of this excerpt when she reads the question about number of inhabitants from their question paper while Malin and Lena work with the highest point. The three boys in the group, Love, Amir and Valton, are mainly occupied with other things not connected to the group work. Love tries to involve himself in the group's work twice in this example, in line 10 where he suggests that one of them should write questions and Lena answers that this is what they are doing, and in line 24

where he talks about the number of inhabitants. This time Lena and Malin seem to ignore him as they work on writing about the highest point and go on reading about the county. Amir has a short turn where he mentions Kalmar while Valton is not verbally involved in the work at all. This pattern, with a few students being occupied with the assigned task while the majority show little enthusiasm or occupy themselves with other things, was common during class time. It may be noted that the teacher's low expectations of these three boys had been adopted by the girls, who did not demand that they involve themselves in the work.

Similar to the classes studied by Johnson & Hayes (2008), students in these classrooms had little chance to make their own choices, and they showed little enthusiasm towards the school work. Particularly low-performing students needed to be motivated by the teacher repeatedly so that they would do the assignments. This was especially true with regard to boys, and in grades four to six it was true of all immigrant students.

3.1.3 One school day

To give an impression of life in these two classes, a glimpse of two school days will be given, the first one in grade one and the second one in grade five. The days have been chosen to represent what commonly happened in the classrooms.

> Grade One, May 11th
>
> 8:15 Students drop in to the classroom. They walk around, talking to their classmates and move towards their individual benches, where they sit down. Some bring notebooks, pencils or other things that they put in their individual drawers. The teacher, Maria, comes in and puts her bag close to her table. She unpacks some things and arranges them on her table. A school assistant comes in and sits on a sofa.
>
> 8:20 Maria stands in front of the class, at the blackboard. She calls in those students who are still out in the corridor. They come in and sit at their desks. Some small talk is going on. The teacher calls for attention. She tells the children to put their homework in front of them on their desks. One of the children is called up to draw the calendar and to tell the class the day, the date and the food that will be served at lunch.
>
> 8:35 Maria starts to talk about a task with geometry boards that they are going to work with later on. She turns to talking about flowers that the children were supposed to have picked on their way to school and bring in to press. Then she starts to talk about an excursion they will be are going on the next week. After that she talks to one of the students about a written story she has found, and then she starts to give instructions to the class for the work with the geometry board.
>
> 8:45 Students start to work individually with the geometry boards.
>
> 9:10 Maria tells them to put the geometry boards on a table and to sit down at their desks. Then she reads a story to the class.
>
> 9:20 Students are sent out for a study break.
>
> 9:45 Students come in and are instructed to take out their individual books for reading. They sit down at different places to read. The assistant sits with one student and reads with him.
>
> 10:25 Lunch break
>
> 11:40 Students come in and sit down at their desks, chatting. Maria calls for attention and starts the lesson by reminding the students to bring clothes for the sports lesson next day. The students take out individual work on the alphabet.
>
> 12:10 Maria and the class sing an ABC song that is played on the tape recorder.
>
> 12:20 They all go out to the playground. Maria hands out skipping ropes and all of the children start to jump in groups that they arrange themselves.
>
> 12:55 In the classroom again. Maria hands out a test with figures in the shapes of

> circles, loops, summits and eights. Students are supposed to follow the lines with their pencils and then to construct their own figures.
> 13:20 Maria collects the papers. Students put their chairs on the tables and Maria finishes the day by saying goodbye.

In this classroom there is little room for students to take initiative, and the level of intellectual demand is low. The atmosphere is friendly and calm, but students are not challenged during their school work. Students' enthusiasm is low, but they engage with the work they are given. They show more enthusiasm when singing and skipping rope than when working with the alphabet and the test. There are few examples where students are required to think creatively and independently. However, most of the tasks are context-embedded and thus those students who have quite recently started to learn Swedish are also included in the work and are involved in the tasks, such as working with the geometry boards. The impression is given that they are included and engaged in the tasks, but the question is, what do they learn? During the work with the geometry boards, for example, students worked individually and then showed each other the patterns they made, but no names of geometric shapes were mentioned either by the teacher or the students. Thus what students actually did was form shapes and chat. Similar observations were made during other types of exercises—that children did not focus on what they were supposed to focus on. One example was when children worked with scales, comparing the weight of different things and writing the results down. In this case most students focused on getting the "right" guess on their papers and comparing with their peers rather than actually estimating and guessing in advance.

The following is an example of a day in grade five.

> Grade Five, May 7th
> 8:15. The teacher, John, walks around the classroom and prepares for the day. Students walk around or sit at their tables, chatting with each other, taking things out of their bags or desks.
> 8:20 John starts to talk about the day. An extra teacher enters the classroom. One student is called to the table to draw the calendar and say what the date is and what food is going to be served for lunch. Students who know somebody with the same name as the current name day raise their hands and in turn mention the person. John starts to call attention to those who are chatting and proceeds to give a short overview of the day. Then he gives the class the instructions for a game on the geography of the Nordic countries. Students are quite unfocused and the instructions are interrupted by questions and small talk. Students start to play the game and the extra teacher sits down at the table of two immigrant students and helps them play. When students have finished playing, John tells them to take out their maths work.
> 9:45 Break
> 10:05 English lesson: John instructs the students to play a vocabulary game in pairs. For some students the words are easy and the level of enthusiasm among these students is low, while others do not know the words and need help from their classmates. When students have finished, John tells them to take out their group work on nations and to prepare for presentations.
> 10:50 Lunch
> 11:40 Students present the work they have done in groups on different nations. The nations are chosen according to some students' backgrounds: Finland, Somalia, Turkey and Kosovo. Students are attentive but they have difficulty understanding what is said by their classmates. When the groups ask a few questions about their presentations the classmates seldom know the answers.
> 12:20 Students start to work with *Pilen.*

> 12:50 Short break
> 13: 00 Work with *Pilen* continues.
> 13:35 Students put their work away, put their chairs on their desks and then John dismisses the class for the day.

Although the assignments in grade five were more varied than in grade one students were still not given the freedom to plan their own work regarding what, when and how to study. For some of the students the level of the work was too low while for others it was too high. Note the routine in which one student draws the calendar and says the date, a routine that had begun in pre-school and continued through grades one to six. The only thing added through the years was the reading of the name day, which started in grade four, and students mentioning some people they knew with that name. Note also that the name days include predominantly Swedish names, while half of the students had immigrant backgrounds. This routine may have had a disciplinary function, helping students focus on the start of the school day, but it did not challenge students or increase their enthusiasm.

The main activities consisted of constructed exercises that were not very cognitively demanding, offering few challenges to students who were highly proficient. As in grade one, the social climate was friendly. Yet students showed low levels of enthusiasm and concentration. The boys in the class had to be encouraged repeatedly to engage in any of the required work. As only 14 students were left in the class at this time and there were usually two teachers present, some of the students were frequently given individual support. This was true particularly of the immigrant students and some of the other students who showed low performance. The work was more context-reduced at this stage and the level of understanding and involvement of some of the students was low. This was the case, for example, during the group work in the earlier example where we could see that reading and writing was done by high-performing students while the others tended to occupy themselves with other things.

3.2 The case of South School

South School, the school in focus in the second study, is situated in a large town in Sweden. In South School roughly half of the students had multilingual backgrounds and teachers estimated that half of the students in the school had not yet reached a level in Swedish-language proficiency that was expected of students of their age. Similar to North School, some students came from families of a relatively high socio-economic status while the majority came from more or less poor or low-income backgrounds. Despite the diversity in the school and a high number of students with special needs, the school was known to receive good results, for example, in the national exams. The school was highly regarded for its educational outcomes, and teachers expressed a high level of awareness of the needs of both students with special needs and students with immigrant backgrounds. Several of the teachers had attended various in-service courses, including courses on education for students developing Swedish as a second language. Teachers stressed the need for challenging education, and they demonstrated awareness about language development among students. Some of the teachers organized their teaching according to the Systemic Functional Linguistics theory (Halliday 1993, Gibbons 2006, 2008), which stresses the importance of focusing on language development in the context of all school subjects. Here examples will be taken from grades three and five, the classes of Anna and Nina.

3.2.1 Teacher attitudes

In interviews, both Anna and Nina stressed the potentials and abilities they saw in the students and talked about their progress. Anna's classroom, grade three, may be

characterized as highly diverse, with some of the students being "the cream of the crop" while others had been diagnosed with autism and/or with severe language disorders. While some children came from high-status families, others came from homes of low socio-economic status and homes with criminal backgrounds. In the interview Anna talked about the importance of maintaining a sense of humor and compassion, and she stressed the need to create a spirit of community in the class. She talked about her students as melodramatic saying that there were "many artists, sentimentalists" in the class and that they were "an impatient class". She said "they are at all ends but they need to be framed in" and "there is lots of talent here, but there is the matter of keeping order".

Nina talked about individual students as either having high standards or having "developed tremendously well", and she used words such as "exceptionally", "marvellous emphatic ability", and "giant vocabulary" when she described the development and performance of the students. Concerning the development of one student she said, "He had a decline when he was sort of ... tired but then he made tremendous progress again."

3.2.2 Organization at the classroom level

The focus that Anna and Nina placed on students' potentials, abilities and progress was visible in the organization of their classrooms. Students in both classrooms were active and enthusiastic. Anna in particular put a great deal of energy into getting students' attention and getting them to focus on what they were supposed to be doing. In the mornings, and in other cases when she wanted to gather the class for joint conversation or discussion, she would gather them in a ring on a mat at the front in the classroom. The following example is from one morning — the first one after the midwinter holiday. Fourteen students, the teacher and an assistant teacher sat around the blue mat. Anna started by making sure she had the students' attention. She counted "one, two, three: Good morning!" and the whole class answered "Good morning" in chorus. She stated that one of the girls, Marie, had got a tan as she had just returned from a holiday trip to Thailand. She asked Marie about the holiday and Marie had started to tell the others about it when she was interrupted by a parent who entered the classroom and asked about some homework for her child, who was ill. Marie continued to tell her story but Anna asked her to wait and rose to attend to the parent. After a few minutes the parent left and Anna sat down again. She made sure everybody was listening again before she asked Marie to continue:

Marie: Ja och sen fick vi åka en jättejätte stor båt som var jättefin den var så här vit hela den var vit den var så här
Anna: Är det som man åker ut till öar då … den båten
Marie: Ja… em och då så vi fick sitta där uppe … det fanns så här som staket så fick man sitta där framme vid båten där uppe alltså vid taket det fanns sånt här staket (visar med händerna) där kan man sitta då och vinden blåste så jag kunde inte andas jag bara A-A-A (drar efter andan och skrattar) det var asroligt och sen … i … ee när vi var på stan

Anna: Vilken stad är det man är i då?
Marie: Mm det är vänta … det är Patong … Patong är det väl eller nej Puket nej
Anna: Mig kan du säga vilket vi går på vilket

Marie: Yes and then we got to go with a huge boat; that was very nice, it was like white all of it was white it was sort of
Anna: Is it that you take to islands then … that boat?
Marie: Yes … um, and then we could sit up there … it was this sort of fence so you could sit there in front of the boat, that is, at the roof there was this fence (shows with her hands) so you can sit then and the wind blow so that I couldn't breathe I like A-A-A (pretends to have lost the breath and laughs) it was awesome and then … in … um when we were in town.
Anna: What town are you in then?
Marie: Um it is wait … it is Patong … Patong isn't it or no Puket no…
Anna: To me you can say whatever one and we'll believe it

som helst
Marie: Ja och sen då am
Anna: Patong eller Puket am
Marie: Och sen så sen när vi när vi var på stan
då så det var massor såna där som säljer saker
alltså det var så himla många och så sen så här
kommer dom så här: "Ei tuk tuk!" (sträcker upp
höger arm i vädret) eh det är taxi så säger dom
"Ei tuk tuk!" (höger arm upp) och så här på
pappa (slår med armen på kamraten till höger)
bara för att man ska få så där taxi eller ja

Marie: Yeah and then am
Anna: Patong or Puket um
Marie: And then, well then when we, when we
were in town there were lots of these who sell
things, that is there were amazingly many and
then there they come like this: "Ei tuk tuk" (puts
her right arm up in the air) eh that's taxi so they
say "Ei tuk tuk" (right arm up) and like this on dad
(hits the girl to her left with her arm) just in order
that you get this taxi or yes

She continued by talking about the pools, and beaches, and when she finished, one classmate who did not yet have a high level of Swedish said:

Arin: Men vänta … om man springer och sen bara
åker in i den där början på bassängen så bara
sjunker man

Arin: But wait … if you run like this and
then go into that beginning of the pool
then you only sink

Anna assumed that what he meant may not be understood so she tried to clarify: "He means if it becomes deep all at once in the pool." Arin verified this with "Yes" and Marie answered that this was the case.

In this case Anna used Marie's experience to give her the opportunity to take the floor. She explained afterwards that the reason she chose to ask Marie and give her so much time during that morning assembly was that Marie was among those who seldom spoke out in class and that she usually did not narrate with cohesion. Anna made sure that Marie got the attention of all the students and she supported her by asking her strategic questions. Afterwards, when Arin had problems expressing his question, she supported him by clarifying the meaning of the question. By ensuring the attention from all students and giving support, she managed to engage students in real conversation and to give one student an opportunity to take the role as knower. In similar ways she often related to students' experiences and tried to make the most of their initiatives when possible. She explained in the interview that she wanted to build on students' experiences although she had to make sure that all students got their chance and thus had to hold some of the more talkative ones back sometimes.

In the grade five classroom, the teacher, Nina, also made a point of keeping a level of teaching that challenged all students and related to students' own interests. She planned the work by using different types of teaching aids and did not follow pre-made plans in particular study kits. When students were doing individual work they were involved with various types of tasks and on different levels. In the centre of the classroom there was a computer, which was usually being used by one of the students. There was another computer in one corner, and there were also some laptops available. Students used the computers to work on different learning programs but also to work on their own home pages or, less frequently, to search for information on the Internet. Three of the boys would bring their own memory sticks from home to work on their own home pages.

During the lesson from which the following example is taken, students worked individually on different types of tasks. Ten students were in the classroom and two of them were practising multiplication together at a table. Two girls worked with geography using programs on the computers. One boy was at a computer writing a text about his favourite interest, motocross training. One boy and a girl were reading fiction and two boys worked on a project about famous artists. One of the boys, Victor, spent extended time at the computer. He had

brought some pictures on his memory stick and was editing them in Photo Shop for his home page.

Nina, the teacher, walked around in the classroom helping students who needed help or just sitting down to listen to questions on their individual work. Most of the time she spent with three of the students who she thought needed extra support. She started with the two boys practising multiplication. Then she sat down a while with the girl who was reading and talked with her about the book. After about 20 minutes she came to Victor, sat down on a chair next to him and asked him to explain what he was doing. He explained about his work on the home page, pointing out things on the screen as he talked, and Nina listened attentively and watched the screen. Then she said:

N: Ok ja … ja jag kan inte det där alltså men jag förs … jag vet att eller jag kan inte göra det själv men jag förstår det ja … jag kanske skulle sätta mig och träna … jag tycker att jag skulle vilja ha en hemsida kanske det vore kul … mm vad tänker du göra idag då?

N: Ok yes … yes I don't know that that is I unders… I know or I can't do it but I understand it yes … maybe I should sit down and try it out … I think that I'd like to have a home page, maybe that would be fun … um what are you going to do today then?

V: Det här gjorde jag idag … den här själva knappen

V: This I did today … this the very button

N: Jaha ok

N: Yeah ok

V: Det här är exakt samma description som jag har

V: This is exactly the same description that I have

While Victor explained, he flipped between pages, scrolled on a page and pointed at the screen to indicate what he was talking about. Note that he used the English "description" instead of the Swedish *beskrivning*. Nina followed and watched attentively. After a while she nodded her head to show that she understood. She said, "Perfekt!" (Perfect) and continued to another student.

In these two examples we see that students concentrate on their work and that there is room for students' initiatives. If we relate to Gibbons' description of challenging education, we see that in this classroom there is not only room for individual construction of knowledge and authentic conversation, but also that there is room for switching expert-learner relations. In both examples students became experts and the teacher agreed to take the role of the learner, without losing control over the classroom.

Both Anna and Nina made room for students' initiatives and gave them responsibilities while keeping the level of demands high and making sure students focused on their work.

3.2.3 One school day

To create an image of life in the classrooms of Anna and Nina I will give an overview of a day from grade three.

> 8:25 Morning assembly. Students are gathered on the mat in front of the classroom. After some small talk Anna focuses the students' attention on the date and the schedule for the day. She explains generally what will happen and writes in English on the whiteboard. One of the students complains about some classmates' behaviour in relation to her birthday party and Anna reminds her that birthday parties have to be discussed outside class and that this is because some children may have them while others may not, as their families are unable to afford them.
> 8:40 Anna starts to talk about a new theme in science, the ear and hearing. She starts by asking the students what they know about the topic. Students raise their hands and the talk continues.
> 9:10 Anna shows a short film about the ear and hearing.

9:15 She tells the students to go back to their desks. She asks them if they learned anything new. She takes the class's lizard out of his terrarium to show his ears. When some boys start to talk about other things not related to the topic she asks them, "Boys, should this be about you or about hearing?" and the boys answer, "Hearing". She continues: "Are you to be brought up or to learn?" and they answer, "Learn".

9:45 Break

10:05 Mathematics lesson. Anna starts by presenting some multiplication and division questions. She instructs them to work together and the students work in groups to solve mathematic problems based on a zoo.

10:40 Students go to another part of the school where they have their music lesson with another teacher.

11:30 The music teacher sends them to lunch.

12:10 English lesson. Students work on a story about Pippi Longstocking in English. Anna has copied the book and they start by reading a few pages together. Anna reads first and the students read after. She explains some words and phrases. Then students read the text aloud in pairs.

12.50 Silent reading. Students take out their books and read silently. Every student has borrowed a book from a shelf in the classroom or from the school library.

13.30 Anna asks students to put the books away and dismisses the class.

As we can see, Anna put a great deal of effort into making the students focus on the school work. This became apparent when she refused to let talk about birthday parties occupy too much time and when she reminded the boys to focus on the topic of the lesson. In the three topics that were dealt with, English reading, multiplication/division and hearing, we can see that pre-fabricated teaching aids were not used as the basis for planning but were used as supplementary resources, such as the film about hearing. In English, Anna tried to make the lesson authentic and put it into a natural context by using English when she presented the schedule for the day and using a storybook as the basis for a lesson. It should be noted that English is taught as a foreign language starting in grade three, which means that these students had only just started formal English learning. When introducing the topic of hearing, Anna made an effort to start from students' prior knowledge and also provided students with an opportunity to give feedback after the film. The tasks in Mathematics were of a type that demanded engagement from all students in the groups, and the groups were small enough to ensure that all were involved in solving the problems.

3.3 Teacher attitudes and organization at the classroom level

Although I state that there are many similarities between what happened in the classrooms of Maria and John in North School, and in those of Anna and Nina in South School, there are certain differences in attitude and classroom organization. While the North School teachers mainly assigned procedural-level tasks, in the South School classrooms there were examples of challenging lessons and opportunities for students' influence over their learning. Maria and John seemed to adhere to what Runfors (2003) called a deficiency theory regarding their students, which results in undemanding education and a high level of teacher control regarding learning. Anna and Nina, on the other hand, may be characterized as holding a theory of ability and potential regarding their students. In their classrooms we see a high level of student involvement. In the classrooms of Maria and John, tasks were mainly procedural and questions rarely demanded more than one- or two-word answers. While work in their classes was mainly based on teaching aids, followed from the first stage to the last, students in Anna's and Nina's classes were assigned work that demanded active involvement. When comparing the morning routines in the classrooms, we see that Maria and John followed a

strict formula, for example, having students in each grade say what the date is, whereas Anna took a more flexible approach, inviting a student to talk about a personal experience. This flexibility, along with Anna's use of English when writing the schedule, placed more demands on students and enabled them to influence what took place in the classroom. Nina's inclusion of students' personal interests in school work, by having them design home pages, for example, gave students opportunities to develop particular skills. By making room for students to work with topics she herself had not mastered, Nina extended the potential for learning. These types of skills were not observed in the classrooms of Maria and John.

As may be expected, Anna's and Nina's students performed well in national tests, while the students of Maria and John did not.

3.4 Language use in the classrooms

Linguistic factors in the school situation are particularly relevant for students who have not yet achieved the expected proficiency level in the language of instruction, in this case Swedish. In North School, language may be characterized as fragmented. Talk consisted mainly of short statements, in the form of small talk. Rarely did anyone, student or teacher, take the floor to express complicated thoughts or to talk about school subjects; in fact, the school subjects were seldom talked about at all. Most of the students for whom Swedish was a second language spent very little time reading or writing, and usually what they read or wrote consisted of single words or short sentences. In South School, in contrast, there were more frequent lengthy discussions, in which complex thoughts were expressed. Through small-group work, which demanded active participation of all students, language use became more varied; this applies mainly to oral expression, but also to written forms. Teachers focused on the form of the language by directing students' attention to words, phrases and styles, and also on its use by ensuring that students were given opportunities to use language in demanding situations in both oral and written forms, as in the case of Marie's narration about her experiences in Thailand. The higher level of engagement among students in the classrooms of Anna and Nina also had an effect on the amount of reading and writing done by students. When considering that the low-performing students in Maria's and John's classes claimed to read and write only in school, classroom organization stands out as of particular importance for the development of these students' literacy skills.

4. Discussion

I conclude that some of the teachers studied in these projects seem to hold a deficiency perspective, as did the teachers in the studies by Runfors (2003), Knapp et al. (1995) and Johnston & Hayes (2008). However those two teachers who dared to risk giving responsibility to students, to change roles and take the role of learner, to give the floor to students and at the same time to demand students' attention and require them to focus on their work may be characterized as holding a perspective of ability, potential and development.

In the examples from North School, students' proficiency was low and so were the cognitive and linguistic demands of their school work. The classrooms were inclusive in the sense that students took care of each other and made sure that new students were included, but tasks in the classrooms seldom challenged students' thought processes. In earlier grades, when tasks were context-embedded, students who had recently started to acquire Swedish were involved in classroom activities, but in the higher grades second-language students whose proficiency in Swedish was low tended to occupy themselves with other things and needed to be re-engaged constantly by the teachers.

As in the cases studied by Johnston & Hayes (2008) and Knapp et al. (1995), in these classrooms students spent most of their time occupied with lower-order intellectual tasks, showed little enthusiasm and poor concentration. Similar to the results of the QSRLS (2001), in this case the teachers seemed to identify social needs and to provide a socially supportive environment in school but at the cost of academic challenges. While students seldom actively opposed the teachers' efforts, the energy they invested in classroom activities remained low. Furthermore, the students' level of engagement decreased over the years.

In the classrooms from South school, however, classroom work that demanded active involvement by students in combination with high level of students' influence on what took place in classrooms resulted in high level of students' engagement and high outcome. It is interesting to see that also the actual amount of reading and writing done by students, particularly among students from low income backgrounds, was higher in these classrooms. That teachers gave room for students to develop skills in areas where students' knowledge went beyond the teacher's extended students opportunities for learning. In the technology intensive development we see today this is particularly important.

High teacher control over content and learning seemed to be linked to low student engagement in these studies also, while low teacher control in combination with high control regarding focus on learning was linked to high student engagement and high outcome. The results highlight the risk of treating immigrant students, as well as other students from socio-economically unprivileged backgrounds, as less competent and less able than those from other backgrounds. A focus on basic skills at the cost of a demanding and challenging education denies students equal opportunities to achieve academic success. Ensuring that all students have access to an education that is linked to their experiences and builds on their potential is a democratic issue. In any school with democratic aspirations, teachers need to be aware of each student's potential. Social, economic or linguistic background should not exclude any student from access to an exciting and challenging education. This means that teachers need to dare to decrease their control of details in the learning process, such as when and how different things are learned. In order to create classrooms where negotiated interactive learning takes place, teachers need to present students with intellectually demanding tasks and challenging education.

●   ●   ●

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Teacher efficacy in an early childhood professional development school

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Abstract

Teacher efficacy is the belief teachers have in their ability to impact student learning. Efficacy includes teacher confidence in instructional, management and collaboration skills. The following study addresses teacher efficacy in an Early Childhood Professional Development School (PDS). The PDS experience provides an opportunity for mentor teachers to share their knowledge with teacher candidates over extended placements, typically more than 100 hours. Preschool through fourth grade teachers participated in pre and post surveys and in a focus group discussion. Analysis revealed strong efficacy across instructional and management aspects of teaching but relatively weaker teacher confidence in assisting families to support their children's success. Findings also suggest that early childhood teachers in this PDS setting believe it is their responsibility to nurture strong self-efficacy among their students.

Keywords: Teacher self-efficacy, Early childhood teacher efficacy, Professional development school mentor teachers

Introduction

Teacher educator programs strive to engage pre-service teachers in highly effective learning experiences. Teachers, the learning environment, and individual learners comprise three prominent components of this endeavor. The following pilot study provides insight regarding the intersection of these components. Specifically, teacher beliefs in their ability to impact student learning (self-efficacy) is studied in the context of a particular type of learning environment (professional development schools). The study addressed efficacy among mentor teachers during the first year of implementation of an Early Childhood Professional Development School program.

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Albert Bandura noted that, "...an efficacy expectation is the conviction that one can successfully execute the behavior required to produce the outcomes." (1997, p. 193). Self-efficacy is a person's belief in his or her ability to succeed in a particular situation. Bandura described these beliefs as determinants of how people think, behave, and feel (1994). The purpose of this study was to clarify components of mentor teachers' self-efficacy in an early childhood professional development school (PDS) setting. We asked, "How does being a mentor teacher in an Early Childhood PDS affect teachers' self efficacy?"

Literature Review: PDS Impact on Teacher Candidate Performance and Mentor Teacher Development

Professional development schools were launched with the intention of providing both mentors and teacher candidates opportunities to develop effective teaching strategies and a deep understanding of why these strategies work (Teitel, 2003; Harris & Van Tassell, 2005; Lee & Hemer-Patnode, 2010). Building on the medical model of teaching hospitals, a group of university education deans founded professional development schools upon the premise that sound learning requires continuous reflection by both experienced teachers (mentors) and novice teachers (candidates) within a collaborative, respectful community (Holmes, 1990).

Research clearly identifies positive outcomes for PDS teacher candidates (Castle, Fox, & Souder, 2006; Darling-Hammond, 2007; Sandoval-Lucero et al., 2011). For example, a study comparing PDS and traditional campus-based field experiences revealed slightly higher performance by PDS students during their field experience (Ridley, 2005). Performance was evaluated through blind scoring of lesson planning, lesson reflections, overall teacher effectiveness and content retention. The stronger performance of PDS teacher candidates was not only maintained but grew stronger over time; during their first year of teaching the PDS teacher candidates performed significantly better across the above dimensions than their peers who completed traditional field experiences.

Fulfilling the original PDS intent, professional skills of mentor teachers are also strengthened. In a study addressing pre-service teacher preparation, in-service teachers' professionalism, and children's achievement (Cobb, 2000), 85% of mentor teachers reported learning innovative teaching strategies. Mentors also report a stronger understanding of culturally responsive teaching (McCormick, Eick, & Womack, 2013) as well as enhanced communication and collaboration skills (Beaty-O'Ferrall & Johnson, 2010).

A comprehensive analysis of "simultaneous renewal" of PDS partners (Shroyer et al., 2007) emphasized the importance of always placing student progress at the center of PDS initiatives. A joint commitment to student achievement, along with sufficient resources and time, can result in renewed energy and professional satisfaction for mentor teachers and university personnel.

Literature Review: Teacher Self-Efficacy

Teachers' beliefs in their ability to perform well have been researched in a variety of settings. One study of 1,430 teachers in traditional school settings revealed teacher confidence in their ability to implement effective instructional and classroom strategies leading to positive student engagement (Klassen & Chiu, 2010). However, teacher efficacy has not been widely addressed in Professional Development Schools.

Particularly relevant to this pilot study, teachers in younger grades have been found to have stronger self-efficacy (Tschannen-Moran & Woolfolk Hoy, 2001). A study of early childhood teacher self-efficacy suggests that staff collaboration, student engagement, and consistent opportunities to participate in decision-making contribute to self-efficacy (Guo et

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al., 2011). However, in a study of 48 early childhood teachers in 38 centers including Head Start and state-funded PreK, student engagement and teacher experience did not appear to contribute to teachers' self-efficacy (McGinty et al, 2008). Teacher collaboration and being able to impact decision-making did correlate significantly with self-efficacy.

Collaboration and Joint Decision-Making are Required in PDS Settings.

While time frames vary, mentor teachers typically guide pre-service teacher candidates several days each week over the course of an entire semester. They discuss instructional strategies, assessment procedures, individual learning styles, classroom guidance procedures and lesson planning. Joint decision-making occurs regularly as mentors work closely with higher education liaisons to address day-to-day procedures and expectations as well as long-term goals.

The PDS setting allows for a more intensive field experience for teacher candidates. The additional time and intensity requires more mentoring and sharing of one's own practice. This study sought to clarify how additional sharing affected mentor teachers' views of their ability to impact children's learning.

Setting and Participants

The pilot study was carried out during the first year of implementation of an early childhood professional development school collaboration in a mid-sized Midwestern community. Several successful PDS programs were underway at the elementary, middle and high school levels. Upon confirming interest among early childhood faculty, an invitation was offered to a school serving children from preschool through fifth grade. The school's final enrollment for 2012-2013 was 395 children; 166 children received free lunch and 25 reduced lunch. The school served children who were learning English as a second language and included children with a range of exceptionalities.

Fourteen early childhood teacher candidates applied to the PDS program. Acceptance into the program required at least a 3.0 grade point average and completion of foundational courses regarding pedagogy, literacy and public education in the United States. PDS teacher candidates were seeking certification to teach children from birth through age 11. They participated in classroom life every Monday, Wednesday and Friday morning for fourteen weeks, logging a minimum of 100 hours. One teacher candidate was placed with each of 14 mentor teachers who volunteered for this inaugural year.

The fourteen mentor teacher participants taught the following grade levels: preschool (3), kindergarten (3), first grade (3), second grade (2), third grade (1), and fourth grade (2). Their teacher candidates had two additional field experiences before reaching their student teaching semester. Therefore, mentor teachers were guiding candidates who were at the beginning of their pre-service field experiences.

Methodology and Analysis

A pre and post survey was used to study mentor teachers' self-efficacy. The short form of the Teachers' Sense of Efficacy Scale is comprised of twelve likert scale questions to assess teachers' views of their ability to address typical aspects of teaching (Tschannen-Moran & Woolfolk Hoy, 2001). Three open-ended questions were added to further study teachers' views of their teaching skills.

Mentor teachers also participated in a focus group discussion that further addressed how the PDS experience affected their views of the following professional areas: individual

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relationships with students, classroom management, understanding of grade or age-level content, teaching strategies, assessment, and creativity.

Descriptive statistical analysis was employed to analyze likert item survey responses. Constant comparative analysis (Miles & Huberman, 1994; Guba & Lincoln, 1981) was used to study mentor teacher comments offered during the focus group discussion, as well as their open-ended survey responses. The authors independently coded and categorized focus group comments and survey responses. To minimize subjectivity, they also identified themes independently.

Findings

Eight (of fourteen) mentor teachers completed the pre survey, three completed the post survey and five participated in the focus group discussion. Response rates may have been affected by the newness of the program (pre survey) and end of the semester activities (post survey and focus group discussion). Participants stated confidence in eleven of the twelve teaching skills (Table 1).

Teachers' responses to open-ended questions echoed their overall confidence as well as their frustrations in several aspects of teaching. The following teacher statement captures the positive influence teachers believe they have in assisting learners.

I believe that each child can learn. I believe that each child has talents and a purpose in this world. If I can make a connection with each child, and build a classroom community I can get each child to believe they can be successful in school.

When asked to provide additional comments regarding what aspects of their profession can sometimes make teaching difficult, mentors described the current culture of high stakes testing, a state-level initiative aimed at assessing teacher effectiveness, assisting children who have disruptive behaviors and collaborating effectively with families. One participant summarized several of these challenges.

Incorporating time into your day for assessment and reflection can be difficult. Managing individual student behaviors that fluctuate from day to day requires you to be very flexible about your schedule and your plans.

Only three teachers provided post survey responses. They rated their level of influence at 9 (a great deal) for nine of the twelve questions. Mentor teacher ratings for question 11 regarding their ability to influence families were similar to pre survey responses (Table 2).

Five teachers participated in the focus group conversation. They were asked to share how being a PDS mentor had affected their skills in the following areas: individual relationships with students, classroom management, understanding of grade or age-level content, teaching strategies, assessment, and creativity. Analyses of their comments revealed the following themes.

Mentors valued the opportunity to share their knowledge with teacher candidates, and saw this as a way to validate their teaching strengths.

Table 1. *Summary of Pre Survey Responses (all except question 11)*

	7 (quite a bit)	8	9 (a great deal)
1. How much can you do to control disruptive behavior in the classroom?	12% (1)	25% (2)	50% (4)
2. How much can you do to motivate students who show low interest in school work?	25% (2)	25% (2)	50% (4)
3. How much can you do to get students to believe they can do well in school work?	25% (2)	25% (2)	50% (4)
4. How much can you do to help your students value learning?	25% (2)	25% (2)	50% (4)
5. To what extent can you craft good questions for your students?	25% (2)	37% (3)	37% (3)
6. How much can you do to get children to follow classroom rules?	37% (3)	10% (1)	50% (4)
7. How much can you do to calm a student who is disruptive or noisy?	37% (3)	10% (1)	50% (4)
8. How well can you establish a classroom management system with each group of students?	25% (2)	25% (2)	50% (4)
9. How much can you use a variety of assessment strategies?		50% (4)	50% (4)
10. To what extent can you provide an alternative explanation or example when students are confused?	25% (2)	25% (2)	50% (4)
12. How well can you implement alternative strategies in your classroom?	25% (2)	25% (2)	50% (4)

Source: Teachers' Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001) http://people.ehe.osu.edu/ahoy/research/instruments/#Sense

They rated their ability to assist families in helping children do well in school somewhat lower (Table 2).

Table 2. *Summary of Pre and Post Survey Responses to Question 11 Regarding Families*

	5 (some influence)	6	7 (quite a bit)	8	9 (a great deal)
11. How much can you assist families in helping their children do well in school?					
Pre-survey	10% (1)	25% (2)	10% (1)	10% (1)	37% (3)
Post-survey		(33% (1)	33% (1)	0	33% (1)

Source: Teachers' Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001) http://people.ehe.osu.edu/ahoy/research/instruments/#Sense

Effective teaching is rooted in respectful relationships with individual learners. Seeing PDS students develop these relationships was particularly satisfying.

Mentor teachers revealed varying levels of comfort and skill, indicating that while most were comfortable with one teacher candidate, one mentor preferred providing guidance for both a PDS student and a student teacher.

Enhanced reflection skills emerged as the strongest theme. A first grade teacher was among the focus group participants. She described how being a mentor strengthened her ability to reflect.

I just found it great to actually analyze my teaching because some things come so naturally now that you don't even realize that you're doing it. So (with a PDS student) you actually have to step back and see what process you take to get there and then whether that's the right process or should I modify that process. Then you will be able to explain it a little better to the PDS student so that they can take their (own) steps to understanding it better.

Several focus group participants commented on the relationships teacher candidates developed with students. They described the sometimes uncomfortable process of moving from being a friendly helper to being a teacher with clear behavioral expectations. At the conclusion of the focus group discussion, a second grade teacher described the strong bonds her PDS teacher candidate developed with students in the class. This resulted in difficulty saying good-bye.

We had to go to "hug Friday" because she (PDS student) would leave Monday and Wednesday and it would take forever. They would all want to hug her goodbye. "We'll hug her on Friday, and we'll high five her on the way out (on Mondays and Wednesdays)." It was just so... "don't leave!"

Discussion

Participants in this pilot study viewed themselves as highly effective academic instructors. They also rated their management skills as strong. In response to open-ended survey questions, several remarked that working with individual students (particularly those with difficult behaviors) was both challenging and rewarding. Collaborating with families was rated as the most challenging aspect of teaching. These findings were consistent across pre and post survey responses. While this was a short time span of three months, it provides some evidence of stability.

The teaching range of the five participants ranged from preschool through second grade. All had been teaching for at least five years and two for over fifteen years. One of the more experienced participants discussed the challenge of balancing her guidance for a student teacher and for a PDS student. She commented on the unique opportunities available with having both a student teacher and a PDS student in her classroom.

The camaraderie and the collaboration between the student teacher and the PDS student is also an interesting one because the student teacher is much closer to where the PDS student is in life and in their job and career and everything than I am. So they had good conversations. They talked about lessons and so that was really a plus for both of them and the student teacher feels like a mentor like I would feel toward the student teacher so that gives them (an additional) purpose.

Providing effective support for mentor teachers who prefer having both a student teacher and a PDS student suggests an area for further study.

The five focus group participants did not address partnering with families. However, it was highlighted by one of the eight mentors who completed the pre survey. Her response to "Please provide any additional comments regarding the type of things that sometimes make teaching difficult" follows.

It is most difficult when one student is so disruptive. Teaching sometimes cannot continue until outside assistance removes the student. Also when a parent does not understand what happens in the classroom, misunderstands a situation, and is upset about it (teaching is difficult).

Combining pre and post responses, thirty-six percent of mentors rated themselves as having a moderate degree of influence in assisting families with helping their children do well in school (Table 2). Even though sixty-three percent gave themselves a score in the quite-a-bit to great-deal ranges of influence, working effectively with families emerged as the lowest area of self-efficacy. Focus group participants did not bring up this topic; mentor teachers did note working with families as a challenge in response to an open-ended survey question. The National Association for the Education of Young Children holds effective collaboration with families as a critical area of effective teaching (Copple & Bredekamp, 2009). This finding suggests a possible area for mentor teacher professional development.

Limitations and Recommendations

Limitations of this pilot study include a low post survey response rate. Despite several email and in-person reminders, only three of the twelve mentor teachers completed the post survey. Therefore, a comparison of pre and post responses is not possible. The wide grade range can be considered both a limitation and a strength. It is difficult to assess the self-efficacy of teachers from preschool through fourth grade with one instrument. While the basic components of effective teaching are similar, how these are carried out is difficult to capture through one set of prompts. However, providing opportunities for mentors across a wide grade range to participate in one PDS setting can facilitate a rich sharing of effective practices and professional insights.

The wide range of grades in this Early Childhood PDS setting may provide a specific opportunity to address the one area of relative weakness regarding teacher efficacy: assisting families. All mentors in this study are fully certified; some are certified to teach children from birth through age eleven and others are certified for first grade through middle school. It is not known if responses to the family question (Table 2) differ by certification range. Early childhood teachers receive more training in the area of working with families. The collaborative nature of PDS settings could provide an atmosphere for sharing expertise regarding effective family partnership strategies.

A central tenant of self-efficacy is one's belief in his or her ability to succeed. A corollary is that teachers who have strong self-efficacy pass this on to their students. A preK teacher captured this opportunity in her pre survey response. She stated the following when asked to explain why she viewed herself as being able to provide a great deal of influence in getting students to believe they can do well in school.

My job as an early childhood teacher is to help my students believe in themselves and their abilities as a student. It is important that I send them off to Kindergarten believing they can and will learn. I do this by frequently sharing with them all that they have learned and reminding them how smart they are.

Findings of this pilot study suggest that not only do professional development school mentors have strong self-efficacy, preschool teachers pass this onto their own students. Additional research could clarify if this holds true for mentors across elementary grade levels.

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All-day schooling: improving social and educational Portuguese policies

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Abstract

Over the past decade, several European countries have implemented policies and programmes leading to the introduction of the concept of 'all-day schooling', thus acknowledging the need to guarantee the guard of all children and to enhance equal opportunities of success at school. The Portuguese Ministry of Education created and funded the Curricular Enrichment Activities Programme as a measure to support the generalisation of all-day schooling in Portuguese primary schools. Our study aimed at evaluating the reach of the political measures associated with all-day schooling, as was implemented in Portugal by the AEC programme, by focusing on two central dimensions: the political and the curricular. Two cases of different local decisions were studied. The results revealed a unanimous valorisation of the philosophy and the objectives underlying the AEC programme, which gives shape to a 'good measure' of social and educational public policies, consistent with the nuclear project of all-day schooling. They also showed, however, that the dimension of the curricular enrichment still needs to be improvedOver the past decade, several European countries have implemented policies and programmes leading to the introduction of the concept of 'all-day schooling', thus acknowledging the need to guarantee the guard of all children and to enhance equal opportunities of success at school. The Portuguese Ministry of Education created and funded the Curricular Enrichment Activities Programme as a measure to support the generalisation of all-day schooling in Portuguese primary schools. Our study aimed at evaluating the reach of the political measures associated with all-day schooling, as was implemented in Portugal by the AEC programme, by focusing on two central dimensions: the political and the curricular. Two cases of different local decisions were studied. The results revealed a unanimous valorisation of the philosophy and the objectives underlying the AEC programme, which gives shape to a 'good measure' of social and educational public policies, consistent with the nuclear project of all-day schooling. They also showed, however, that the dimension of the curricular enrichment still needs to be improved.

Keywords: Educational Policies; Educational equity; All-day schooling; Curricular enrichment activities.

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Introduction

Educational policies are in line with globalization and policy borrowing movement that crossed Europe in the last 20 years and aloud extensive reforms of education systems (Steiner-Khamsi, 2012) that accompany wider reforms of the welfare states. Welfare States should evolve from a social protection to a social promotion framework, in which Educational equity for all is essential (Bolívar, 2012). However, the idea of universal welfare has been increasingly affected by market-oriented and globalised economy's close connections with educational policy (Põder, Kerem, & Lauri, 2013). Therefore, given this changing educational landscape, this text, focused in a unique programme implemented in Portugal is to be seen as a paradigmatic case of the controversial uses and perceptions that "all day schooling programme" could cause in educational discourses, school everyday practices, and educational outcomes, within other educational contexts.

In contemporary societies, thousands of children and adolescents are left every day to their own devices after they leave school. As a result of a change of the patterns of employment, as well as of the family typology, many parents do not succeed in guaranteeing the care and supervision of their children after school (Armstrong & Armstrong, 2004). It is estimated that in 2008, in the USA, 7.5 million children were left without supervision after school.

In Europe, this situation has reached alarming dimensions, namely in Germany, a country which particularly penalises the children of divorced parents, of single parents, and resource-poor families, who have to work in order to guarantee the well-being of their children (Pfeifer & Holtappels, 2008).

After-school hours have thus become a problematic period, on the one hand, because children are more susceptible to being neglected, and on the other hand, due to the relationship that has been established, both in Germany and the United States of America, between that period of time and the academic difficulties experienced by the students. In the USA that time is still associated with the emotional and behavioural problems experienced by children and adolescents, as well as with delinquency and the use of drugs (Armstrong & Armstrong, 2004).

In the last decade, acknowledging the need to guarantee the guard of all children, as well as to ensure equal opportunities for academic success to the children and adolescents from socio-economic disadvantaged backgrounds, several European countries have implemented policies and programmes which led to the introduction of "all-day schooling", i.e., to the expansion of school time. Amongst these countries were Germany (Reh, Rabenstein, & Fritzsche, 2011; Pfeifer & Holtappels, 2008; den Besten, 2010; Schnniter & Häselhorff, n.d.) and Portugal.

In the case of Germany, as stated by the above mentioned authors, the creation of "all-day schooling" programmes was a strategy to avoid the low levels of performance of the students that had been disclosed by the Programme for International Student Assessment (PISA) in 2000. Those low levels were seen as a negative result of the fact that a remarkable number of children and adolescents were left to their own devices, i.e., were left without adult supervision in the period between the end of school and the end of their parent(s)' day at work. In this country, the all-day schooling programme, which was implemented over a decade ago, has won increasing importance. Still, it has not been extended to all the state schools yet (Reh et al., 2011; Pfeifer & Holtappels, 2008; den Besten, 2010; Schnniter & Häselhorff, n.d.).

Accordingly with Gepwert, Hofmann, and Hopmann (2012), the "current state of research shows that all-day schooling is seen as a necessary response to social and societal change, structural change in the family, social inequality and unequal education opportunities" (Gepwert, Hofmann, and Hopmann, 2012, 17). Furthermore, all-day schooling is seen by policies parties as an interesting measure that contributes to promote equity.

In Portugal, the all-day schooling programme has been generalised to the 1st cycle of all the state schools during the school year of 2006-2007, through the AEC (Curricular Enrichment Activities) programme1. This programme became a relevant political tool for the fulfilment of the PETI (All-Day Schooling Programme)2, a decentralised educational public service meant for social intervention with a double finality: 1) to provide, free of charge, a number of activities capable of enriching the curriculum of the 1st cycle of elementary education; 2) to provide social measures for family support. When compared to the above-mentioned German case, the Portuguese case reveals greater concern for the social dimension of the measure.

This study aimed to evaluate the scope of the political measures associated with all-day schooling as it was implemented in Portugal by the AEC programme and put into practice in 2009/2010. The two fundamental dimensions of its means of operating were identified: the political and the curricular. The study focuses on two cases of different local decision.

Political Dimensions of the Programme

The Curricular Enrichment Activities Programme is a powerful instrument for intervention and change in several domains of the educational field and in particular in the administration and management of the 1st cycle of elementary education. This programme has asserted itself as a relevant component of a decentralised educational public service, which is contracted and open to the laws of the educational market.

Designed at first by the Socialist Government (2005-2009) as a tool for the policy of "modernization" of the country, in line with the prevailing European policies, the programme aimed to promote the early teaching of the English language in the 1st cycle of elementary education. It thus aspired to pair the Portuguese educational system with the "European patterns" with respect to the "high level of training and qualification of the future generations", as well as to the "early development of competencies, in the framework of the increasing mobility of people in the space of the European Union" (Ordinance no. 16 795/2005). However, the Programme for the generalisation of the teaching of English in the 3rd and 4th years of the 1st cycle of elementary education was soon extended and converted, by the diverse dynamics of its decentralised development, into the AEC, a programme with strong social concerns that aimed to promote relative equality of educational opportunities.

Many were the changes the programme introduced in the curricular offer of basic education: (i) it put forward, right from the beginning, the concept of "enrichment" in the context of an "old" curriculum which had reached a critical point, (ii) it reformulated the finalities of the 1st cycle in the framework of the pedagogical continuity desired by the schools groups, (iii) it led to the recruitment of new professional profiles meant to work with children within the same class-space, (iv) it established new relationships with respect to the way schools and groups of schools were supposed to work, (v) and it forced the sharing of educational tasks between the central administration, the municipalities and the schools. However, the programme took root mainly in the social sphere. This happened not only because it provided answers to many problems families had with the management of their daily lives – when it was reconfigured as PETI –, but also because it democratised a number of educational advantages, which were within reach of certain social strata only. The programme also innovated as it provided ground for the compatibility of the promotion of those apparent

educational equal opportunities and the diverse curricular proposals made by different entities, having thus tried to respond to the interest evinced by local communities.

In spite of some criticism on the part of the ANMP – Associação Nacional de Municípios Portugueses (Portuguese Association of Municipalities), who put back on the agenda the discussion about the circumstances pertinent to the operating of that measure, the programme relies on a strong involvement on behalf of the municipalities. It was, in fact, mainly the gradual juridical recognition of the social importance of the autonomous educational intervention of the municipalities that led the Government to successively change the normative definition of the support activities offered by the municipalities to the 1st cycle of elementary education: being at first described as "extra-school activities for the occupation of leisure-time", they were subsequently named "support and complementary educational activities", then "complementary curricular activities", and finally "curricular enrichment activities".

For the first time, "subject areas" chosen by the promoting entities (municipalities, parent associations and groups of schools) among a number of areas considered by the Ministry of Education relevant for the promotion of success (thus being funded) were integrated into the curriculum of the 1st cycle. These "subjects" have "programming guidelines", support material, staff and schedules specially designed for them and defined by the promoting entities as if they were real curricular subjects. It is thus a form of educational decentralisation, which manifested itself in the first and most significant reconfiguration of the old relationship between the two powers that used to oversee the 1st cycle. In spite of a renewed "school-centrism" (Correia & Matos, 2001), the doors of a field that had so far been of the exclusive responsibility of the central administration were opened to local institutions and entities: they now define the curriculum – what 'enriches' –, as well as which classroom is going to be used for that purpose.

The support component for families that the programme works with is mainly characterised by an expansion of the time children are now spending in educational activities in the school environment (Table I). The implications of this extension of the opening hours of 1st cycle schools forced the adoption of new equipment and changes to physical and human resources.

Besides the characteristics mentioned in Table 1, it is necessary to clarify that the planning of the activities is carried out by coordinators of the AEC programme, while the pedagogical supervision is of the responsibility of the head teachers of each class. It is also worth noting that those in charge of schools may, when necessary, render the schedule of the curricular activities more flexible in order to provide the best conditions for the implementation of curricular and enrichment activities.

Curricular Issues

The AEC programme aims to achieve the double objective of guaranteeing, to all students of the 1st cycle, the offer – free of charge – of a variety of learning activities that may contribute to the enrichment of the curriculum, as well as the accomplishment of the Government's priority of promoting the articulation between the operational conditions of schools and the organisation of the social response to families' needs. The student's length of stay at school is thus extended, and all is done to render that period pedagogically enriching and complementary to the learning associated with the acquisition of key competencies.

Table 1. *Characterisation of the AEC Programme in the context of the PETI*

	AEC Programme Optional	Formal Curriculum Compulsory	Family support component Optional
Entity in charge	Local Authority: municipalities, parent associations, school groups	Central Administration Ministry of Education	Central Administration and Local Administration
Length of stay at school (40 hours per week)	7.5 hours	25 hours	Variable Up to 15 hours
Place	Classroom /other spaces around the school building / spaces outside the school facilities (swimming pools)	Classroom/School	Classroom / other spaces around the school building / spaces outside the school facilities
Compulsory offer Optional offer	. English . Learning support . Music . Physical and Sport activities . Artistic expression . Other	Formal Curriculum	Meals and surveillance
Operational staff	AEC teachers of each specific area	Head Teacher	Non-teaching staff
Attendance control	Regulated by schools, but without any effect on the students	Regulated by the Ministry of Education, with effect on the students	Not applicable
Assessment of student learning	Without any effect on academic progression	With effect on academic progression	

This brief description of the intentionality behind the AEC programme, as well as of the way it has been put into action, entails two concepts, which are worth revisiting: the concept of all-day schooling and the concept of informal curriculum.

The concept of all-day schooling can be defined as the !full-time educational occupation of students over the course of school time and in the physical space of the school" (Pires, 2007, p. 78). As it corresponds to an important change of the learning time, as well as of the agents that are in charge of its definition, the concept defies what one usually understands as schooling.

All-day schooling is a response to the challenges – never before experienced – raised by mass schooling in Portugal, and has forced people to face new issues, such as the idea that social justice should be guaranteed above all. This new reality of having all children at school involves thinking about what should be taught, and how it would serve the goals (which goals?) of the education provided by the State (Leite, 2006). This worry is ever more relevant at a time such as the one we are currently living, when political speeches resort to the flag of

qualification as a way to reach the 2015 targets for Education and contribute to the Europe of knowledge defined by the Lisbon Strategy.

The concept of all-day schooling is often associated with an egalitarian intent, as it aims to ensure equal educational opportunities to all children (Dobert, Echard, & Sroka, 2004; OCDE, 2007). In this regard it is essential to guarantee that the "real and effective equality offers adequate and differentiated opportunities so that all students, no matter their starting points, their needs or circumstances, can go beyond the minimum knowledge and acquire basic school learning" (Muñoz, 2005, p. 17).

With the AEC programme, Portugal is following the political measures that have been implemented in other European countries for the past twenty years, with the same purpose of positive discrimination (Demeuse, Frandji, Greger, & Rochex, 2008). Such measures were conceived in order to resolve or minimise, in one go, some social inequality, thus contributing to improve the level of success of students, during their years of formal schooling, as prescribed by the tendencies identified by the OECD with regard to the forms of promoting equity in the field of education. "To strengthen the links between school and home to help disadvantaged parents help their children to learn; to provide strong education for all, giving priority to early childhood provision and basic schooling" (OECD, 2007, p. 9) are two of the ten steps to support social equity.

The concept of all-day schooling also incorporates the idea that some of the learning provided by the school, during that supplementary time, is more important and becomes socially more homogeneous over time than the activities that the families and the children themselves would be able to arrange. As argue by authors like Magalhães and Stoer (2002) this effort contributes also to a new commitment that middle class addresses to school system. An additional finality associated with all-day schooling concerns its capacity to prevent marginal behaviour on the part of the students that could occur if they were left alone without adult supervision. Furthermore, the national policy chose to value structured educational action, to be held, in most cases, at school, or to resort to a model of schooling, as happens with the AEC programme.

Finally, all-day schooling is associated with the idea that students, in their capacity as learners, are somehow unaccountable. In fact, although it is said that the intent is to promote the autonomy of students, it contributes instead to a more extended reliance on adults, who are taken as their reference.

It is precisely within the dimension of the offer that characterises all-day schooling that it makes sense to examine the concept of informal curriculum, as well as the links that the concept has established with other concepts, which may contribute to the understanding of its theoretical density, namely the concepts of territorialisation, of curricular coherence and curricular articulation.

The concept of informal curriculum is defined by the learning that the school intends to foster in its students, which results from the values that shape their educational projects or their identities in their role as educational organisations, but which are not an explicit target of a formal instruction and of an evaluation of the results evinced by the students (Pacheco, 1996). The underlying conviction, shared by many authors of the critical sociology of the curriculum (Forquin, 1993), is that the walls around schools are merely symbols of other social control walls, which the school conveys. Therefore, when an educational system does not just give shape and determine the formal curriculum, but chooses and funds a number of choices regarding the offer for the occupation of free time instead, it is formatting the school culture

twice, thus contradicting the idea of curricular territorialisation. In other words, it formats school culture as it chooses a formal curriculum, but also because, taking over the parents' role of conveying the values that are closer to their family experiences, it forgets the principle that all learning should be locally significant and that it should depend on local agencies, as vindicated by curricular territorialisation.

As mentioned by Leite (2005, p. 5), "the foundations that legitimise the curricular contextualisation, at a micro level, refer to the possibilities of local action in the process of curricular decisions, within the logic of territorialisation of education". This concept is founded upon the possibility offered to local territories, as well as to their agents, to decide matters concerning education in accordance with principles and interests that are locally relevant.

In Portugal, curricular territorialisation has been commonly used to justify a curricular offer of a compensatory nature, in the context of elementary education, as it has been primarily oriented to the formative offer aimed at students who have failed regular schooling. On the contrary, the rationale behind the AECs has been to enrich the formal curriculum or to provide a number of physical or artistic activities of a more universal nature. We believe it is legitimate to read in that difference evidence of a certain return to the movement Back to Basics. It certainly is what the practice (also preached in contemporary political speeches) of maintaining the pressure on the areas of learning considered more noble and more basic – thus making time available for the learning of those activities – indicates. Thus, as a result of the inscription of a set of findings associated with artistic expressions in an area of informal curriculum, it has made room for what is considered essential. That is why all-day schooling – and the AECs in particular – is seen today as a way of implementing the tendency of the back to basics, of the fundamental literacies (reading, writing, numeracy, communication). The dimensions of the curriculum that are more connoted with the achievement of projects or with a training of a more humanistic nature are thereby relegated to other periods of time. As a result, we would have two kinds of schools: in the morning, the school of the essential curriculum with the aim to ensure the basic literacies, and at the end of the day the school of the territorialised curriculum with a more informal and experiential nature.

Two objections can be made to this unfulfilled promise of articulating the formal with the informal curricula: 1) If the curricular coherence and significance is entrusted with the informal part of the curriculum, do we not risk a divide between the experiential and the official curricula? In fact, the experiential curriculum can very well transform experiences into learning, whereas the official curriculum is based on the idea of an external knowledge appropriated by a student who has in mind the final exam that will confirm that appropriation. 2) Should we not beware of the results of a relative inconsequential superficiality of the educational offers as they risk the temptation of trying to ensure a high range of educational experiences, which is very close to the exaggerated experientialism that characterises contemporary society? (Lipovetsky, 1989). From another point of view, the curricular coherence is not restricted in regard to the application of the knowledge which derives from the formal curriculum to the informal one, or vice-versa, to the continuity between knowing and acting, but rather to the transforming potential that the learned knowledge can have on the lives and the contexts of the learning individuals. Such is its potentiality, such is its frailty.

The concept of curricular articulation has acquired increasing importance in the curricular development, as it is discursively presented in the documents which shape the curricular decisions of the schools, and results both from the legal acts and the observation that the curriculum cannot just be a conglomerate of juxtaposed parts. Theoretically associated with the globalising dimension of the curriculum, the concept has been split into two vectors that

explain how that totality has been achieved, either from a diachronic or a synchronic perspective. This is what we call the vertical or the horizontal articulation.

1. The "vertical curricular articulation is present in the continuity of the levels/cycles/years, in the hierarchy of decisions and in the balance between the formative curricular components and their extension;

2. The horizontal curricular articulation can be observed in the correlation which exists inside each unity and each organ, in the transversal relationship between areas/subjects in the same year and in the coherence between the components that make the curriculum operational". (Leite & Pacheco, 2010, p. 6)

The curricular articulation reaches its full sustainability in three planes that correspond to three other relevant axes of the curricular work, namely: the development of the students; the work of teachers and curricular agents; the structure of the system where the articulation is politically shaped. These three axes define what is to be understood as a good practice of curricular articulation, i.e., an articulation able to identify and intervene in each school at the level of decision or curricular implementation where it seems to be most needed. A good practice of curricular articulation also ensures a work of curricular coherence, which is centred on the curricular alignment and made available to the collective subject responsible for its implementation – the teachers who, over time, work with the same student. As an extension of the former reason, a good practice of curricular articulation values the availability of teachers to work in a collaborative way with their peers.

Methodology

In order to evaluate the implementation of the AEC programme in the district of Porto, we decided for a "multi-case" qualitative study (Triviños, 1987), as it is the most adequate for the study of contemporary events (Yin, 2002). As it is customary in this methodology, the choice of two cases, in a total of four schools, was made in order to ensure the variability that is present in the universe of the promoting entities responsible for the AECs in that district. Case A, chosen among the universe of groups of schools of which the Porto Town Council was in charge, represents 16 cases (Stake, 2005), or groups of schools. Case B, on the other hand, stands for the exception to the rule: schools integrating an alternative offer promoted by a Parish Council. In all cases, we selected groups of schools that might contribute, on a voluntary basis, to a better understanding of the circumstances, as well as of the implications and the problems resulting from the implementation of the AEC programme.

The data collecting tools were: official documents, interviews, observation of the AEC activities, texts and drawings by the students.

The set of documents that have been examined is composed of:

• Legal documents by the Ministry of Education

• Programming Guidelines issued by the Ministry of Education

• Educational Projects and Annual Activities Plans

• AEC Annual Planning

• AEC Evaluation Forms

The interviews, individual or in group, according to an open and complex model, were made to the representatives of the local promoting entities, to the people in charge of the administration and management of the AECs, to the directors of the groups of schools and the directors of the schools, to the head teachers and to the AEC schools, to the

representatives of the companies (hired as a result of the political option of the Town Council) and to the entities responsible for the provision of services, and also to the students' parents and guardians. The criterion of availability was used for the selection of all the participants, as well as for the phases of observation and gathering of the students' work.

The observations were both informal and formal. The latter were based on "observation protocols", whereas the former, made over the course of field visits, originated a number of research notes that were examined as well. A qualitative analysis of all the sources was implemented, and NVivo software was used. The referential analysis, initially oriented by the research questions, was subsequently enlarged by emerging categories.

Results

In this section, we present the results of the research carried out in order to meet the research questions. These were as follows:

1. What distinguishes the organisational model of the programme of the submitting entities?

2. What characterises the educational offer of the submitting entities?

3. What are the effects of the different offers on students' learning?

4. What are the effects of the different offers on personal and social development?

The text follows the axes: i) characterisation of the offer and working regulations; ii) impacts on the AEC programme.

Characterisation of the Offer and Work Regulations

With regard to the nature of the offer, we observed that, in both cases, it was composed of a pack of activities that would grant the highest funding on the part of the Ministry of Education (English, Music, Physical and Sport Activities and Other). Thus, although there were small variances regarding the selected optional activities and week workload of the activities, there were no significant differences.

In the first year, except for the optional activity, the offers were fairly homogeneous: Music, English, and Learning Support. In case B, the optional activity consisted of two weekly slots of Portuguese Learning Support. In case A, in two of the schools the optional activity consisted of ICT (Information and Communication Technology) and in the third one of Math Learning Support. In the 2nd year, the coincidence was even bigger: besides Music, English and Learning Support, the optional activities consisted, in both cases, of Math Learning Support. In the 3rd and 4th years, the offer was exactly the same.

Although the promoting entities were different, we came to the conclusion that the offer was not very different (1st and 2nd years) or even quite the same (3rd and 4th years). Probably, this may have resulted from the situation created by the Ministry of Education when it defined the funding of the activities. On the other hand, in breach of what has been established by the founding text of the AEC programme, the definition of the offer counted, in both cases, with a modest participation of the school groups, which – it is important to emphasise – should have been more substantial.

As was happening at the national level, in the schools of Case A the activities were held in the classrooms or the school facilities. In case B, because of the high number of students and of the low number of rooms available, alternative places had to be found for the extra-curricular activities, and protocols with neighbouring entities were signed, as Bernet (1999) recommends, in order to make the best use of the educational resources of local institutions.

With regard to the working hours of the AECs, as stated above, there were big differences between the school in case B and the schools in case A. In the latter, the activities were held from 4:00 pm to 5:30 pm, i.e., after the curricular activities. In case B, the activities were held in the morning when the students had their curricular activities in the afternoon, and vice-versa.

As a rule, AEC classes integrated students of the same year, and each group had no more than 20 students, in case A, and no more than 15, in case B. In both cases, however, there were some classes where children from the 1st and 2nd years, on the one hand, and from the 3rd and 4th years, on the other, were brought together. Also in both cases, the students' parents and guardians could decide whether they wanted their children to attend the activities, and in case they enrolled their children, the latter were bound to attend all the offered activities. Nonetheless, because of the situation described above, only in case B did that option involve the choice for the physical space of the institution where they wanted their children to attend the AECs.

Setup and Human Resources

In their quality as promoting entities of the AEC Programme, both the Town Council and the Parish Council felt they should create new structures to coordinate and accompany the implementation of the activities in the schools for which they were responsible.

In case A, a "technical team" was established, and they directly depended on the Office for Educational Policies, and were trusted with the accompaniment, coordination and evaluation of the programme. In case B, a team called 'technical device' was brought into being, and they depended on the Vice-President of the Parish Council. In both cases, the above-mentioned structures had forms of coordination of their own and very specific competencies.

As we can conclude from Table 2, part of the competencies of those teams were very similar, from the meetings with the representatives of the groups of schools to the method used for the evaluation of the activities and the AEC programme, as a whole. However, in case B the competencies of the coordinating team included a pedagogical dimension. On the other hand, both the team of case A and the companies – according to what had been established by law – left the pedagogical issues to be managed by the head teachers of each class.

The team in case A centred its action on the control and monitoring of the fulfilment of the contract documents signed with the companies hired for the implementation of the programme. The team in case B revealed a veritable preoccupation with the pedagogical dimension, and this resulted in the elaboration of a teaching pack – a portfolio – that aimed to provide support for the people involved in the implementation of the programme, as well as in the work of pedagogical guidance provided by the team coordinator to the AEC programme teachers, which included the articulation of the AECs with the schools' plans of activities and the curricular projects of each class. It should be further noted that the promoting entity, in case A, delegated to the companies which acted as service providers the hiring of the activities, whereas the promoting entity B took charge of that responsibility. In both cases, the teachers who were hired were graduates.

Table 2. *Devices created by the promoting entities*

	Parish Council	Town Council
Human Resources	Sport, Education and Youth Office	Technical Team
Dependency	Vice-President of the PC	Alderman in charge of Education
Composition	Coordinator	Coordinator of the Educational Services
	Area Coordinator	Head of Office
	School Coordinator	Companies
		Company Coordinator
		Area Coordinator
Mission	Management, Coordination and Evaluation of the implementation of the programme	Management, Coordination and Evaluation of the implementation of the programme
	Pedagogical Accompaniment of the AECs	
	Pedagogical Accompaniment of Family Support Activities	
Duties	Relationship with entities	Relationship with other entities, namely the coordinators of the hired companies (EDUTEC, Espalha Ideias, PortoLazer) and with the coordinators of the schools and of the groups of schools
	Elaboration of a Pedagogical Portfolio	
	Production of Pedagogical Documents	
	Curricular articulation with the structures of the schools and of the groups of schools	Production of Documents connected with the programme
	Evaluation of the AEC teachers	Elaboration and Management of the Questionnaires to be sent to schools
	Update of the evaluation methodologies of the AECs	Evaluation of the AEC teachers
		Annual meetings with representatives of the groups of schools

Impact of the AEC Programme

On the Schools

One of the most obvious impacts of the programme was the expansion of the school offer to eight daily hours, five for the formal curriculum and three for the enrichment activities. In most Portuguese schools, all the activities are held in the same physical space. This redefinition of the 'intra-scholar temporality' originated relevant changes in the organisation and management of the schools in case A, namely with regard to the need to monitor students during the extension periods and between the time when the curricular activities of the school end and the AECs begin, and to the need to provide lunch for the students.

This extension of time in the same physical space has fostered conflicts and has originated disciplinary problems. This idea has, in fact, been mentioned by the children, who have often referred to the existence of conflicts in their texts. The fact that there was not enough staff to ensure the supervision of the children, in most schools, also contributed to the situation.

In case B, for the aforementioned reasons, there was no need neither to resort to the flexibility of the timetables of the head teachers, nor to extend the period of supervision of

the students, so the school management was able to keep to its routine. The temporal impact was not thus felt in the same way.

Another sort of impact is the one connected with the changes produced by the integration of "Learning Support" activities into the head teachers' set of tasks and timetables. Although this activity is part of the AEC programme, as the school was responsible for its implementation, the effect was particularly felt in case B: in fact, it originated an increase of the head teachers' weekly workload and forced them to go to one or more physical spaces outside of the school facilities during the periods when they were not teaching curricular subjects.

Finally, it should be noted that, in order to achieve the aims that have been set for the programme, the curricular enrichment activities still call for a significant horizontal and vertical articulation with both the 1st and the 2nd cycle curricula. According to the testimonies, the conditions that would enable that articulation have not been met yet, either from the point of view of the formal conditions, or from the subjective point of view of the intervening people. In that sense, the curricula need to be redefined and the teachers' timetables need to be changed. Even the concept of having one teacher responsible for the teaching of all the curricular subjects in the 1st cycle would have to be altered in order to strengthen the co-operation.

On the Relationship between the Students and the School, as well as on the Learned Knowledge

In both cases, those in charge of the pedagogical and administrative managements of the schools, as well as the head teachers, acknowledged the pertinence of the social dimension of the programme and the role that the AECs can potentially play in the development of children. However, at the same time, they identified a number of adverse effects on the students, both with respect to their behaviour and attitudes, and to their relationship with the school and learned knowledge. Some of the worries and reservations concerning the AEC programme have been based on this idea, namely:

- the exhaustion provoked by an excess of school hours, i.e., the hyper scholarisation of children. According to the head teachers, this has negative consequences on the process of teaching and learning, such as student distraction, and loss of interest and demotivation with regard to the curricular learning, which is far more complex and non-ludic;

- the lack of interest conveyed by some students for most curricular activities;

- the anomie (according to several head teachers, the enrichment activities can favour indiscipline and loss of the sense of "rules", and have negative effects on the formal curricular activities);

- The reduction, almost annulment, of time for individual work and study and the consequent diminishment of academic achievement;

- The "pedagogisation of leisure" which significantly reduces the time children have to play and, as such, carries with it the risk of getting tired of school.

Until the current moment, a systematic evaluation of the effects of the AEC programme on the progression of the students' learning has not yet been carried out. In the absence of that process, the nonexistence of benefits, on the plane of the acquisition of knowledge and development of competencies, underlined by the majority of the PTTs, is based on an 'impressionistic' evaluation which cannot, and should not, be devalued, but which calls for a better substantiation.

On The Relationship between the Parents and Guardians and the School

In both cases, the parents and guardians valued the All-day Schooling Programme and the free of charge offer of activities and lunch, as well as the prolongation of the period of supervision of the children. The degree of involvement of parents in the All-day Schooling and in the implementation of the programme was diverse. In school B, where the offer was locally promoted, parents played a relevant role in the establishment of cooperation protocols with partner institutions. In case A, parents did not play any sort of role in the implementation of the programme. That is perhaps why they kept themselves at a distance from the AEC programme, as well as from the school, and why they somehow devaluated the activities and showed no respect neither for the way the AEC programme was organised nor for the teachers' work. It should be noted that this devaluation has been reinforced by the lack of influence on the evaluation of the students.

On the other hand, and having the two cases in mind, we can say that the parents were confronted, in the process, with new fields of knowledge and new forms or methodologies of teaching and learning. Although this dimension still needs to be thoroughly studied, we admit that the introduction of the AECs has changed the way parents and guardians perceive the educational institution and the people who work there, namely the teaching work of the head teachers.

Final Reflections

The unanimous valorisation of the philosophy and objectives of the AEC Programme – stated in the introduction – on the part of all the involved subjects, and in particular on the part of the parents and guardians, gives clear evidence that this programme was a "good measure" of public educational policy, and was coherent with the nuclear project of "All-day Schooling".

The effectiveness of this socio-educational measure depends, however, on a set of factors that have not yet been consolidated, and thus call for a deep reflection. Among these, we should mention the weak articulation between 1st cycle teachers (and particularly AEC programme teachers) and the technical team responsible for the local implementation and evaluation of the activities. One of the conditioning aspects of that connection lies in the curricular articulation. Most of the head teachers, of the AEC programme teachers, as well as schools in general, discursively value the curricular articulation (one of its formal competencies) and believe that it should exist, but – as they themselves recognize – it has not been enough to change practices. This dimension is still evidencing low levels of satisfaction and is even one of the most acknowledged weaknesses.

Another critical factor stems from the overlapping of formal and non-formal education in the same educational space, which gave rise to some misunderstandings with regard to the aims of the activities. If we look at the terminology used by all the subjects involved in this programme (the recurrent use of words such as classes, students, teachers, textbooks, pedagogical material, evaluation…) we will come to the conclusion that for both parents and the children in general, and also for some head teachers and AEC programme teachers, the specificity of the AECs has not been identified yet. In spite of that, curiously enough, for a group of children from João de Deus Elementary School, the AECs do clearly belong to the field of Free Time Occupation. The absence of a thorough clarification of this issue has, meanwhile, led to the devaluation of the activities, either on the part of the parents and guardians or on the part of the head teachers.

One of the central reasons for their criticism lies on the weariness of the students as a result of their remaining in the same physical space (mainly in the classroom). This worry with

the consequences of physical space is present in the studies by Schnitter and Haselhoff (n.d.) and Reh et al. (2011), who underline the need for a diversification and flexibility in terms of physical spaces as a way to foster the socio-educational development of the students.

Incited by a similar worry, and with the aim to avoid the repetition of the model of the school and to minimise the weariness and/or the annoyance generated by the activities on the children, the parents and their representatives put forward a set of proposals. These, however, have not been as welcome as described in other European experiences (Schnitter & Haselhoff, n.d.; Reh et al., 2011).

Although they did not put it precisely in the same terms as Bernet (1998), underlying the proposals presented by the parents we can clearly see the idea of citizenship education. This is evident in the recommendation to make the most of the educational resources of the parish or of neighbouring parishes, of having the activities held in local studios or workshops, of organising visits to exhibitions, planning to attend concerts or participate in other cultural local events. These suggestions aim no doubt to overcome the "poverty" of the children's cultural world. According to den Besten (2010), this should in fact be a measure of public policy and one of the aims of the AECs, especially in culturally disfavoured and resource-poor families.

Another nonconsolidated factor relates to the "time and its use", as described by Roldão (2008). According to this researcher, the AECs cannot originate an unbearable and inadmissible pressure on children in case the municipalities and the children decide to invest in many areas, thus taking away the effective free time the children have. The promoters, be they the town councils, the parish councils or the groups of schools, have the possibility to put into practice curricular differentiation through the selection of part of the offer that best suits the local needs and meets the problems felt by the local community.

But instability was also caused by the fact that although the offer of activities was compulsory, the children's attendance was not obligatory – especially with regard to the teaching of English. This incongruence potentiates inequalities in the process of learning this foreign language and has negative consequences in the transition to the next cycle (Madureira, 2011). The solution to this problem lies in the decision to integrate – or not – this activity into the curriculum of the school.

Finally, the success of the AEC programme is compromised by the absence of an ample and rigorous system of evaluation, which allows for the identification, in a sustainable way, of the measures needed for its improvement.

The directions towards which the AEC programme seem to evolve oscillate among the social dimension of the programme, the concern with the curricular articulation and the curricular differentiation. The tendency to exaggerate one of these dimensions is a risk associated with some of the interveners. It is fundamental to balance these dimensions. The uncertainty with regard to the funding of the programme is no doubt another menace to this balance.

The AEC programme was created with the stated aim of promoting the improvement of the quality of the schools of the 1st cycle and consequently to contribute to the progress of the students in terms of learning, as well as to provide a social response in the field of the support to families, namely in the harmonisation between the professional and the family life. If it is true that the latter aim has been reasonably met, further improvements still have to be implemented in order to meet the former.

In a broad perspective, as AEC programme could be a part of educational policies conducting to equity, it could be an assessment of welfare state's measures. Educational equity for all is essential in a changing view of Welfare States from a social protection to a social promotion framework. This is relevant at the present as Europe is facing a financial crisis which puts this equity at risk as investment in Education has been regarded as expenditure.

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Notes
Note 1. AEC – in Portuguese, Atividades de Enriquecimento Curricular.
Note 2. In Portuguese, "Programa Escola a Tempo Inteiro".

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Children's sense of being a writer: identity construction in second grade writers workshop

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Abstract

Literacy activities in which children invest in and understand literacy creates spaces for them to construct their identity as readers/writers and build their personal theories of literacy. This study presents the identity construction of second grade students who identified as successful, average or struggling in their first time engagement with writing workshops. Writing as a process approach in which students practiced drafting, sharing, editing and publishing their pieces of writing were implemented during a year. 27 second grade students were interviewed at the end of the school year. Analysis of the data revealed that students conceptualized identity under four dimensions: (1) purposes of writing, (2) assumptions/views about writers/writing, (3) the process of writing, and (4) competence in writing. Involvement in the writing workshops influenced students' identity as writers. Children's perceptions of themselves also played a role in their engagement in literacy learning especially writing and identity construction.

Keywords: Identity, Writing workshops, Elementary students.

Introduction

Theories based on social constructivist and postmodern perspectives "emphasize the constructed and dynamic nature of identity" (McCarthey, 2001, p. 125). According to Norton (1997) identity refers to "how people understand their relationship to the world, how that relationship is constructed across time and space and how people understand their possibilities for the future" (p. 410). As literacy practices are also constructed by language learners' understanding of themselves, their social environment and their histories (Norton & Toohey, 2003), the relationship between identity and literacy as a social practice has been the subject of research, however, the literate identities of younger students, especially when they

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are beginning to learn how to write have been explored less compared to the identities of adolescents (Collier, 2010).

From a social and cultural perspective literacy is more than practicing skills and transferring knowledge because it requires that people are involved in interaction, participation and relation in which people's sense of themselves and others is identified, situated and mediated (Moje & Luke, 2009). Writing like any other forms of language is a "constitutive force" that creates "a particular view of reality and the Self" (Richardson & St. Pierre, 2005, p. 960).

Bakhtin (1981) states that identities are conceptualized in the nature of dialogue. Because of its dialogic nature, literate practices like reading, writing, talking, listening, and other forms of interaction with multimodal texts have an impact on one's identity construction (Collier, 2010). Children's understanding of the reading and writing process and their perception of themselves as readers and writers reflects their sense of identity as literacy users (Kauffman, 2006). According to Young (1996) young children's sense of being literate includes their understanding of what being literate means, competence in reading and writing, their sense of capability in reading and writing, and what behavior is valued, consistent with their interpretation of the literacy events and their own participation in those events. Beliefs about writing and interaction with others in writing activities shape students' identities. In their longitudinal study Laursen and Fabrin (2013) found that students' perception about reading and writing affects the individual children's commitment to language and literacy acquisition that is also an investment in their identity and social relations in which they take a part or wish to take a part. They also negotiate different identities available to them in which their investments have different consequences. It is also found that the voice they use in their writing and their social identity are inextricably linked (Flint & Cappello, 2003).

Students' literate identity development is a complex social process and influenced by a variety of factors (school practices, home literacy, practices, race, gender, second language learning etc.) however, schools, including the classroom teacher and literacy practices in the classroom, are the most influential factor in students' literacy learning life and identity (Smith, 2008; Martens & Adamson, 2001). Students' identities are reconstructed through the writing events in the classroom (Bourne, 2002; Compton-Lilly, 2006). Honoring and supporting children's identities, cultural recourses and literacy activities out of the classroom help them identify themselves as readers and writers (Compton-Lilly, 2006). Rowe, Fitch and Bass (2001) explored the power and identity that students embodied during a first grade writing class. According to the results students use a variety of roles in expressing their literate identity during the classroom activities. They are positioned in these roles by the formal classroom culture, teacher, peers and other communities in which they participated. On the other hand children's literate identity is an important factor that makes literacy activities at school an opportunity for literacy learning (Beach & Ward, 2013).

Writing as a process approach has long been acknowledged and studied in detail in the classroom setting. There are other studies that view writing workshops from a social perspective with a particular focus on identity. Writing as a process approach highlights the social aspect of writing because it puts the writer in the center of writing activities through allowing the writer to take ownership of writing, spend time on writing activities and respond to his or her own and others' writing in many different ways. It has a potential to support young writers' identities by allowing them to generate their topics, sharing drafts with peers, responding to others' writing, and sharing the published form with the intended audience (Flint & Cappello, 2003). When children write they use voice which is a dynamic expression of oneself and it is linked to children's socially situated identities. Thus, the texts they created during writing workshops play an active role in shaping students' social identities (Cappello,

2006). Through exploring the process and the practices involved in writing, students develop understanding of themselves as a writer who uses writing for different personal and social purposes, in spite of the difficulty in changing one's image of oneself as a writer (Graham, 2000).

McCarthey (2001) explored the students' perceptions of themselves as readers and writers; perception of others (i.e. teacher, peers and parents) and the classroom context contribute to the understanding of literacy learning and identity of students who identified as high, average and low achieving readers. According to the results, students in different categories had different perceptions influencing their identity construction, and literacy plays a major role for high achiever students in how they view themselves as readers and writers. Social positions available to a student, whose identity was constructed with less competence as a writer, impact the student's access to literacy learning in a negative way (West, 2002).

Curricula and writing pedagogies shaped by national policies, different institutional structures, policies and the understanding of the practice affect students' growth as writers (Freedman, 1994a). Improving students' writing performances is a world-wide concern. Although teaching writing as a process approach is validated and has been widely used by many countries for years it is fairly new when considering the nationwide practices via the national curriculum. In Turkey, the new curriculum was revised in the light of constructivist theories in 2004. National standards in writing do not explicitly place an emphasis on teaching writing as a process approach. The features of the curriculum also reflect the traditional approach of teaching writing and focusing on increasing students' achievement in the area of reading. Writing is mostly emphasized in first grade in which the focus is on teaching writing technically. Writing different genres is practiced in the following years but they are not developed within a time span including the stages of process writing. In standardized testing students' language abilities are tested but writing is not an area assessed in these assessments. Cagımlar and Iflazoglu (2002) indicate that there is no effective conceptual framework to teach writing in elementary classrooms and also students do not actively and systematically engage in writing in Turkey.

In this study, a second grade class was organized according to the process writing model to develop students' writing performances. Writing practices construct children's writer identity as well as their development as writers. Studies about literacy practices and identity construction suggest students' perception of literacy is connected to their identification of self as a reader and a writer which is determinative of what they learnt, how they learnt and the way they respond in the classroom context (Beach & Ward, 2013). The purpose of this study is to understand the role and the contribution of writing workshops in shaping students' literacy especially writing identity and the difference between students who identified as successful, average or struggling students in language and literacy learning.

Method

A qualitative method was used to explore second grade students' literate identities particularly their sense of self as a writer.

Setting and participants

The study was conducted in a state elementary school located in an urban area where mostly middle class families are located. The teacher who advocated the process approach did not want to introduce students to writing workshops in their first grade. Because of the unfamiliarity of the program and the concern to teach reading and writing the teacher offered to start the program in the second grade after the children had learned reading and writing

technically. The teacher who has 20 years of experience and the researcher worked together. In the course of the year students engaged in the study units including small moment stories, informative, procedural writing, reviews, letters and poetry. The process included getting students into writing, picking a seed idea, developing writing, drafting, revising, editing and publishing. The lessons started with mini lessons and were followed by the active engagement of the students. Every week for the year the researcher spent at least two hours in the classroom with the teacher. The researcher was perceived as a teacher by the students. During the week the teacher followed up the activities. The researcher and the teacher had a meeting every week of one hour to discuss teaching practices, materials, conferences with students and their progress. The study consisted of 27 second grade students, 14 girls, 13 boys.

Data collection

The interview questions developed by two researchers focused on children's perceptions of literacy especially the writing process. Young's (1996) categories for children's sense of being literate were also used as a guide in developing the questions. The eight categories included questions on the students' ideas about learning reading and writing (i.e. what does one need to learn? or how does one read and write?), literacy competence (i.e. how does one view oneself as a capable reader and writer? or how does one view oneself as a member of the literate classroom community?) and the purpose of reading/writing (why does one read/write?).

The questions are:

1. I want you to think of someone who you think writes well. What makes her/him a good writer?

(......is a good writer because......)

2. Tell me about yourself as a writer. How do you know you are a (good/average/poor) writer?

3. I wonder what you know about reading and writing. (How one reads and writes? Why do people write? Do you think it is important to know how to read and write? Why?)

4. Do you like to write? What is the best thing about writing? Why?

5. What do you do to write better?

6. What kind of writing/activities do you like/have the most fun with? Why? Tell me about the best piece you wrote and why.

7. Do you think you write better now? How?

8. What makes your writing good?

9. What do you think about getting help to write better?

10. What do you think about sharing your writing with others?

11. How do your friends respond to your writing? How do you feel when they suggest some changes?

12. I want you to write down the important things you have learned about writing so far on the cards using as many cards as necessary. (Ask the student to put them in order from most important to the least and talk about them.)

13. How do you feel about writing something you have chosen?

14. Is there anything you want to add?

The interviews took place in a quiet room in the school, and were audio-taped and transcribed. All the interviews were conducted in the last two weeks of the school year by the researcher and a research assistant who joined the classroom as an observer during the year so the children were already familiar with the interviewers. Each interview took approximately 20 minutes. The students were informed that the interview was about what they knew and had learned about writing and also the writing activities we did during the year. The interview questions were semi-structured and during the interview researchers were sensitive to the child's responses. The questions were posed in a different way to get information when necessary.

Data analysis

Before data analysis the students were grouped as successful/high, average and struggling/low achievers according to their scores in the language class. The scores they achieved at the end of the year were not the only criteria the researcher used. In the interview, the children were asked to tell about themselves as a writer (Tell me about yourself as a writer. How do you know you are a (good/average/poor) writer?). The children's perceptions about themselves as a writer and the classroom teacher's opinion of the students' performances were also used as other sources/criteria for grouping students. Ten students were identified as high achievers (9 girls and a boy), 7 students were identified as average (4 girls and 3 boys), 10 students were identified as low achievers (2 girls and 8 boys). The students' names were not used. The quotes were labeled with a number followed by the group initials (high achiever "HA"; average achiever "AA"; low achiever "LA").

Throughout the research, questions were used to focus the analysis. Thus, data analysis started with the following questions:

- What are the skills/ processes they learn and how do they describe themselves in terms of writing?
- What are the differences between students who identified as successful, average and struggling students?

At the beginning the data were read and re-read to get a general understanding and to put the children's statements into brief categories or phrases. The responses to each question were analyzed separately to identify repeating patterns and themes. For each question how many times the statements were mentioned was also noted. The phrases were color-coded and listed. The themes in the lists were grouped into larger categories which are as follows: (1) the purposes of writing, (2) assumptions/views about writers/writing, (3) the process of writing, and (4) competence in writing. The data in each category were examined to address the following questions:

What do children think about literacy and being literate?

What do children think about the purpose of reading and writing?

What do children know/learn about the process of writing?

How do children view their competence in writing?

Results

Addressing the research question, the results were reported under four categories that are: students' assumptions and views about the purpose of reading and writing; writers; the process of writing; and their own competence in writing. Students' responses in each category

were also examined according to students being successful, average or struggling learners in writing.

Assumptions/views about the purpose of reading and writing

The children were asked what they know about literacy and what they think about the importance of reading and writing. As shown in Table 1, the responses mainly focused on reading and writing as a tool and necessity. Although it is mentioned as a means to learn and acquire knowledge they mostly characterized that as a need too.

Table 1: *Students' knowledge about literacy*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
Reading as a tool (for reading stories etc.)	14	70	43	40
Writing as a tool (taking notes, doing homework, writing letters, etc.)	12	80	29	20
Social obligation	12	50	43	40
To learn and acquire knowledge	9	30	43	30
To have a job and easier life	8	30	29	30
To develop literacy skills	7		57	30
To have fun	1	10		
Total frequencies		26	17	20

Students emphasized that they need to be literate because it will be received very negatively by their environment:

> *Um... because if someone asks us to read then we are ashamed of not reading and feel embarrassed. We say 'I wish I could read and write.' (6, HA)*

> *...to know and read if somebody asks "do you know how to read?" If we don't know they laugh at us. Then, our life is disrupted. (2, LA)*

Besides, they highlighted that being literate makes life easier and it has an important role in acquiring a job in the future. Students said that reading and writing develops together and needs to be continuously improved, and also spoke of the need for continuous reading:

> *... because reading and writing is nested together. We can't write if we don't know reading and then we check and revise our writing whether it is right or wrong through reading. (5, LA)*

To technically know how to write is a necessary tool for doing homework and writing letters. Using reading and writing as a means to do other things was mentioned by mostly high achiever students.

When children were asked to write and assess the most important thing they have learned about writing they expressed their thinking about literacy in a broad sense (see Table 2). On the other hand, they revealed more and gave a detailed opinion about writing by addressing different dimensions like solving problems:

> *We write to solve problems, for instance I upset a friend of mine. This breaks his/her heart. I can write a letter to fix this and this might solve my problem (6, AA).*

Students with high writing skills gave more opinions compared to other students. Unlike the responses to previous questions children explained more about the writing as an affecting

and improving factor using some other viewpoints. How writing has increased reading skills was mentioned more than the development of writing skills.

Table 2: *The important things students learned about writing during the year*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
Affecting and improving factor (on technical writing skills, reading, mind etc)	22	100	85	50
Writing helps to learn, acquire and transform knowledge	19	100	71	40
Writing means sharing	11	60	29	30
Writing is a tool (to solve problems, be successful etc.)	9	20	57	30
Writing is good and important	8	30	43	20
Writing means having fun and being happy	6	10	57	20
Social obligation	1	10		
Being a writer	1			10
Drawing	1	10		
Total frequencies		34 (%3.2)	23(%3.2)	21(%2.1)

Learning was explained in detail and some other dimensions like being informed or transforming information were also talked about. Only 4 high achiever students mentioned that writing helps them to transfer knowledge to others:

> *The most important thing is to transfer knowledge. I always thought that it is important to transfer knowledge to our friends and others. We can teach something and we can learn together through teaching others. (3, HA)*

Students mostly pointed to writing as a tool to share when answering this question, however, sharing was assigned by students as third or fourth in importance. Students placed writing as a means of learning and knowledge transfer as of first and second importance. Writing as an obligation was mentioned by one child, whereas writing for fun and being happy were reported by more children:

> *I feel better and happier when I write my ideas. I share and I teach. It is fun because I learn while I am helping others. (9, HA)*

Assumptions/views about writers and writing

Students described the characteristics of good writers or people who write well as having natural writing skills, being hardworking, a researcher, good reader and attentive to the rules of writing. Emphasis on personal abilities depended on the students' perceptions of themselves about being a good writer. The students who perceived themselves as not very good at writing or average emphasized more personal abilities than other students (see Table 3).

Table 3: *The characteristics of good writers*

Categories	ƒ	High achievers %	Average achievers %	Low achievers %
Personal Abilities (intelligence, creativity, imagination etc.)	19	60	85	88
Hardworking	16	30	85	70
Pay attention to the technical rules of writing	11	50	29	40
Know and know how to learn	9	60	42	
Writes better than others	7	40	14	20
Reads	4	30		10
Loves writing	1	10		
Do not know	3		14	10
Total frequencies				

Knowing the rules of writing like conventions or spelling were considered important characteristics of good writers in all groups:

> *…um… produce very good sentences, pay attention to punctuation, careful about spelling and read well. (2, AA)*

Compared to the high achievers other students emphasized that good writing requires hard work and learning:

> *I know two people who write better. Because, how should I explain, maybe they study every day during the summer holiday after they learned how to read and write in first grade. They might study the genres and try out writing. They might have hired a tutor and that tutor might go and help them after school and in the holidays. (3, AA)*

Students who are successful and also perceive themselves as good at writing highlighted that good writers know what to do and write or are able to do research and gather information on anything they want to know:

> *For instance; if they write well this means they read a lot, do research about the things they wonder about, they are knowledgeable or become knowledgeable about the topics. (1, HA)*

This group also stated that loving to write and read is an important characteristic of good writers. Some of the struggling students did not answer the question reporting that "*I don't know because of not reading enough*". (7, AA)

As seen in Table 4, almost all of the students (fewer among the struggling writers) stated that they like to write also with an emphasis on the genres of writing and the reasons why they like to write:

> *Writing poems creates happiness inside me. I feel happy, um… I think poems make people feel relieved. (5, AA)*

> *Because, when you write a book you (kind of) express your feelings. Explaining feelings makes people relieved. I feel more self-confident because I write stories and children's books. My books can be useful to other children and I feel that I am important. Not in a smug way. (5, LA)*

Table 4: *Opinions about writing*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
Writing has benefits (connection, satisfaction, support, etc.)	18	100	43	40
Loves writing	10	30	43	30
I love to write ....(story etc.)	9	40	71	0
I love to write because	4	20		20
Total frequencies				

Writing as a means of achieving different benefits was also stated. They said writing makes them feel relieved or satisfied and supports their development.

Views about the process of writing

Students were asked about their favorite practices and the reasons why they like those practices to reveal their opinions about the practices during the year. They were also asked what they think and feel about gaining ownership of their writing through determining the topics, audiences, purposes and forms of their texts, sharing their works with teacher and peers, asking for help to revise their work and also publishing finished written works with a larger audience.

The genres students like to write are given in Table 5. Except for poetry, students mentioned that they like writing more when they have more information about the topic and are having fun when they write.

> We wrote what we know best. Because it is fun to write and writing about the things I know is not difficult. I also like to draw pictures. (10, LA)

> I like to write, do you remember we wrote about how to feed a bird and how to bake a cake. For instance I know a lot about fish and I gave a lot of information. If you had a dog you should know how to care for a dog and if you need a book you should know how to look at one. I like that. (2, HA)

Five students said they like to write poetry, two of them indicated that writing poetry needs skills and compared to the other genres it looks easier:

> I discovered my ability, I didn't know how to write poems. (6, HA)

> You need to think harder when you write. When you write poems you dream and write easily. (8, HA)

Low achievers commented on different types of writing compared to the other students. The preferred genres were mostly the ones that take less time to write and might be shorter texts.

Students expressed positive opinions about being free to determine the topics and audiences (see Table 6). Students mentioned they like to write because they are free to choose what to write about, and especially explained how they feel about this:

> Because you write what you want to write and you finish easily. When I finish and read what I write I feel happy because I think I wrote something very good. (9, HA)

> I know the subject. I can develop ideas and ask questions about the subject I know. This makes me feel happy because I am knowledgeable about something. (10, HA)

Table 5: *Opinions about genres*

Genres	ƒ	High achievers %	Average achievers %	Low achievers %
Small moment stories	9	40	43	20
Poetry	7	40	43	10
Informational books	5	10	43	20
Procedural writing	3	20		10
Book review	3			30
All of them	2			20
Persuasive letter	1			10
Total frequencies				

Writing on topics they know has motivated students to write because low achievers mostly mentioned about their feelings. High achievers emphasized the importance of audience:

> *I want to make readers feel about the things I wrote. (4, HA)*

Some students in low achiever groups did not want to comment about this issue, one mentioned having a hard time to find a topic and one said it is better to write on a given topic:

> *I like somebody to make me write about a topic. Sometimes I feel happy to write what I want but I am having a hard time finding a topic to write about. (2, LA)*

When talking about getting help to write better and sharing their writing with others the students said that they need assistance on the conventions of writing (see Table 7). The students who said we should ask others' opinions stressed that support from teachers or peers was always good even if someone does know what to do:

> *It is good to have mistakes because when I made changes and correct them it becomes better. I also learn a new thing and I feel good. (3, HA)*

> *We should ask for help and shouldn't say I will do everything by myself. The person we get help from can provide more information, can teach us and can have more information than we have. We shouldn't say "how can you say this to me and everything I've written is correct'. (9, HA)*

Table 6: *Opinions about ownership*

Categories	ƒ	High achievers %	Average achievers %	Low achievers %
Makes them feel good and willing to write	18	70	71	60
Transferring ideas and feeling to the audience	3	20	14	
Makes text better	2	10	14	
Given topic is better	2			20
Finding topic is hard	1			10
Do not know	2		20	
Total frequencies				

Some students reported seeking help only when needed. The students who were identified as having an average performance level expressed that getting help is good because it has some advantages (others like the written piece more, it helps to get good grades etc.).

Table 7: *Students' ideas to get help for becoming better writers*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
Need support in conventions of writing	11	50	43	30
Support is always good	8	40	14	30
Support on unknown issues	4	20		20
Support changes results/outcomes	3		43	
Do not know	2		14	20
Total frequencies				

Furthermore, 23 students stated that they feel good and 3 students said they feel bad when they were recommended to make some changes to their writing. They explained their feelings using words like feeling upset (9) feeling good (8), feeling bad (4), and feeling angry (1). As shown in Table 8 they stated that revised texts are better than the drafts. This makes them feel better so they easily ask others, make changes and correct mistakes:

> *Good idea. I mentioned before that we get lots of feedback when we share. If we don't share others also won't learn from us and our piece of writing. (7, HA)*

> *I sometimes feel sad and think I can't write well. Later when I revise and do some changes my draft looks better and I say to myself I wish I hadn't got upset. (1, AA)*

The students who write better added they make changes if the recommendations are meaningful to them:

> *I listen and if the feedback is meaningful and fits the thing I am writing I make the changes but if they are not meaningful I keep my writing as it is. (5, HA)*

Two students in the low achiever group added that they make the changes whatever it is. At least two students commented about the effect of audience and friends: "*I think that I need to apply their suggestions because they are the readers I will write for and they will read. Their appreciation is important. This is what I think (10, HA)*", the utterance style; and "*I feel upset and heart broken when they say my piece is ugly, change it as it is not good like this (3, LA)*", feeling of inadequacy. One student in the low achiever group said that revising the text might make the piece worse.

Table 8: *Students' ideas about revision*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
Drafts become better pieces	13	70	29	50
Revising is a normal process	3		29	10
The editor is important (close friend or not)	2		14	10
The utterance style is important	2			20
Makes feel inadequate	2	10	14	
Revising importance comes from the idea of audience	2	10		10
Revising is not a good thing				10
Total frequencies				

When students were asked about publishing the finished written works and sharing them with a larger audience they focused on sharing information or informing others on several subjects (see Table 9). Low achiever students describe the situation indirectly through saying that others might learn from what they wrote.

Table 9: *Students' ideas about publishing and sharing*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
We learn and develop ourselves	10	50	43	20
Inform others	5	30	14	10
Provide information	5	10	14	30
We have to share	4	20	14	10
We might not share	1			10
Others responses is important	1			10
Total frequencies				

Children's own perceptions about competence in writing

Children were asked to talk about themselves as a writer; 20 of them responded to this question that they see themselves as good writers; 5 out of 20 emphasized that they are only good at using conventions in their writing:

> *I listen to my teacher carefully, I pay attention to the punctuation and apostrophes. (7, LA)*

> *I am an average writer, I write fast when I hurry, I write well when I am calm, I draw carefully. (4, AA)*

Six children described themselves as average writers and one reported not writing well:

> *I am a second grader. They are trying to make us writers but I write less and my friends, too. (10, LA)*

Statements of 15 out of 20 children included the other processes of writing. In addition, 22 children mentioned that they got better in writing after the application of the writing program. While 4 students emphasized the technical writing rules, 18 students have commented on the process and content:

> *I am an average writer, I write the letters badly, and am not good at handwriting. (8, LA)*

> *I am a good writer. I can focus on my writing, I know what to write and I can imagine it in my mind. (4, HA)*

Students said their writing competencies were mostly determined by the content of their written texts. For instance, high achievers think that they are competent in writing because they are knowledgeable and write things that interest readers:

> *I have/know a lot of information about math and life sciences. And then I read a lot and I do research, I ask many questions about the things I am interested in. I also listen to the lectures. (1, HA)*

Talking about the content was less common among lower achievers who think applying the rules of technical writing correctly makes them good writers. This is mostly mentioned by the lower achievers. Two students mentioned that they were unable to write according to the rules. Personal ability, preferring to listen to the lesson, reading, personal effort (asking questions, studying etc.) came to the fore among high achievers. Two students highlighted

that their best friends were also good writers. One student said he writes less than his friend. One student said he thinks he writes because others like to read it (see Table 10)

Table 10: *The sources of competence*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
Technical rules (readable, conventions, sentence fluency, etc.)	20	50	100	70
Content of the written texts	14	90	29	20
Personal ability	9	60	29	10
Listening lessons carefully	6	30		30
Personal endeavor	6	30	29	10
Friends	3			30
Others opinions				10
Total frequencies				

When students talk about the things that make their writing better (see Table 11) they stressed applying the technical rules correctly and reading books as before, however, they explained mostly what they have learned from classroom practices and the effect of continuous writing:

> I was writing very big. Do you know the letters the teacher hangs on the walls? I was writing as big as those letters. Let's say there is a line. My writing was not between the lines. They were over the lines. Now my writing, handwriting, is very good as I practiced a lot. Also I found meaning in my writing. (10, HA)

> It becomes a habit. Continuous writing. And you write better because of habit. (7, HA)

Table 11: *Students' ideas about what makes their writing better*

Categories	*f*	High achievers %	Average achievers %	Low achievers %
Writing activities (practicing, teaching tips, revising etc.)	11	30	29	60
Continuous writing	6	30	29	10
Technical progress	5	40	14	
Reading	4		14	30
Biological reasons	3		29	10
Total frequencies		10	8	11

The emphasis on the stages that are applied in process-based writing instruction was increased. The effect of continuous writing and progress in technical writing (writing more, beautiful, correct etc.) was mostly mentioned by high achievers. The effect of reading was indicated by low achievers especially students who think of themselves as not good writers:

> I read pretty much. This makes my writing better. I learn from a book and I like that. (9, LA)

Discussion

When children are reading and writing they are not just engaging in these activities they are also in the process of becoming a literate being as well. Literacy practices and the context of their learning environment became a benchmark for students' literacy identity development

(Johnston, Woodside-Jiron & Day, 2001). According to the findings of this study the students' literate identity was shaped by their involvement in the writing workshops. The students' successes in literacy and their perceptions of themselves also played a role in their engagement in literacy learning especially writing and identity construction. McCarthey (2001) also points to this issue saying successful, average and struggling readers have different perceptions influencing their identity development. Literacy plays a major role for avid readers in how they perceive themselves, whereas reluctant readers find other means of identity development and reading and writing were not a central issue for them.

Before discussing the effect of writing using the practices of a process approach and the perception of themselves through identity construction, there are some other conclusions that were highlighted as a result of the data analysis. First of all, the issue of learning and acquiring knowledge were discussed in detail by students when talking about the importance of knowing how to read and write. Technical rules like conventions, and accurate writing were considered important by all students. The effect of the traditional writing approach in the curriculum and the teacher's strategies and focus on teaching reading and writing in first grade, including control of the writing structure and the focus on the importance of conventions and marks of achievement, might be the reason for students to highlight these issues. Students' epistemologies and identities are influenced by their interaction with their teachers and teachers' epistemology about literacy and being literate (Martens & Adamson, 2001; Johnston et al., 2001). Secondly, struggling writers answered some of the questions as "I don't know." The successful students in writing offered more explanations about the issues and brought different viewpoints into the discussion.

Students' identities and writing practices

The students who were new to the writing workshop talked about the writing processes and practices in more detail. The writing workshop created spaces for students to grow as writers. When they are asked about what they know about being literate they revealed less information than when they were asked about their learning until the end of the year. In addition to that they expressed the social obligation for being literate is less when talking about the important things they learned.

The ongoing writing practices and the mini lessons through study units on different genres, and responses to others' writing and sharing, increased their knowledge about the purposes of writing and they became more aware of their writing processes. Students did not mention that writing also means sharing when they were talking about the reasons why people write. When they were explaining the important things they had learned so far, half of the students mentioned the sharing aspect of writing and they also mentioned the importance of writing as an effective and improving factor including different dimensions (being a tool for fun, problem solving, success etc.). The effect of writing on reading ability was mentioned prominently here as a result of reading and using mentor texts and books as a part of the program. They also gave importance to the content of the written pieces and discussed the practices involved while talking about the things that make their writing better.

Students' identity and writing performances

Teachers pose demands and the satisfactory results of those demands determine the direction the writer will take in future work and also through experiences, students think about their competence as good or not being very good readers and writers (Bourne, 2002). The practices might create new identities for students because struggling students pointed to the effect of activities and being hardworking for writing better than other students.

Personal abilities like being creative or intelligent were perceived as the primary sources of competence for writers especially for struggling students, however, the effect of personal abilities were decreased as a source of their own competence in writing. Students made a connection between ability and performance in writing. High achieving students perceived themselves as having higher abilities whereas struggling ones think that they have lower abilities to write well. As Dutro, Kazemi and Balf (2006) indicated, children's intellectual identity and their very personal ways of being potentially impact performance in writing.

Genre influences the writing proficiency of girls and boys. It is important to provide a multi-genre writing curriculum that allows students various opportunities to achieve success in writing because many aspects of student identity intersect with the specific requirements of particular genres (McPhail, 2008). Struggling writers addressed different forms of written expression such as, letter, review, procedural writing as their favorite genres. One of them especially noted that he likes to draw pictures to the texts. Integrating different forms of written expression gives a chance for struggling writers to develop their identities as writers in a positive way. The genres they talked about were shorter to write and have specific easy rules to follow for organizing the texts. It is important for students to express themselves in a broad writing curriculum. If the curriculum places more emphasis on narrative writing it may cause some students to think of themselves as unsuccessful in writing and develop writing identity along with this idea.

Hierarchical social structure like being a "good reader" (Christian & Bloome, 2004) or "popular writer" (Madden, 2010) affects students' interaction with others and they use this identity to their advantage. Struggling writers talked about revision more than other students and pointed to different dimensions. Some of them criticized the way of expressing ideas about a written piece especially the tone and voice of a person. They are comfortable when talking about their writing with their closest friends. High achiever students were criticized for being harsher when editing the pieces of struggling writers. One added revising is not a good thing. On the other hand, high achiever students complained that they feel inadequate when their friends criticize their drafts. In her case study West (2002) also concluded that being a low achiever means having limited access to literacy and being treated disrespectfully by others. She also said that struggling students feel more comfortable and perform better when working with a low performing peer. Rowe, Fitch and Bass (2001) also found that students whose literacy practices were valued have more power in the classroom and they try producing texts without help because students who need help are considered weaker readers and writers.

The importance of the context is emphasized mostly by high achiever students. Being free to choose topics and starting writing about the things they already know increased their willingness to write. Some of the struggling writers have negative feelings about this issue. They mentioned it is better to write about a given topic because it is hard for them to decide what to write about. They do not want to take risks about choosing the topic and tend to avoid writing about personal topics. An over-emphasis on the self-selection of topics in workshops is criticized by some scholars. According to Graham and Harris (1994) such a writing task would be very powerful and a starting point for beginning and struggling writers but may not be challenging enough to go further. Furthermore, Lensmire (1994) indicates that when we give students a chance to choose their own topic boys tend to write violent stories and girls tend to write fairy tales. He also noted that some of the students felt uncomfortable sharing their work with their peers because they are from a lower social status. In the case of this study the unwillingness of students to choose their own topic might be the fear of peer responses and the academic performances of students.

Conclusion

This study is limited in several ways. One of them, this study did not focus on other aspects of identity such as gender, social and economic status of children and also the role of family and out of school activities that have a potential to affect literacy identity development. The data were collected only from the interviews. Other alternative techniques to gather data like interviewing the teacher and a family member and further student interviews over the year to encourage them to talk about their sense of self as writers could be used. On the other hand the results of this study provide insights about the construction of the writer identities of young children who are learning to become writers. Instead of researching the construction of writing identity in depth through case studies and ethnographies of an intentionally chosen small number of participants, in this study a larger number of participants were chosen to contribute to this discussion.

Being and becoming writers in not an easy issue. Through literacy practices students develop and enact their identities as writers. If teachers want to help their students develop competent writer identities they need to consider the potential use of writing as a way to express themselves. Teaching writing as a process approach has a potential for students to see the different aspects of writing. As has been demonstrated from the findings of this study, literacy identity for successful and struggling students differs in some ways. Teachers need to provide different opportunities for reluctant students to identify themselves more with literacy practices and also develop other sub-identities that are valued in the classroom. Teachers may also use students' explanations as a mirror to look at their epistemological beliefs about literacy and being literate.

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Examining pre-service teacher views on the implementation of screen-based writing instruction

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Abstract

Today, as new technological developments continue to emerge, education, like many other fields, is going through major changes. Technological developments are causing changes to many common concepts. In particular, studies that benefit from technology in the field of education are becoming increasingly widespread, opening the door for the emergence of new teaching methods by abandoning traditional ones. New technologies, and computers in particular, can benefit the teaching of writing, the most complex of the four basic language skills (reading, writing, speaking, and listening). This study aims to explore pre-service teachers' views on screen-based writing practices via a course they attended. A qualitative case study method (holistic single-case design) was employed to explore pre-service teachers' views. The study participants were selected using a purposeful sampling method among 4th year students majoring in Turkish Language Teaching at a major state university. The study group consisted of sixty-two pre-service teachers who were enrolled in the "Written Expression" I and II courses in the 2013-2014 education year. The study was conducted both in Fall and Spring semesters. All writing activities were conducted in a digital environment. The study results revealed that a majority (77%) of the pre-service teachers favored continuation of the screen-based writing instruction. The study supported that digital literacy is important and the advantages of screen-based writing instruction outweighed its disadvantages. Screen-based writing activities should be integrated into the courses and instruction materials of pre-service Turkish teachers' education programs.

Keywords: Screen-based writing, Writing instruction, Digital literacy, Pre-service teachers.

Introduction

Although pen and paper have become less popular in daily life, the act of writing retains its importance. With the increased use of digital technologies, such applications have started to extend to the act of writing as well. People compose many text messages and electronic mails each day and create text files on their computers. Although it is argued that the technology we use for writing has negative consequences in some respects, it does provide opportunities that

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make life easier. This study focuses on pre-service teachers' views on screen-based writing activities. Activities at a written expression course were used as the main starting point for this research. This study bears importance because today's students use screen-based writing in daily activities as well as in their coursework.

As a concept, technology has largely been associated with the physical sciences. However, technology has always had a social aspect (Childe, 2007; Diamond, 2006; cited in Yigit, 2013) and affects social life in various ways. Postman (2006) states that technology is both a friend and an enemy, and for this reason, emphasizes that the positive and negative aspects of technology should be jointly addressed. In this regard, the concepts of "technological optimism" and "technological pessimism" are used in the literature. As a balanced approach between these two concepts, the concept of "technorealism" was proposed in the late 1990's (Kabakci & Odabasi, 2004).

Attempts to take advantage of technology in schools and integrate it with educational content have recently gained great importance (Morrison, Ross & Lowther, 2009). Computers have become such an important part of our lives that the younger generations, in particular, cannot envision life without them. According to Kress (2003), following a long era of dominance, writing has been replaced by visuals, and books with screens.

Postman (2006) links the emergence of technology into the school to the emergence of printed texts. From this perspective, one could suppose that the emergence of digital texts would result in a new type of education. Today, we have a great deal of proof demonstrating that elementary school students have advanced digital technology skills (Blanchard & Moore, 2010; Lewis, 2009). As students receiving education in their mother tongues are natives to the digital age, it can be argued that computers are also a candidate to play an important role in language arts education.

Writing in Electronic Environments

In language arts, writing falls under the category of expression skills (Coskun, 2013). Students' skills in written expression play a significant role in their educational careers. Insufficient skills in this area may cause students to fall behind in their educational program and fail (Amundson & Weil, 2001). In this respect, developing written expression skills is not only an issue of importance in Turkish education, but also in all other educational areas. Gedizli (2006) stated that one of the primary goals of written expression courses was to develop the ability to benefit from writing and the writing culture based on the needs of today's world. It would be apt to utilize the opportunities of the technological age to develop students' written expression skills. Considering the fact that today's students have been exposed to digital environments rather than books and notebooks makes the issue even more vital.

Today, nearly everyone can access closed source (e.g., Microsoft Office©) or open source (e.g., Open Office©) word processing programs (Jelderks, 2012). These and similar programs provide great opportunities for computer users when it comes to writing. The new technological writing tools are quite different from traditional reading-writing technologies (pencil, book, chalk, etc.) (Grabill & Hicks, 2005; Jewitt, 2005; Merchant, 2003, 2005, 2007; Tuzel, 2013; Yost, 2000). Computers have brought about significant changes to the traditional concept of writing (Ferris, 2002). However, computers are not tools for writing alone, and with the additional services they offer, they can change the writing process, products and context.

With recent changes to the structure of communication tools, we have seen that the act of writing in the electronic environment has become increasingly differentiated from traditional writing (Tuzel & Tok, 2013). In fact, while all relevant writing technologies suffice for the act of

writing itself, only some have a striking social effect (Grabill & Hicks, 2005). Such effects are enabled when writing composed in electronic environments is delivered to the masses through either print and distribution or online sharing. The recent development and proliferation of social media has strengthened these effects (Tok & Kucuk, 2014).

Printed texts and computers are among the primary tools used in education (Van Manen & Adams, 2009). In the initial period of computer technology development, the Instructional Technology Committee of the National Council of English Teachers emphasized that computers could be an important resource for teaching writing processes (Thomas, 1985). Since the time when computers first started to be used for writing, various studies have been conducted on developing digital writing skills. Some of these studies were carried out within the scope of the National Writing Project (NWP), which was implemented in 1974. In these studies, the focus has been on writing practices in electronic environments (www.nwp.org). The Center for Research on Writing in Digital Environments (WIDE) founded at Michigan State University in 2003 has also produced significant research on this subject. WIDE focuses on research related to digital writing and online writing (Grabill, 2005). In their evaluation of the study results, Grabill and colleagues (2010) exerted that some students have developed sophisticated rhetorical and literacy skills through these environments. They further explained that only focusing on the classroom use of such environments would undermine the importance of the issue. They further suggested that researchers and teachers could benefit immensely from a deeper focus on how students might integrate the use of such sites and practices into their daily lives.

Additionally, Santos and Leahy (2014) suggested that writing for the real world and online communities should not be such different practices. They employed a post-pedagogical model for English writing class and concluded that what is labeled as valuable in students' writing depends on the community's definition of valuable. They further noted, "In the act of building an audience, students not only pursue popularity, but also play an active role in establishing the standards by which their writing is to be assessed" (p. 92). Dyehouse, Pennell and Shamoon (2009) consider an electronic writing environment as an opportunity to improve writing programs. They specifically noted, "Teaching writing in electronic environments also means encouraging our students to conceive of better spaces for the kinds of digital writing that they—and others—might eventually want to practice" (p. 330).

In his analysis of the National Digital Literacy Narrative Project (NDLN), Bradbury (2014) focused on the detailed experiences of three students in digital writing environments. He noted that all three students agreed on the invaluable benefits of the project for their writing practices using environments in which they had no previous experiences. He focused on the benefits of analyzing public rhetoric on technology and its impact on literacy practices. Participants commented that they learned how to use the technology together, and that writing while using the visual materials and connecting with others provided infinite possibilities. Bradbury suggested that teachers should explore their computer pedagogies to support better student learning. He agreed with Selber (2004) and suggested that educators needed to "incorporate even more opportunities for students and teachers to recognize computer literacy as a 'social practice' and to elevate our discussions beyond why and how to use technology to teach literacy" (p. 66). Thus digital writing has become an important aspect in the teaching and learning processes of today. Students and teachers should explore ways to incorporate such practices in the educational environments.

According to Burnett and Myers (2006), screen-based texts can easily be changed and used, and such editions can have a greater impact on writers' textual experiences. Writing on a screen not only includes words, but also images, videos, links, sounds and animations. It involves

different physical relationships with the text. It leads writers to an awareness of the visual effect of their work. It unites the relationship among screen, keyboard and mouse, and the appearance of the text onscreen makes it easier to present the work for others' comments.

Students' interactions among themselves and with the teacher are significant issues in the process of writing education. In computer-supported writing education, students can easily access what their peers are writing by viewing the texts onscreen or printing them, state their opinions, discuss each other's writings, and receive and provide feedback (Montague, 1990). All these interactions can make valuable contributions in terms of creating an effective writing environment.

Aim of the Study

This study aimed to reveal pre-service teachers' views on a screen-based writing course that they attended and the methodology used. The following research questions were posed in connection to this aim:

a.   What are pre-service teachers' views on the advantages of screen-based writing instruction practices?

b.   What are pre-service teachers' views on the disadvantages of screen-based writing instruction practices?

c.   What are pre-service teachers' views on the process of screen-based writing instruction?

Method

Research Design

The present study employed a holistic single-case design, one of the qualitative case study designs. In case studies, the focus is on a limited system that is to be examined and described (Merriam, 2013). In holistic single-case design, there is only one unit of analysis (Yildirim & Simsek, 2014). As this study aimed to reveal the post-implementation views of pre-service teachers who received screen-based writing instruction in the courses Written Expression I and II, it was decided that the holistic single-case design would be most suitable.

Participants

The study was conducted with the participation of 62 pre-service teachers studying in two different classes at Canakkale Onsekiz Mart University. The participants consisted of 34 female and 28 male first year students majoring in Turkish language education. A typical case sample is a type of purposeful sampling, and this was used in the selection of participants. In typical case sampling, when introducing a new application or innovation, typical cases are selected from the environment where the novelty is introduced or the application is conducted (Yildirim & Simsek, 2014). Therefore, the sample consisted of pre-service teachers who received screen-based writing instruction.

The data was gathered over two semesters with two groups of students. Thus participant triangulation as well as time triangulation was used to improve trustworthiness. According to Cresswell (1998), there are eight verification techniques: (1) prolonged engagement and persistent observation, (2) triangulation, (3) peer review or debriefing, (4) negative case analysis, (5) research bias clarification, (6) member checks, (7) rich and thick descriptions, and (8) external audits. Additionally Cresswell (1998) noted that a researcher should use at least two of these procedures in a given study. This study employed four of these techniques, which are emphasized in italics (Items 1, 2, 6, and 7). While rich and thick descriptions refer to

transferability, prolonged engagement, triangulation and member checks deal with the issue of credibility. Triangulation can be accomplished in various ways. One of these is data triangulation, that includes (a) time triangulation, exploring chronological influences by longitudinal and cross-sectional designs; (b) space triangulation, using two or more settings as the research focus (becomes comparative); and (c) person triangulation, using different groups or individuals in gathering data. This study used two groups of students over a years' time and member checks were conducted to improve credibility.

Instruments and Data Collection Process

The data was gathered via the use of short interviews along with an open- ended form to express their views on digital writing and courses incorporating digital writing practices. The interviews and the completion of the forms took place at the end of the courses for both groups. Thus, students were given a chance to see the full advantages or disadvantages of digital writing activities. A total of 62 pre-service teachers completed the form. Short interviews took place after the class and lasted approximately five to ten minutes for each participant.

Data Analysis

The forms and interview notes were transferred into electronic texts and analyzed using content analysis. In content analysis, themes are formed based on the data collected. The content analysis technique requires coding the data and grouping codes with similar characteristics under categories or themes organizing and subsequently interpreting these themes in a way that is easy for the readers to understand (Yildirim & Simsek, 2014). In the study, the forms were completed by the pre-service teachers after the course and the interview data were examined in-depth. Themes were formed based on various patterns and links, and interpretations were made accordingly.

Findings

Findings and Interpretation Related to the Advantages of Screen-Based Writing Instruction

As a result of analyzing the pre-service teachers' views on the advantages of screen-based writing instruction, 11 categories were revealed. These categories are presented in Table 1 together with their frequency values.

Table 1. *Advantages of screen-based writing instruction*

Categories	*f*
Shareability	33
Practicality	26
Being Economic	23
Computer skills development	20
Future usability	18
Seeing spelling mistakes	16
Saving time	15
Writing in an orderly/grammatical manner	9
Writing legibly	5
Motivation to write	3
Physical ease	2

Shareability

According to the results obtained based on the pre-service teachers' views, shareability (*f*=33) ranked first among the identified advantage for screen-based writing instruction. The pre-service teachers expressed positive views about the fact that their own writing and that of others could be discussed and analyzed by using a projector in the classroom. Some of their views are indicated below:

> *The courses taught through computers is more suitable. In this way, we can better see our mistakes. Since we are open to any kind of criticism, we can produce better work when we rewrite. I believe that the reflection method is more successful in the course. (S33)*

> *It enables us to analyze the texts in the classroom. Everybody can see and make comments on what is written. This helps us to develop ourselves. (S36)*

> *You can share what you write with a large group with computer assistance. There is an opportunity to hold discussions with the entire group. I believe it is beneficial when my writing is shown [in this manner]. (S37)*

One of the aspects of a digital environment that comes to the fore is that it provides an opportunity to share. In this regard, the participants also attached great importance to the sharing of their written works. Using a digital environment enabled them to see their strengths and errors as well as those of others, and they were able to better develop their writing skills.

Practicality

According to the pre-service teachers' views, the practicality feature of computer-based writing instruction was ranked second, with a frequency of 26. The participants stated that the features that made their work easier provided practicality. Some of the pre-service teachers' views on this issue are as follows:

> *In this way, editions can be completed more quickly and easily. (S28)*

> *Screen-based writing is easier and more fluent for us. (S34)*

> *I say that processing texts on computers is more suitable in terms of the ease of deleting what you write, storing information, and reaching a larger group. (S57)*

In the active lifestyle of today's world, people are usually interested in practical solutions that make life easier. The reason for the high rate of preference for screen-based instruction could be that it provides significant practicality and facilitates the writing process.

Being Economic.

The feature of being economic (*f* = 23) was in third place among the participants views on the advantages of screen-based writing instruction. Issues such as "time-saving" and "preventing paper waste" were stated. Some pre-service teachers' comments are indicated below:

> *The positive features include not wasting paper, and it is easy to store files. (S13)*

> *It's cliché to say it, but no trees are harmed. (S19)*

> *In this way, we prevent the waste of paper. (S33)*

It is understood that most of the participants, as natives of the digital age, regarded the usage of pen and paper as wasteful. For them, digital environments have economical features in terms of both materials and storage.

Computer Skills Development.

Positive advantages cited also included the development of computer skills, with a frequency value of 20. Specifically, the pre-service teachers stated that they learned various features of word processing programs that they did not know about, noting that this was quite beneficial for them. In addition, there were participants who asserted that such features developed their general computer use skills. The views of pre-service teachers regarding the development of computer skills include the following:

> *In this course, I learned the programs that are necessary for writing on a computer. (S44)*

> *Before taking this course, I didn't know how to write on a Word document. I learned many things by doing and trying here. (S39)*

> *One of the advantages is that those who don't know how to use Word learned it in the class. (S21)*

Apparently, most pre-service teachers did not know about the features included in the Word program. As they exposed to these advantages, they were more inclined to prefer screen-based writing. It was observed that most of the participants who did not know how to use such computer programs, learned many features during this course.

Future Usability.

Almost one-third of the pre-service teachers (f=18) stated that they could use screen-based writing in their professional lives. Some of the participant views related to this category include:

> *I think adapting to today's world of technology will be useful for us when we start the teaching profession in the future. (S1)*

> *It is a great advantage that most work is now done in a computer environment, and we prepare for this in our education. (S30)*

> *Learning how to use Word here is an advantage since it will be necessary for us in our future lives. We not only receive writing instruction, but also learn the program. This is beneficial for us. (S61)*

One of the aims of providing technology-supported education to pre-service teachers is to enable them to make use of these technologies in their classrooms when they become teachers. From this perspective, it is noteworthy that 18 pre-service teachers stated they would adopt this implementation in their future teaching.

Seeing Spelling Mistakes.

One of the areas in which pre-service teachers' encounter difficulty is spelling rules. Although there are certain rules, memorizing them along with some exceptions is a point of difficulty for many students. According to the participants' views, one advantage of screen-based writing instruction was being able to see their spelling errors. The reason is that most word processing programs have features such as underlining and highlighting misspellings. The following statements were provided by the pre-service teachers regarding this issue:

> *We can easily notice spelling mistakes and correct them. (S20)*

> *We learned to conduct a better evaluation of writing, which usages are wrong, and what shouldn't be used. (S12)*

> *Enabling us to easily notice grammar mistakes is among the advantages. (S25)*

While writing in electronic environments, pre-service teachers can avoid spelling mistakes that they might otherwise overlook. Therefore, they did not encounter any problems with this application and also learn the correct spellings.

Saving Time

Some of the pre-service teachers (f=15) indicated that writing on a computer saved time. Examples of the pre-service teachers' views include the following:

> *It is astute to prefer a computer because it saves time. (S18)*
>
> *Instead of starting from scratch when we make a spelling mistake on paper, we use the delete key and don't lose much time. (S19)*
>
> *Since the age requires electronic environments, it is easier and faster to write on a computer. It saves time. (S44)*

One of the characteristics of digital natives is that they become easily bored with what they are doing. The time that digital environments save in terms of writing is appealing to them.

Writing in an Orderly/Grammatical Manner

One important advantage of word processing programs is that page layout can be organized as desired. Nine of the pre-service teachers indicated this advantage with the following statements:

> *We can write in a more orderly fashion while creating a text on a computer. (S23)*
>
> *The ease at which you can set text, font, and page organization is an advantage. (S26)*
>
> *I learned how to embellish the appearance of text. I started to be more careful about details such as centering the text, line spacing, and text fonts. (S39)*

With the various tools in word processing programs, it is possible to create the desired order and shape of the text. This is a convenience for pre-service teachers.

Writing Legibly

One of the problems that pre-service teachers face is students who do not write legibly as well as their own ability to write legibly. This is a difficulty for teachers who read student texts. Since standard characters are used in word processing programs, being legible is a prominent feature. Five of the pre-service teachers emphasized this particular issue. Given below are some examples of the participants' views:

> *Since I have difficulty writing properly, writing on a computer is more suitable for me. (S9)*
>
> *This resolves the problem of having a bad handwriting. (S42)*
>
> *I think that education should be computer-supported because writing on a computer is both easier and more orderly and legible. (S53)*

Those pre-service teachers, in particular, those with poor handwriting, preferred the standard writing style produced in a computer environment.

Motivation to Write

Three of the participants stated that screen-based writing motivated them to write and made them love writing. They stated the following:

> *With the computer-supported writing course, my concerns about writing disappeared. I started to love writing. (S32)*
>
> *I gained the habit of writing with computers. (S29)*
>
> *It helps us to focus our attention on the lesson. It motivates us. (S45)*

Motivation is one of the prominent elements of writing. In this sense, three of the pre-service teachers stated that writing in a computer environment motivated them to write.

Physical Ease

Two of the pre-service teachers said that screen-based writing reduced physical fatigue. They provided the following statements regarding this issue:

> *Although computer-supported writing is faster, it reduces physical tiredness. (S17)*

> *By this means, we develop writing on a computer and also our wrists don't hurt as they do when writing by hand. (S56)*

Digital environments provide physical ease in writing, as in many other areas. Two of the pre-service teachers pointed out this issue.

Findings and Interpretations Related to the Disadvantages of Screen-Based Writing Instruction

Nine categories were revealed based on the participants' views on the disadvantages of screen-based writing instruction. According to the results, the advantages of screen-based writing instruction outnumbered the disadvantages. While some participants stated that there were no disadvantages, some indicated more than one disadvantage. The nine categories and their frequency values are presented in Table 2.

Table 2. *Disadvantages of screen-based writing instruction*

Categories	f
Problem of obtaining a computer	16
Adaptation problem	12
Technical problems	10
Health problems	6
Receiving negative criticism	6
Disappearance of paper culture	3
Loss of attention	2
Perceiving its applicability as low	2
Plagiarism	1

Problem of Obtaining a Computer

Some of the pre-service teachers (f=16) stated that they had difficulty in obtaining personal laptop computers, while some verbalized this problem on behalf of their friends. The fact that this study was conducted at a state university with a student demographic of a medium socioeconomic level can be seen as the reason for this situation. Participants' views include the following:

> *For me, the disadvantage was that I didn't have a computer. So I had some difficulty, but I handled it anyway. Besides that, it didn't have any disadvantages. (S2)*

> *There was a problem for those who don't have a computer and Word. (S14)*

> *I think the only disadvantage was the difficulties that our friends who didn't have a computer experienced. Apart from that, there seems to be no disadvantage. (S47)*

Some of the pre-service teachers who participated in the course without owning a computer said that it negatively affected them.

Adaptation Problem

Twelve pre-service teachers stated that they had difficulty in adapting to the implementation. Some participant indicated the following:

> *I can't say there are no difficulties. There are things that I can't do since I don't know them very well. (S19)*

> *Not everybody's computer competency is the same. Some of the students may have more difficulty in adapting to the computer. (S39)*

> *Since we don't have a good command of computers, we make many mistakes. It is a little bothersome that others see our mistakes in the classroom. (S57)*

Some of the pre-service teachers that had no previous familiarity with screen-based writing activities were observed to have adaptation problems. This can be due to fact that their computer skills were not at a sufficient level.

Technical Problems.

Ten of the pre-service teachers identified technical problems as the top issue they experienced in screen-based writing instruction. Some of their views are indicated below:

> *As a negative side, I can only mention the problems due to some programs. (S13)*

> *When there was an electrical problem, the lessons were disrupted. (S26)*

> *Sometime there are technical problems that don't have anything to do with us. What we write does not show up or can be deleted. (S35)*

One of the common issues encountered with electronic devices is technical problems. Such problems are also experienced while using computers. Examples of these problems include electricity outages/running out of battery power, and problems due to the computer processor and software programs.

Health Problems

Electronic devices are known to cause various health problems. In this regard, it is possible that depending on the context and conditions, some health problems can be experienced in studies conducted with computers. Examples of health problems that some of the pre-service teachers (*f*=6) stated that they had are provided below:

> *It is harmful to be exposed to the light of a computer screen for a long time. Our eyes get tired quickly. (S7)*

> *It causes physical tiredness. Especially in the eyes. (S15)*

> *It is not good for us to be exposed to radiation while studying. (S59)*

Some of the pre-service teachers encountered health issues in the process of screen-based writing instruction. Various arrangements, such as the usage of screensavers and devices that reduce radiation, can be arranged to prevent these problems.

Receiving Negative Criticism

In the course, samples from the texts written by the pre-service teachers in a computer environment were projected using a projector, allowing the faculty member and all the students to critique the texts. This aimed to help the pre-service teachers produce better work by seeing their weaknesses and strengths. However, some of the pre-service teachers (*f*=6) stated that they did not feel comfortable receiving negative criticism. Some of the statements on this issue are:

The disadvantage is that our writings were subjected to criticism, and as a result of this, I tried to be perfect, and felt weary of writing when unable to accomplish this. (S25)

I don't really like my writing being read by everybody and criticized. (S43)

Those who are not open to criticism can be hurt. (S54)

Since there is a work that is produced and shared, there will certainly be criticism. The fact that some pre-service teachers were not open to criticism brings up the possibility that they had not been criticized much, or had previously received only positive feedback. It is important for pre-service teachers to receive criticism and for their work to be evaluated to normalize this situation.

Disappearance of Paper Culture

Three pre-service teachers indicated that the use of current technology in writing instruction weakened and destroyed the traditional paper-based culture. Below are the statements of these participants:

Computers keep us away from paper. Being into technology may weaken our old values. Of course, it has advantages, but these disadvantages should not be underestimated. (S5)

I think it would be better if we wrote on paper. People may not convey exactly what they think on a computer. Paper has a unique place. It is not appropriate to abandon it for good. (S29)

Its disadvantage is attaching secondary importance to pen and paper. However, we think of pen and paper when it comes to writing. (S30)

As technology entered human life very quickly in the last century, it also caused old technologies and traditional structures to disappear. Some of the pre-service teachers emphasized these values.

Loss of Attention

Two participants stated that screen-based writing led to loss of attention. Their views related to this issue are as follows:

Going on the Internet while writing distracts me. (S7)

I can experience distraction problems during the lesson. (S18)

The multi-functional aspect of the computer environment may cause users to be distracted by something while doing something else. Some of the pre-service teachers were affected by this situation.

Perceiving its Applicability as Low

Two of the pre-service teachers expressed that while they had positive views about the course, they believed that they would not have a chance to replicate this implementation. Their views are as follows:

Teaching with computer support is a good practice to adapt to the times. It is a positive development for us to be into technology. However, when we start the profession, we will have to provide paper-based writing instruction. (S16)

This implementation is good, but we won't have the facilities to teach writing like this in the future. (S50)

Because some pre-service teachers thought that they would not have the facilities necessary to implement this process in their professional lives, they see the possibility of using this practice in the future as low.

Plagiarism

Access to the Internet has brought about many challenges. One of the results of such problems in education is plagiarism. One of the participants pointed out this particular problem:

> *Unfortunately, using computers can yield texts that are merely copied and pasted. (S46)*

It is known that some pre-service teachers try to present texts that are produced by using the "cut/copy-paste" features as their own works. In this regard, plagiarism detection programs might present a solution.

Findings Related to the Screen-Based Writing Instruction Process

In the open-ended surveys, participants were asked to state their opinions on whether the screen-based writing instruction should continue. A majority of the 62 participants (f=48) said the writing instruction should continue as screen-based. While ten participants preferred to be taught using a paper-based approach, four participants stated that such courses should be both paper and screen-based. The frequencies are presented in Table 3.

Table 3. *Views related to the screen-based writing instruction process*

Categories	f
Those preferring screen-based writing instruction	448
Those preferring paper-based writing instruction	110
Those preferring that paper and screen-based writing instruction be combined	44

Those Preferring Screen-based Writing Instruction

In the following section, some examples from the views of participants stating that the screen-based implementation should continue are provided:

> *For writing, the computer environment is more suitable. It has more advantages in terms of time and speed. We also see and read what our friends have written. We couldn't see many examples if it was on paper. The computer environment yields more positive results for sharing texts academically or in any other fields. (S22)*

> *I think that it is more suitable if the course is taught through computers. If what we learn only stays on paper, we would have received an outdated instruction, and it is possible that we would be in a difficult position against our target crowd. (S26)*

> *With the computer writing course, my concerns about writing disappeared. I started to love writing. The course should be given in a computer-based manner. (S32)*

> *I think this course should be computer-based because writing on a computer is both easier and more orderly and legible. After all, the age is the technology age. We should get the most out of the benefits of technology. (S53)*

As a result of the study, most participants (77.4%) stated that the screen-based writing instruction should continue. The aspect of screen-based writing that the pre-service teachers generally found positive was its sharing dimension. Additionally, they also viewed screen-based writing instruction as a method suitable to the conditions of the age.

Those Preferring Paper-based Writing Instruction

Ten of the pre-service teachers stated that writing instruction should continue in a paper-based manner. Given below are examples from the statements of such pre-service teachers:

> *It should be continued on paper. However practical computers are, there are students in the class who don't have a computer or have a faulty one. (S12)*

For me, using paper feels like we write something, drop a line. Writing down my thoughts on paper speeds up my writing process. (S3)

I would prefer writing on paper since I normally prefer paper. However, writing on a computer is easier. (S34)

The joy of writing on paper is something unique. Personally, I write on paper before I write on a computer. However, not everyone could have seen the texts if they were on paper. (S48)

The reason for some of the pre-service teachers preferring paper-based writing could be computer-related problems. In general, the pre-service teachers also expressed that computer-based writing instruction had advantages in different ways.

Those Preferring a Combination of Paper and Screen-based Writing Instruction

Only four participants preferred a writing instruction methodology in which paper and screen-based writing were combined. The statements of these participants include the following:

Although it is suitable to teach in a computer-based manner, it would be better to do so in conjunction with paper-based writing. (S1)

A computer is very good for reflection. Because you understand better both visually and orally. However, I know that those without a computer had difficulty. It would be better if both of them were possible. (S15)

I think writing instruction in which both paper and computers were used could be better. (S20)

Both can be used together. It is easier to show written work in a computer environment; that's why I say computer. There can be technical problems; that's why I say paper. But again I say computer in terms of the ease of deleting text and of storage, and also sharing with large groups. (S37)

Only a small number of pre-service teachers expressed that both paper and screen-based writing could be implemented together.

Discussion, Results and Recommendations

Discussions arguing that digital screens are gaining more importance and fulfilling more functions have been expanding (Livingstone, 2002). Grabill (2005) points out the importance for all writing teachers to use various information technologies such as computers. Considering the present study, it can be argued that 77.4% of the participants held the same view.

Digital literacy is a concept that has come to the fore in today's educational world. It is understood from the pre-service teachers' statements that screen-based writing instruction has made a positive contribution to their digital literacy skills. The views of those who preferred screen-based writing instruction can be summarized as "adapting to the conditions of the age" and "making use of the benefits of technology".

One indispensable stage in the writing process is evaluation. It is more useful in terms of appraisal for written works to be evaluated by many people. One of the most important stages of the practices in the National Writing Project (NWP) was having students share what they wrote (Liebermann & Wood, 2003). In this study, the pre-service teachers ranked sharing their written works (*f*=33) at the top of the list of positive features, consistent with NWP practices. In addition, Tuzel and Tok's study (2013) indicated that sharing the writing in a digital environment was among the top positive features of digital writing. This result is also consistent with the results of this study.

Graham and Perin (2007) state that writing can be used as a tool to teach the contents of written materials. In this sense, one of the prominent study results is that nearly one-third of the pre-service teachers (f=20) stated that their computer skills had been further developed as

a result of this implementation. Morrison, Ross and Lowther (2009) conducted a study using a mixed method in a high school for three years. Each student was provided with a personal laptop computer and wireless Internet access for 24 hours. The NTeQ model developed by Morrison and Lowther (2005) and based on teaching with personal laptop computers was used in the study. The study results included an observable development in the pre-service teachers' computer skills as well as their writing skills.

The Ministry of National Education determined one of the five skills included in the elective course, Writing Skills, to be "making use of the benefits of technology in writing". These skills taught as an elective course in middle schools as of 2012 were seen as an important need at the undergraduate level in this study. Furthermore, considering that the participants were pre-service teachers, it can be argued that they went through an important implementation in terms of the teaching process.

As a result of his study at a US school, Norris (2012) recommends a hybrid model of writing instruction incorporating both paper-based and digital technologies. In the current study, a small number of pre-service teachers ($f=4$) were found to prefer both paper and screen-based writing instruction; however, the majority of participants preferred digital or screen based writing exclusively. Thus this study produced different results from Norris's findings and extends the use of digital writing as a major technique for use in classroom activities.

Gogus (1978) emphasizes spelling education as an important step in written expression. He lists the correct spelling of words and spelling rules among the objectives of spelling education. As a result of the computer-supported writing instruction, 16 participants stated that screen-based writing reduced spelling mistakes, and five said that it enabled legible writing.

In his study on the digital technology usage of English teachers teaching writing, Razali (2013) points out the importance of organizing the course contents of writing instruction with the inclusion of technological elements. According to him, students who are digital natives are more inclined to write in electronic environments. A course environment in which technological tools are used would both motivate them and enable teachers, who are mostly digital immigrants, to renew themselves by learning these technologies. Furthermore, this study also supported the claims of Youngquist (2003) who investigated students' electronic writing skills, and claimed that technology, when integrated into writing classes, contributes to a better quality of work among students. Participants in this study also agreed that digital writing would help improve their writing skills, save time in writing, and share ideas. Paper waste and economically viability were additional findings in this study that most researchers did not address.

Today's technology can be used for positive purposes, although there are some negative aspects. Particularly, the significance of technological support in education has been the focus of many studies in the West. In this study, it was found that according to participants' views, the advantages of screen-based writing outnumber its disadvantages. It can be argued that the fact that a considerable number of the participants ($f=48$) preferred screen-based writing instruction, can be a starting point to explore and incorporate screen-based writing practices in various courses. Furthermore, the study supports the clams of other researchers that argue for a digital writing environment in instruction as well as in students' daily lives.

Based on the results of the study, students became more comfortable with digital-writing practices as they continued to use it. While this is a case study and generalizations based on pre-service teachers would not be appropriate, it is important to note that pre-service teachers in Turkish language education might benefit from the inclusion of such contents and activities

in their course work. As is the nature of case studies, more studies with various groups would help explore the issue better and provide a greater understanding.

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Restorative justice:
a changing community response

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Abstract

Our purpose herein is to demonstrate how restorative justice continues to unfold globally and we explain how the use of a restorative justice ideology and intervention leads to a common alternative, not only in criminal justice institutions, but also within social agencies, such as elementary schools, and the related social support systems. We draw attention to this emerging trend via current research and resources that enable us to put forward a definition, theoretical background and list the characteristic traits of this alternative mode of life consequence. Finally, we argue that the use of restorative justice in schools is a focus that is really a paradigm shift within the landscape of the educational enterprise.

Keywords: School discipline, Student conduct, Restorative Justice

Introduction

In several countries such as New Zealand, Australia, Chile, Canada, and Brazil the use of restorative justice ideology and intervention has developed to become a common alternative not only in the criminal justice institutions, but also within social agencies such as elementary and secondary schools, and the social support systems (McCluskey, Lloyd, Stead, Kane, Riddell, & Weedon, 2008). To draw attention to this emerging trend we define restorative justice, its theoretical background and list the characteristic traits of this changing alternative mode of life consequence. The use of restorative justice in schools is a focus that is presented as a paradigm shift within the landscape of the educational enterprise.

Historically within education there have been numerous theories and strategies applied in order to deal with student misbehaviour, classroom management and school climate (Lockhart, & Zammit, 2005). Within Canada, specifically Ontario, we report that up until February 2008, we were legislated to enforce a "zero tolerance" policy in our schools (Ontario

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Ministry of education, 2007), as there were mandatory suspensions and expulsions for certain infractions of the policy. In February 2008, the Ontario provincial government amended the Safe Schools Act and everything changed. No longer were we dealing in absolutes and fact; we were dealing in all shades of gray within context. Suspensions and expulsions were no longer mandatory and administrators now had to consider a number of factors prior to suspending. Included in these factors was whether or not progressive discipline has been used.

Progressive discipline is a whole-school approach that utilizes a continuum of interventions, supports, and consequences to address inappropriate student behaviour and to build upon strategies that promote positive behaviours described above. When inappropriate behaviour occurs, disciplinary measures should be applied within a framework that shifts the focus from one that is solely punitive to one that is both corrective and supportive. Schools should utilize a range of interventions, supports, and consequences that include learning opportunities for reinforcing positive behaviour while helping students to make good choices. (Memorandum, 2007)

With this Ontario provincial government shift in philosophy when it came to student discipline, school boards and administrators had to look for new ways to work with all students. One of the options that existed was the application of a restorative justice way of life within the framework of school discipline.

Restorative Justice Defined

When a student commits a wrongdoing within a school community or within the greater community, how is it handled? Does the punishment fit the crime? "The criminal justice system is concerned about holding offenders accountable, but that means making sure offenders get the punishment they deserve. Very little in the process encourages offenders to understand the consequences of their actions or to empathize with victims" (Zehr, 2002, p. 16). Is there another way to deal with the wrongdoing? There are many different ways to define restorative justice. Zehr (2002) defines restorative justice as "a process to involve, to the extent possible, those who have a stake in a specific offense and to collectively identify and address harms, needs, and obligations, in order to heal and put things as right as possible" (p. 36). Lockhart and Zammit (2005) suggest:

It is a valued-based approach to responding to wrongdoing and conflict, with a balanced focus on the offender, victim, and community. Restorative justice focuses on transforming wrongdoing by healing the harm, particularly to relationships, that is created by the harmful behavior. (p. 7)

The guiding questions when using a restorative approach, either formally or informally include the following:

1. Who has been hurt?

2. What are their needs?

3. Whose obligations are they?

4. What are the causes?

5. Who has a "stake" in this?

6. What is the appropriate process to involve stakeholders in an effort to put things right? (Stutzman Amstutz & Mullet, 2005, p. 14)

The common theme between the two definitions is that restorative justice brings the person who created the harm together with the person or persons who were impacted by the harm. This is in stark contrast to what, historically, we would do in an Ontario school setting - through a suspension or an expulsion, we would remove the student that caused the harm to the school community and, at no time, would we ever give the victim a voice. By changing this focus, restorative justice brings the person who committed the harm closer to the community by allowing them to make reparation for the harm caused.

When we look at things with reparation in mind, we gain a better appreciation for the problem that exists with the traditional punitive model. Zehr (1995) reports clearly via lists within a pragmatic chart under the heading "Understandings of Crime", it is also very relevant to an educational setting. He breaks it down into a comparison chart between a "retributive lens" and "restorative lens".

Retributive Lens

Crime defined by violation of rules (i.e., broken rules)

Harms defined abstractly

Interpersonal dimensions irrelevant

Conflictual nature of crime obscured

Wounds of offender peripheral

Offense defined in technical, legal terms

Restorative Lens

Crime defined by harm to people and relationships (i.e., broken relationships)

Harms defined concretely

Crime seen as categorically different from other harms

State as victim

State and offender seen as primary parties

Victims' needs and rights ignored

Crime recognized as related to other harms and conflicts

People and relationships as victims

Victim and offender seen as primary parties

Victims' needs and rights central

Interpersonal dimensions central

Conflictual nature of crime recognized

Wounds of offender important

Offense understood in full context: moral, social, economic, political. (p. 184-185)

In order to apply this chart to an educational setting, one would only have to change the word "crime" to "incident". When an incident occurs, the restorative model allows for all of the stakeholders in the school community, on both the side of the victim and that of the offender, to be treated equally and fairly, and for their feelings and opinions to be openly communicated. Thus the relationships that are necessary for students, teaching staff, administrators, support staff, and parents to be able to work together in the future are then more easily repaired. The retributive model forces distance between the offender and the victim, and between them and the school community. The restorative model forces all parties to bridge the distance created during an incident and allow for healing to begin.

Theoretical Background: Restorative Justice

When reviewing current literature, the origins of this mode surface in a unique and surprising manner. Most researchers may conclude that most of the principles of restorative justice come naturally to some people. For example, if a child of mine threw a rock and hit a neighbor's window, how would I react? Instinctively, I would march them over to the

neighbor's house, have them apologize, explain the actions, and have them let the neighbor know how they intend to pay for the broken window. In addition, they would have to earn my trust back prior to letting them out of the house again. This seems to match closely with the definitions of restorative justice that have been previously stated. Surprisingly, the formal concept of restorative justice came out of victim-offender reconciliation in New Zealand. The key moment came in 1989 when the Children, Young Persons and their Families Act came to pass and they began using a modified Maori circle in juvenile court. What they found was that by using this alternative program many court trials were averted and settled. In addition, those that were most affected by the crime - the victims - were involved in the process. In 1991, the program was then brought to Australia and a program was developed in the city of Wagga Wagga. By 1994, formal conferencing began to spread into other sectors of society, including education (Lockhart & Zammit, 2005, p. 49).

Canada

In Canada, there have been a number of different models of restorative justice. The aboriginal people have used healing circles within their community. In 1974, initiatives from the Mennonite Church in the Kitchener-Waterloo region started the first victim/offender mediation program. There have also been Family Group Conferencing models, originating from the New Zealand model, which started happening in 1981. One of the largest programs in Canada, the Manitoba Mediation Services, handles up to 400 mediations per year (Lockhart & Zammit, 2005, p. 49-50).

Although New Zealand started to incorporate restorative justice into its school communities in 1994, Canada has had a much slower start. Lynn Zammit and Art Lockhart created the first school board training for the Toronto District School Board, based on the New Zealand Family Group Conferencing model, in 1995 (Lockhart & Zammit, 2005, p. 50). There have been numerous workshops and professional development sessions put on by various school boards to introduce this concept to both administrators and staff. In June 2008, the Near North District School Board situated in Northern Ontario fully trained all administrators to become restorative justice facilitators. The shift in provincial legislation has helped to put this philosophy in the spotlight in the education field. The authors were fortunate enough to attend the International Institute for Restorative Practices World Conference on October 22nd – 24th, 2008 in Toronto, Ontario. We were amazed that I was able to network with educational colleagues from around the world and, in particular, around the province and see how they are shaping their own philosophies around the new legislation.

Community

In all of our research concerning restorative justice, and the philosophy behind it, the central theme is always community. Wachtel (1997) defined community succinctly:

Community is not a place. Rather, it is a feeling, a perception. When people see themselves as belonging to a community, they feel connected. They have a sense of ownership and responsibility. They feel they have a say in how things are run and a stake in the outcome. (p. 193)

When there is friction or conflict within that community, which is inevitable, a restorative approach tries to use that conflict as learning and a healing experience. This concept of community is not without critique.

Restorative justice approaches to community safety and non-social behaviours, as argued in the literature, rejuvenate the notion that the 'community' has a very real interest in what is

happening to its members. However there can be a pronounced naivety or romanticism about 'community' within much restorative justice literature. (Verity & King, 2008, p. 474)

This can be viewed as exclusion and a challenge to the process that is often common with right wing political groups. An example of this would be the Ontario zero tolerance Safe Schools Act which simply punished and did not educate which emanated from within the Ontario Progressive Conservative political party of the 1990's.

Central to the community ideology is variable of relationships. We now know that "strong institutions that develop genuine positive relationships within the nexus that sustains individual and collective life seem essential to our capacity to build a civil society" (Morrison, Blood & Thorsborne, 2005, p. 336). Using the restorative philosophy, built on relationships, contributes to the shift away from punitive and moves towards the supportive. "What have more recently emerged is the recognition that restorative practice also needs to be proactive, immersing the school community in a pedagogy that values relationships and a curriculum that values social and emotional learning" (Morrison et al., 2005, p. 338). As an educational system, I often think that relationships take a back seat to the curriculum. Biffis and Lockhart (2008) add,

it's the students, staff, parents and friends who make each day worthwhile. Imagine the smiles, the hugs, the camaraderie to achieve common goals; rising to challenges, overcoming obstacles and setting new directions. That's the feel good stuff and it's the feel good stuff that forms the very heart of all relationships. (p.19)

We believe that if you put the relationship ahead of the curricula, the entire curriculum will positively balance within a healthy climate.

*Global Paradigm Shift in Education*

Restorative justice has been implemented within many countries and is now embedded into many schools globally. The unfolding of this mode is very much dependent upon the leadership of the country, Ministry of Education and school board or district and ultimately, the administration of the particular school. In 2004, the Australian Research Centre conducted a study of 18 primary and secondary Australian schools as they implemented a restorative justice philosophy. For a number of schools, they used conferencing, classroom circles, or formal community circles. Shaw (2007) explains,

For some teachers and administrators, the use of restorative practices represented a fundamental shift in thinking about school justice and discipline. The application of restorative practices may threaten some teachers with a perceived loss of power and control, particularly within frameworks that involve compliance with school rules regulated by punishment regimes and conferred power of teachers. However, the experience of participants suggested that punishments based on a high control, low support paradigm are less effective in changing negative behavior. (p. 131)

This is a major change in philosophy for some people.

The Social Discipline Window:

High Control
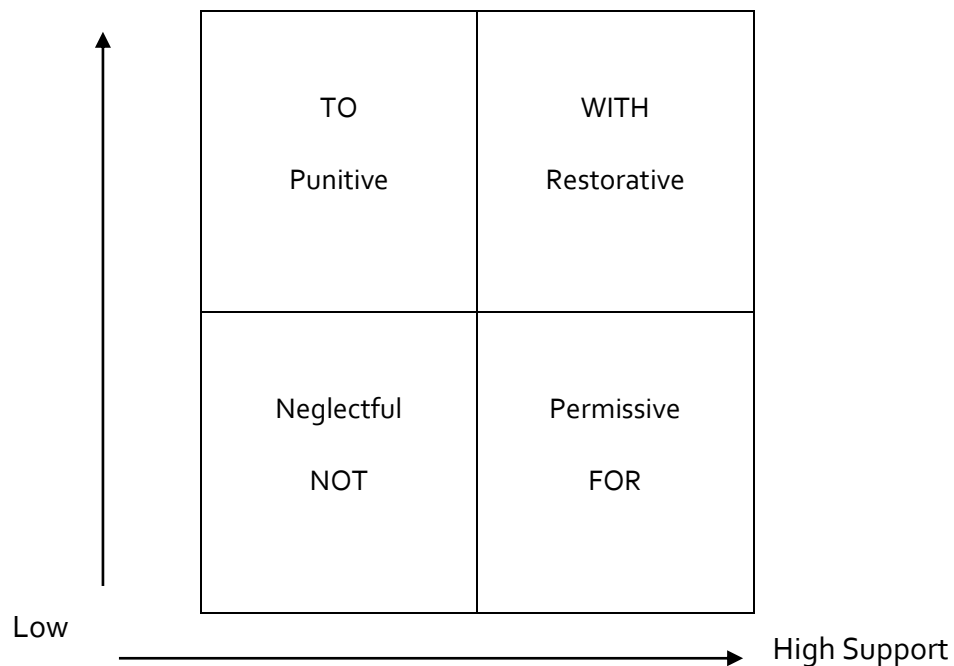
(O'Connell, Wachtel & Wachtel, 1999, p.78)

The impact on the educational setting seems clear. You would want to work in the "WITH" quadrant, high in supporting the student as well as high in control. Having said that, the will to be punitive or punish is still prevalent within our schools. "Formal restorative justice does not take any account of the historical and embedded power relations between teacher and pupil, adult and child, school and home. It cannot address the very particular risks for both sides if this power balance is challenged" (McCluskey et al., 2008 p. 206-207). This becomes particularly problematic if you are trying to introduce a restorative justice approach in a school that has a history of punishment.

Moreover, restorative justice philosophy and the embedded interventions are founded on the belief that misconduct is a fracture in a relationship; it demonstrates a disconnection and should not merely be described as a contravention of guidelines, code, rules or laws of the land (Morrison et al., 2005). We embrace the notion that the very purpose of restorative justice practice is to restore and mend the fracture within the strained or provisionally dysfunctional relationship which has been damaged by the misbehaviour or crime. All behaviour has a purpose. Indeed, restorative practices comprise an assortment of recognized (informal) and casual (informal) interventions (McCluskey et al., 2008). Our recognized interventions are often referred to as stakeholder conferences connecting the victim and offender with families/ guardians and other school/community support agencies.

The requirement to oversee and mediate the process cannot be overemphasized since we were trained as restorative justice conference facilitators who watch and listen for both positive and problematic overt and covert interpersonal signals. As conference facilitators we act to support, facilitate and guide the course of action. We must remind ourselves that we are there to mend a relationship, to repair a fracture, and act ethically. Trust, respect, integrity and due care are common traits noted within the process or act, as it ensures both

psychological and physical safety of the participants. We aim to assist the stakeholders to appreciate and understand who, and to what extent, individuals have been both effected and affected. We act in this manner to develop a space for compassion, empathy and understanding. The result is almost always a resolution accord that mends, repairs, and deconstructs damage caused.

School health, culture and climate often will have a direct impact on whether or not implementing a restorative justice approach will be successful. If the entire discipline structure has been historically based on an increasing level of punitive consequences that eventually lead to the student leaving the school community, it would be a huge shift for that particular school. When you walk into a school, you can pick up on the school climate and its culture via clues quite quickly. Morrison et al. (2005) explained,

These cultural cues include: how management speaks to, and about, staff; how staff speak to, and about, students and parents; the patterns of communication within staff meetings and what is said immediately after meeting; how criticism and disagreement are handled (p. 339).

Positive modeling and engaging teachers in the restorative process is one way to move the school climate along the restorative continuum. School culture change will not happen overnight. The frustrating thing is that we are all at the mercy of the next government regulation, legislation or curricular change. In Ontario, if and when the government changes, we might be back playing with a new set of rules, policies and curricula that revisits traditional punitive measures.

Summary

There is sufficient support from around the world to suggest that the use of restorative justice philosophies will continue to grow in our Canadian educational system. Having said that, it is certainly not the fix all answer to the way students act at school. Moreover, "a restorative approach is a philosophy or framework that can guide us as we design programs and make decisions within our particular settings" (Stutzman, Amstutz & Mullet, 2005, p. 4). The personal style of the administrator or teacher will always come into play in dealing with the relationships in the educational setting. We believe the new legislation makes it incumbent on school boards and administrators to work towards a supportive environment for our students. Making that happen is very difficult. Embedding some of the key restorative approaches, from the continuum, into the school policy will help move it along. For some schools, this may mean significant change. Another threat to this movement is sustainability. Will some teachers see this as a "new" initiative that will go away in a few years? "Restorative justice is not a map, but the principles of restorative justice can be seen as a compass pointing a direction. We believe, at a minimum, restorative justice is an invitation for dialogue and exploration" (Zehr, 2002, p. 10). As we mentioned earlier, we believe that many great teachers instinctively build relationships and interact with students in a restorative way. By their daily interactions, they inspire and motivate students to unexpected levels. For many students, that may be the only positive interaction they have with an adult in their life. As educators, we have a profound impact on students' lives and that is reinforced in every interaction we have with them. At a recent conference, we heard an educational leader speak about community. She asked the group to think of the worst student in your school. Then picture that student ten years from now and he or she is your next door neighbor. Would you do anything to intervene with this student now? Should that intervention be a punitive one or an intervention with a foundation of support?

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APPENDIX

Native Canadian

Australian / New Zealand Aboriginals

Definintion /Historical Background

Restorative Justice / Practices

Relationships

Community

Paradigm Shift

Changing School Culture

Education System

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The effects of classic and web-designed conceptual change texts on the subject of water chemistry

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Abstract

The purpose of this study is to research the effects of traditional and web-assisted conceptual change texts for the subject of water chemistry on the success, conceptual errors and permanent learning of students. A total of 37 8th graders in a secondary school of Samsun participated in this study which had a random experimental design with pre–test and post-test groups. With the three-stage conceptual success test developed by the researchers, a pilot scheme was conducted with 103 participants (9th graders). As a result of this scheme, the test's validity and reliability was completed and traditional conceptual change texts based on the determinated conceptual errors were prepared. In addition, this test was applied to students as pre-test at the beginning of the study. Classical conceptual change texts that were prepared were taught with traditional methods in control group's lessons. On the other hand, traditional conceptual change texts were prepared web-assisted and the experimental group was taught by using web-assisted conceptual change texts. At the end of the study, three-stage conceptual success test was conducted on the sample again as post-test. The data collected was analyzed by using SPSS and Microsoft Office Excel 2007 package program. As a result of the study, it was found that conceptual change texts caused a decrease in the conceptual errors of students on the subject of water chemistry. This improvement was 65% for the experimental group and 14% for the control group. In addition, even after three months, this rate was 61% for the experimental group and 3,8 % for the control group. Web-assisted conceptual change texts were found to be more effective in the permanence of what is learned

Keywords: Conceptual change texts, Water chemistry, Elementary school.

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Introduction

In science education, in order to structure information well, teaching concepts is determined as an issue of priority and structuring concepts in the minds of students meaningfully is one of the primary aims. In science education, learning concepts enables individuals to make sense of concepts and to use them in their daily lives in accordance with their needs (Ahopelto, Mikkilä-Erdmann, Anto & Penttinen, 2011). What sets science education apart from other fields is the large number of concepts and the great deal of time that needs to pass in order to have learned a concept. Studies show that learning scientific concepts clearly makes it easier for students to learn the subsequent subjects (Ayas, Özmen & Coştu, 2002; Aydın & Balım, 2007; Anggoro, Stein & Jee, 2012; Bramwell-Lalor & Rainford, 2014; Lawless, Smee & O'Shea, 1998). Researchers emphasize that it is important to teach scientific concepts fully, accurately, effectively and fast and also to learn concepts meaningfully in science education beginning from the first years of education (Coştu, Ayas & Ünal, 2007; Chu & Treagust, 2014; Demirci & Efe, 2007; Gündoğdu, 2013). For individuals, a meaningful learning of concepts is related to turning information into concepts, using concepts in different environments, making connections between concepts and being able to distinguish between concepts (Bütüner & Gür, 2008). Concept can be defined as making representations, generalizing them with new examples and distinguishing examples from situations that are not examples (Schunk, 2011). In other words, concept is the expression of concrete things, phenomenon, incidents, beings and thoughts represented in terms of meaning unity. They are the common mental units attributed to thoughts when grouped in terms of their similarities. Concepts are the building stones of knowledge (Ayas, 2012; Baysarı, 2007; Demirkuş, 2009; Gülen, 2010; Kaptan, 1999; Koray & Bal, 2002; Turgut, Baker, Cunningham & Piburn, 1997; Ülgen, 2006).

One of the main goals of science education is to enable individuals to learn concepts meaningfully and permanently (Ercan, Taşdere & Ercan, 2010; Köse & Uşak, 2006; Taş, Çetinkaya, Karakaya & Apaydın, 2013). For individuals to learn concepts permanently and correctly, modern (through discovery) techniques of teaching concepts should be applied. With this purpose, (a) a concept should be exemplified, (b) a concepts should be supported with different examples, (c) a concept's characteristics should be found, (d) generalizations should be made, (e) examples not included in the concepts should be given (f) distinctive characteristics of the concept should be found (Çaycı, 2007).

Ayaş (2012) examines the processes of concept developing in his book *Concept Learning* in five steps. These steps are (a) *Generalization*, the naming process of the structured information based on their common features. (b) *Differentiation*, the process of differentiating between similar information. (c) *Induction*, the process of induction by generalizing from specific to general or limited number of experiences. (d) *Defining*, the definition of thought units in our minds as concepts. Definitions or similar words are also names for concepts. (e) *Deduction*, way of thinking that goes from general to the specific. It is the process of structuring specific examples from general information. Since teaching concepts correctly and meaningfully in science education affects future learning significantly, preventing the conceptual errors of students and eliminating the existing ones are among the principal factors that increase the success of students.

What are conceptual errors?

According to researchers, the pioneer of constructivist approach for cognitive functions is Piaget in this century (Eraslan, 2005). Beginning from very young ages, individuals try to categorize all the events and phenomenon around them in their minds, they try to form conceptual patterns from these and interpret them (Şensoy, Aydoğdu, Yıldırım, Uşak &

Henger, 2005). They can develop concepts that won't coincide with scientific knowledge in the mental schemes they have developed previously (Ayaş, 2012; Braasch, Goldman & Wiley, 2013; Güneş, Dilek, Hoplan & Güneş, 2011). These errors formed by the concepts the individuals have and the ones they have learned which do not coincide with the old ones and which are not realized by the individual are called conceptual errors. According to the studies conducted, a person's experience, misbelieves, flawed mental models and even teachers can cause conceptual errors in a person (Gadgil, Nokes-Malach & Chi, 2012; Özgür & Pelitoğlu, 2008; Özsoy, Memiş & Temur, 2009; Sülün & Kozcu, 2005). One of the biggest reasons of conceptual errors is the false and insufficient learning that occurs when a person is exposed to false and insufficient guidance in the process of forming knowledge based on constructivist approach. When factors such as experiences and instructors are added to false and insufficient learning, conceptual errors become inevitable (Ercan, 2010). Conceptual errors in the field of sciences increase the problems encountered later on. They also affect the transfer of knowledge to new circumstances negatively (Bacanak, Küçük & Çepni, 2004).

Since conceptual errors are structures that a person forms in his/her mind and since they are difficult to be observed directly, it is difficult to bring these into open most of the time (Sen & Yılmaz, 2012; Tippett, 2010). There are a great number of methods used in international literature in determining comprehension levels of concepts and conceptual errors. These methods are conceptual maps (Hwang, Kuo, Chen & Ho, 2014), prediction-observation-explanation (Costu, Ayas & Niaz, 2012), interviews (Abdullah & Scaife, 1997), drawings (Smith & Metz, 1996), word association, V- diagrams, concept test (Atasoy & Akdeniz, 2007;Artun & Coştu, 2011; Gülçiçek & Yağbasan, 2004; İsen & Kavcar, 2006; Kutluay, 2005; Karakuyu, 2006; Karakuyu & Tüysüz, 2011; Koray, Özdemir & Tatar, 2005), interview forms (Anıl & Küçüközer, 2010) and games (Genç, Genç & Yüzüak, 2012; Karataş & Baki 2013).

The purpose of methods of determining conceptual errors is to find out the reason behind the knowledge that a person has or the choices a person prefers. When these reasons are determined, correctness of the reason is examined by experts and as a result of the examination, if scientific errors are found, conceptual error is defined. It is not possible to use the same methods in every course in order to determine conceptual errors. Researchers aim to develop methods which are easy to apply and to score and the results of which are supported by objective data and to find more conceptual errors in less time and to eliminate these errors. In their study, Demirci & Efe (2007) used *three- stage tests* which were easy to apply and score. These tests did not reveal the cognitive structure fully; however, they were used in determining the misconceptions of a group through well-prepared distracters and in the generalization of results by being applied to bigger groups. In multiple choice tests, it is not possible to understand the reason underlying a person's answer. Thus, researchers can make use of three-stage tests that can present the reason for a person's answer and find out a person's level of understanding and conceptual errors (Aykutlu & Şen, 2012; Arslan, Cigdemoglu & Moseley, 2012; Kilic & Saglam, 2009). There are studies that concentrate on preventing and eliminating conceptual errors of individuals starting from primary education (Çetinkaya, 2010,). The important point here is how to eliminate conceptual errors after defining them. Learning and teaching techniques should first be determined based on the errors found out and conceptual errors should be turned into scientific facts. There are various methods and techniques used to realize this change effectively. These are -observation-explanation, conceptual change texts, concept cartoons, modeling analogy, word association tests, structured grid, diagnostic trees and mental maps (Aydın & Balım, 2007; Ercan, Taşdere & Ercan, 2010; Kıngır & Geban, 2012). In addition, it has been reported that computer assisted teaching can also be used in eliminating conceptual errors (Çepni, Taş & Köse, 2006; Çalik,

Kolomuç & Karakölge, 2010; Ünal, 2007). Conceptual change texts are among important techniques used to realize conceptual change effectively.

Changing conceptual errors can be possible only by implementing four strategies. These strategies are: (1) the individual should be aware that his/her knowledge is insufficient for solving a problem s/he meets. (2) The individual should think that the new knowledge is comprehensible. (3) The individual should believe that this knowledge is reasonable gradually as s/he comprehends this knowledge. (4) The new knowledge should provide ease to the individual in solving the problems encountered later on (Köse, Ayaş & Uşak, 2006; Köse, Kaya, Gezer & Kara, 2011).

In a great number of studies conducted, there are alternative methods which encourage students to change their nonscientific knowledge into scientific knowledge in order to eliminate their conceptual errors. Conceptual change texts, one of these methods, define what the conceptual errors of students are and they try to explain these errors with examples. Next, they prove with explanation or examples that these errors are insufficient or wrong. Scripting these insufficient and wrong learning and associating them with daily life is especially important for conceptual changes (Kendeou, Muis & Fulton, 2011). Thus, the student is made to realize the errors in his/her own knowledge and conceptual change is realized. Conceptual change texts are one of the important methods which are used in eliminating conceptual errors and which are based on conceptual change approach (Balci, Cakiroglu & Tekkaya, 2006; Berber & Sarı, 2009; Sinatra & Broughton, 2011; Tsai & Chou, 2002).

Another effective method used for eliminating conceptual errors is computer-assisted teaching. Computer assisted teaching is a teaching method that strengthens teaching process and learner motivation and allows learners the possibility of learning with their own individual paces. The most important characteristic of this method is that individuals who have an active role in their own learning can use computer and the internet (web) (Köse, Kaya, Gezer & Kara, 2011). It is thought that by combining conceptual change texts and computer assisted teaching methods, computer assisted conceptual change texts or web assisted conceptual change texts will be effective in eliminating conceptual errors. Hence, web-assisted teaching provides advantages in increasing the analysis, synthesis and assessment skills of students (Taş, Köse & Çepni, 2006). This advantage is thought to prevent students from making errors. In addition, it is thought that web-assisted preparation of conceptual change texts (Picture, video, animation and simulation) will prevent students from making cognitive errors (Çalik, Okur & Taylor, 2011).

In this study, the students' conceptual errors on the subject of "*water chemistry*" were found with three-stage tests and conceptual change texts and web-assisted conceptual change texts were used in eliminating these errors.

Significance of the study

In education, finding out the conceptual errors which are caused by a person's previous learning and which affect the process of learning negatively is of great importance especially for science education. Conceptual changes which are caused by a person's previous errors in learning affect future learning negatively. Thus, the errors of a person should be determined and eliminated as soon as possible. Three-stage tests, which were designed to determine the conceptual errors of individuals in a short time and effectively, enable a more effective determination of conceptual errors especially in science education. It is important to eliminate these conceptual errors with comprehensible, scripted conceptual change texts that are associated with daily life. Recently, especially with the introduction of computer to the

educational process, it is believed that web-assisted conceptual change texts will have an important place in eliminating conceptual errors because conceptual change texts have advantages such as pictures, video, animation and simulation. In the literature review, no conceptual error study on the concepts used in this study (water chemistry) was found. It is thought that this study will provide an example.

Basis of the study

Conceptual errors occur as a result of concepts being mislearned by students, concepts being taught incorrectly by teachers, insufficient use of background knowledge by students, failure of students in realizing conceptual change in their minds and failure of students in forming a unity in meaning while learning concepts (Koray, Özdemir & Tatar, 2005). In order to be able to eliminate the conceptual errors that occur because of the aforementioned reasons, first of all errors should be determined. Objective methods are needed in determining these errors. Hence, the three-stage tests used in the determination of errors in this study are significant in eliminating these errors since they can find out the conceptual errors of a great number of people simultaneously and in a short time. A great number of studies have shown that traditional methods used in science teaching are not effective in eliminating conceptual errors (Akgün & Aydın, 2009; Köse, 2004). In order to eliminate conceptual errors, the errors in students' cognitive structure should be found and they should be replaced with scientifically correct information (Köse, Kaya, Gezer & Kara, 2011). It is important for the student to be able to associate concepts with daily life and make the necessary changes. This change brings to mind that web-assisted conceptual changes can also cause this change effectively.

Aim of the study

The primary aim of this study is to find out the effects of traditional and web-assisted conceptual change texts in eliminating conceptual errors. The answers to the following questions were sought in line with this aim:

1. What are the conceptual errors of students on water chemistry by using three-stage tests?
2. Can conceptual errors be eliminated by using web-assisted conceptual change texts and conceptual change texts?
3. Is there a significant association between the web-assisted conceptual change texts and traditional conceptual change texts used for eliminating conceptual errors?
4. How do the use of web-assisted conceptual change texts and the conceptual change texts affect the permanency of knowledge?

Method

The study used random experimental design with pre-test and post-test control group (fully experimental design). Three-stage test developed by the researchers in order to find out the probable conceptual errors of students was used in the study. With this purpose, a pilot study was conducted to ensure the validity and reliability of the data collection tool. Necessary corrections and additions were made to the data collection tool and students' conceptual errors on the subject of water chemistry were found. With the pilot study, traditional and web-based conceptual change texts were prepared. Traditional conceptual change texts were used for the elimination of conceptual errors of the control group while web-assisted conceptual change texts were used for the experimental group.

Universe and sample

The study was conducted with 37 8th graders studying at a state secondary school of Bafra, Samsun. The pilot study was conducted with 103 participants studying in a state high school in the town of Ondokuz Mayıs.

Data collection tool

A three-stage test was prepared to find out the changes in student success and the conceptual errors of students on the subject of water chemistry. Three-stage test questions have basically three parts and they undergo three different stages.

Stage 1 (a) Preparation of the test that measures attainments. A multiple choice test is prepared to measure attainments here. In this test, one choice is correct while the others are distracters. At this stage of the study, a table of specifications was prepared based on the attainments on the subject of water chemistry (Table 1). 12 questions were prepared by two teachers and one academic based on the attainments and the curriculum. Thus, content validity of the test was attained. (b) Preparation of the test that determines the reason of attainment: Here, the reasons for the students' choices in the multiple choice test are questioned. One choice questions the correct reason while the others question the reason for distracters. In addition, another empty choice is left in case there is a situation that the test taker wants to state, the test taker can write down his/her reason of choice here with his/her own expressions. The questions that examined the reasons of 12 attainments in this multiple choice test were prepared in line with the attainments in the science and technology teacher's book, student's book and student's workbook. Care was taken to prepare a multiple choice test or a multiple choice test with one open-ended choice that included student's conceptual errors based on test literature review, teaching experience, academic experience and results of interviews. (c) Preparation of the test that determines how sure the test-taker is of his/her attainments: here, the test-taker is questioned about whether he/she is sure about his/her answers. Test-taker states how sure s/he is of her/his opinion by choosing from "sure, not sure, I guessed". At this point, 12 test questions stating the level of sureness were prepared. As a result, 36 questions-12 questions measuring the attainment,12 questions searching the reason for the attainment and 12 questions stating the level of sureness- on the students' changes in success and the students' conceptual errors which were prepared by the researchers were included in the three-stage test.

In a study, it is important to find out how sure the students were about their answers. It is possible to guess the answers in multiple choice tests. Thus, following the attainment questions, test takers were asked about their reasons for the choices they made and whether they were sure about their choices. When the student thinks that s/he is sure, his/her answer is checked. If the answer is correct, there is no error. However, when the answer is incorrect, it can be said that the student has an error. This is because when the student is sure that s/he is correct, actually s/he is incorrect. Thus, while determining conceptual errors, it is better to prefer three-stage tests rather than one or two-stage tests.

Stage 2. At this stage, a pilot study is conducted on questions and the shortages of the study are made up with the results. For this study, in order to be able to determine the possible conceptual errors on the subject and to take necessary safety precautions about the assessment instrument, a three-stage test was conducted on 9 th graders (N:103) who had studied this subject before. The shortages were made up in the light of the results of this pilot study. Since the "*r*" value (distinctiveness value) of two items were found to be lower than 0,2 in the item analysis conducted as a result of the pilot study, these two items were excluded from the test. In addition, since the"*p*" value- difficulty value- of an item was found to be 0,28,

this item was assessed to be a difficult item and the question was reviewed. After this review, the test became a test of 30 items with 10 items that measured attainment (cognitive levels of the questions are presented in table 1), 10 items that question the reason for attainment and 10 items that express the level of being sure. In addition, item difficulty index of the test was found to be p = 0.51 while its item distinctiveness index was found to be r = 0,43. In addition, the test's Cronbach's Alpha (α) reliability coefficient was found to be 0.69

Table 1. *Table of Specifications*

| Multiple Choice Test	Cognitive Process Steps		
Attainments	Comprehension	Application	Total
1. Can understand the concepts hard water, soft waster and can explain why hardness is an undesired characteristic	2	2	4
2. Researches how hardness can be resolved in water.	1	2	3
3. Realizes through research that antimicrobial effect of chlorine is used in purifying water.	2	1	3
Note: Questions were not prepared from other steps			10

The order of cognitive process steps in Table 1 were prepared based on Köğce, Aydın & Yıldız's (2009) paper entitled *A Revision of Bloom Taxonomy: A General Overview*

Stage 3. At this stage, the questions are applied and their results are analyzed. In this study, three-stage test was applied to randomly chosen experimental and control groups before the study as pre-test and it was applied again as post-test after the study. In addition, three months after the study, the test was used as a test of permanency. The data obtained from these tests are presented in the "finding" section.

Material

As a result of the pilot study, the conceptual errors stated in Table 2 were found. In order to prevent these errors to be seen in the sample, web-assisted conceptual change texts and conceptual change texts were used.

Four conceptual change texts were prepared based on the attainments of the subject. These texts were prepared as scripts that can cause to eliminate the students' conceptual errors. During the application, one conceptual change text was given to each student. The texts were taught to students with the guidance of the researcher in parallel with the subject. Control group used the conceptual change texts besides text books and the experimental group used the web-assisted conceptual change texts besides text books. Web-assisted conceptual change texts were prepared by the researchers as video/pictures that could be studied interactively and as texts in which concepts difficult to understand were visualized. Adobe Dreamweaver CS4 and adobe flash package program were used while preparing these materials.
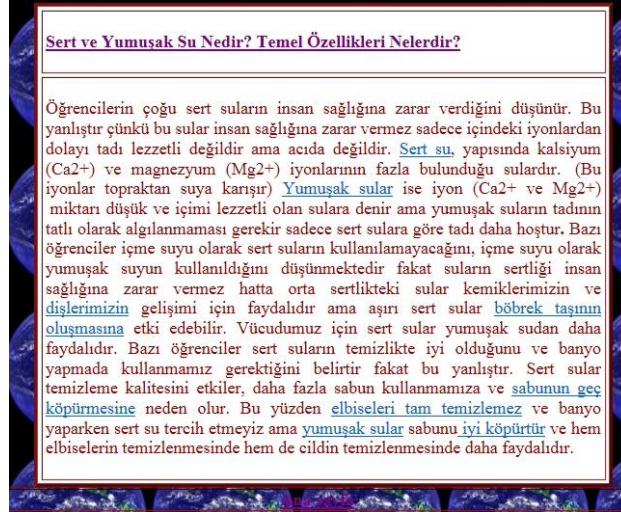
Picture 1. *The interface of the visual material*

Picture 2. *Sample video used in the visual material*

Picture 3. *The Outlook of use of web-assisted conceptual change texts in the experimental group*

Data analysis

The data obtained from the three-stage test were analyzed by using descriptive statistical techniques. SPSS and Microsoft Office Excel 2007 were used for the analysis of the data.

Percentage (*%*), frequency (*f*) and Mann Whitney U test were also used. The data obtained were stated in the findings section.

Findings and Remarks

In line with the aim of the study, possible conceptual errors of the study group were determined with a pilot study.

Table 2. *Conceptual errors from the pilot study*

Conceptual errors found in the 9th graders (*N*:103)	Frequency(*f*)	Percentage(%)
1. Hard water should be used for bath.	45	43.6
2. Soft water should be used as drinking water.	47	45.6
3. When dirty water is warmed, it forms residues in the base of the container.	25	24.2
4. Hard water is harmful for human health.	64	62.1
5. Sodium is not used to remove the hardness of water.	34	33
6. Chlorine gas softens hard water.	27	26.2
7. Hard water does not cause corrosion.	63	61.1
8. Ion Exchange resines clean contaminated water.	48	46.6

As can be seen from Table 2, as a result of the pilot study, the students' conceptual errors on the subject of water chemistry were found. Each error here was seen in students who were educated about water chemistry in the previous academic year.

Table 3. *Pre-test post-test percentage values of the students' conceptual errors*

Category and conceptual errors	Pre-Test		Post-Test		Change		Permanency	
	EG (%)	CG (%)	EG (%)	CG (%)	EG (%)	CG (%)	EG (%)	CG (%)
1 Undesired characteristics of the hardness of water								
a Hard water should be used for bath.*	0	0	0	0	20	-11	0	0
b Hard water does not cause corrosion.	58.82	45	47.06	50			47.06	56.25
2 Ways to resolve the hardness of water								
a Sodium is not used to remove the hardness of water.	29.41	45	11.76	50	80	37	11.76	68.75
b Chlorine gas softens hard water.	17.65	10	0	5			23.53	12.5
c Ion Exchange resines clean contaminated water.	58.82	55	11.76	15			11.76	18.75
3 Characteristics of water that affect human health								
a Soft water should be used as drinking water.*	0	0	0	0	75	61	0	0
b When dirty water is warmed, it forms residues in the base of the container.	17.65	30	0	15			5.88	0
c Hard water is harmful for human health.	23.53	35	11.76	10			0	31.25
4 Errors outside of the pilot study.								
a Sodium ion reacts with calcium and magnesium ions.	23.53	25	5.88	40	78	-113	0	37.5
b Sodium, calcium and magnesium ions are used in removing bacteria.	58.82	15	11.76	40			11.76	25
Total	288	260	100	225			112	250
Rate of progress			%65	%14			%61	%3.8
*The questions about these errors were corrected with the pilot study and no error was seen.								
EG (*N*:17): Experimental group, CG (*N*:20): Control group								

When the data in Table 3 was examined, the conceptual errors determined by the study were grouped in three. Error rates of experimental and control groups can be examined from the table in terms of pre-test and post-test results. In addition, the rates of change and the rates of the results of permanency test in pre and post-test groups can be examined from this table. According to the pre-test and post-test results, the progress in the conceptual errors of students was 65% for the experimental group and 14% for the control group. As for the progress rate in permanency tests, the rate of progress was 61% for the experimental group and 3.8% for the control group.

Table 4. *Mann Whitney U Test results of three-stage post-test scores for experimental and control groups*

Groups	N	Rank average	Rank sum	U	p
Control	20	15.65	313	103	0.038
Experimental	17	22.94	390		

As can be seen from Table 4, "*U*" value was found to be 103 while "*p*" value was found to be 0.038 ($p < 0.05$). In addition, rank sums in the table are significant for the study. While the rank sum of the control group was 313, rank sum of the experimental group was 309 (Experimental group rank sum>control group rank sum).

Table 5. *Mann Whitney U Test results of three-stage permanency scores for experimental and control groups*

Groups	N	Rank average	Rank sum	U	p
Control	16	12.69	203	67	0.011
Experimental	17	21.06	353		

As can be seen from Table 5, "*U*" value was found to be 67 while "*p*" value was found to be 0,011 ($p < 0.05$). In addition, rank sums in the table are significant for the study. While the rank sum of the control group was 203, rank sum of the experimental group was 353 (Experimental group rank sum>control group rank sum).

Result and Discussion

The following conclusions were made in line with the aim and problems of the study:

1. As can be seen from tables 2 and 3, conceptual errors of a great number of students were determined simultaneously by using three-stage tests. The questions of the pilot study and the three-stage test used as pre and post tests were analyzed as the sample question in table 6.

Table 6. *The students' answers to question 7 and the percentages (%)*

Question:	Choice	Frequency (*f*)	Percentage (%)
7.	A	64	62.1
	B*	**32**	**31**
	C	2	1.9
	D	4	3.8
7.1.	A	7	6.7
	B	64	62.1
	C*	**29**	**28.1**
	D	2	1.9
7.2.	**A**	**80**	**77.6**
	B	10	9.7
	C	13	12.6
Correct choice, N: 103			

According to table 6, 31% of the students answered the question 7correctly and the percentage of correct answers given to the question 7.1 which was asked to explain the reason of question 7 was 28.1%. For the question 7.2 that asked how sure they were of their answers, 77.6% stated that they were sure. In this question, 62.1% of the students chose A as their answer and thus gave the wrong answer while 62.1% of the students gave the right answer to question 7.1 which was asked to explain the reason of question 7 by choosing B and considering the increase in the percentage of the students who were sure, it can be said that the students have conceptual error about the statement "*hard water is harmful for human health*".

Just like the example in Table 6, all the questions were analyzed and the students' conceptual errors were determined. As can be seen from table 2, the results of the pilot study show that the sample (9 th graders) has important conceptual errors about the subject of water chemistry. Despite the use of conceptual change texts and web-assisted conceptual change texts, the formation of conceptual errors such as *"Sodium is not used to remove the hardness of water"* and *"Hard water does not cause corrosion"* could not be prevented in both the experimental and the control group. In addition, two new conceptual errors were found in addition to these errors. As for the answer to the first question of our study, three-stage tests were used to determine the conceptual errors of students. In the studies of Demirci & Efe (2007) and Aykutlu & Şen (2012), conceptual errors of students were found by three-stage tests. The results of these studies are in parallel with the results of our study.

2. Table 3 presents the percentages of changes in the conceptual errors of students at the end of the study based on pre-test and post-test results. According to this table, the students' conceptual errors can be analyzed in three categories.

Category 1: *Undesired characteristics of the hardness of water*

There are 2 conceptual errors in this category. The question of the first of these concepts which was "*Hard water should be used for bath*" was excluded from the test after its distinctiveness index was found to be low with the item analysis done after the pilot study. According to the pre and post-test results of the second conceptual error of the study, *"Hard water does not cause corrosion"*; a 20% regression (progress) was seen in the experimental group while a 11% increase (degradation) was seen in the control group. This error of the students can be interpreted that the students have incorrect information about the reasons of corrosion in metals. It can be said that the precautions that we took for this error found in the pilot study not to be seen in the students of our actual study were insufficient. Hence, it can be said that the traditional conceptual change texts prepared for the control group were not sufficient to prevent this error and that the web-assisted conceptual change texts prepared for the experimental group had a better percentage. The reason for the 20% increase in the experimental group is thought to be resulting from the pictures illustrating corrosion in the web-assisted conceptual change texts. In addition, in the permanency test conducted three months later; no change was seen in the percentages of this error in the experimental group, while an increase was found in the control group, although little.

Category 2: *Ways to resolve the hardness of water*

There are 3 conceptual errors in this category. According to the pre and post-test results, it can be said that these errors were inclined to progress in both the experimental and the control group. The reason for these errors in the students can be the incorrect knowledge of some of the softening or decreasing hardness techniques of hard water. The web-assisted conceptual change texts prepared to prevent the conceptual errors found in the pilot study

from being seen in the actual study were quite successful. The progress rate of these errors was found to be 80% in the experimental group. On the other hand, we can also talk about the success of traditional conceptual change texts prepared for the control group. Progress rate of the errors in the control group was found to be 37%. The reason for this big difference in the progress rates of the experimental and control groups can be resulting from the pictures, videos and animations used in the web-assisted conceptual change texts. Although the techniques of resolving hardness in water were dealt in detail, these techniques and the concepts related to these techniques were materialized only in the web-assisted conceptual change texts. In addition, according to the permanency test results conducted three months later; an increase was seen only in one of these errors in the experimental group while no change was found in the rates of other errors. An increase was seen in the percentages of these errors in the control group.

Category 3: *Characteristics of water that affect human health*

There are 3 conceptual errors in this category. The question of the first of these concepts which was "*Soft water should be used as drinking water*" was excluded from the test after its distinctiveness index was found to be low with the item analysis done after the pilot study. The other errors of the category can be said to have shown significant progress. According to the pre and post- test results, the experimental group showed a progress of 75% while the control group showed a progress of 66%. This progress in errors is thought to be resulting from the examples and scientific corrections in the web and traditional conceptual change texts prepared. In addition to these; pictures, videos and animations were used in the web-assisted conceptual change texts. These texts are better understood when the differences in the progress rates are considered. The reason for errors is thought to be resulting from some misbelieves caused by daily life (Bogart et al., 2013). According to the permanency test results conducted three months later; an increase was seen only in only one of the errors in both the experimental group and the control group.

Category 4: *Errors outside of the pilot study*

The two conceptual errors in this category are different from the other errors. These conceptual errors were not among the errors determined by the pilot study; they came out only in the actual study. It can be said that these errors were seen only in the control group. These errors showed a 100% increase in the control group. The reason for this is thought to be the need to concretize the concept of "ions" which is the common point of the errors. In the web-assisted conceptual change texts used by the experimental group, this concept was supported by pictures and videos and a 78% progress was seen in the prevention of these errors. According to the permanency test results conducted three months later; no increase was seen in these errors in both the experimental group and the control group.

In answer to the second question of our study, it can be said that web-assisted conceptual change texts were relatively successful in eliminating conceptual changes. Thus, the progress in conceptual errors at the end of the study was 65% in the experimental group while it was 14% in the control group. Literature review showed that studies by researchers such as Berber & Sarı (2009), Ahopelto, Mikkilä-Erdmann, Anto & Penttinen, (2011) and Kıngır & Geban (2012) showed that conceptual change texts had a positive effect in changing conceptual errors. However, in their study, Çalik, Ayas & Coll (2010) found that conceptual change texts were not sufficient to eliminate conceptual errors. In addition, in the studies by researchers such as Broughton, Sinatra & Reynolds (2010), Tippett, (2010), Diakidoy, Mouskounti & Ioannides (2011), conceptual change texts are called "*refutation texts*" and they found that these texts decreased conceptual errors. In his study, McCrudden (2012) found that

conceptual change texts enabled students to see the contradictions in information, while Ariasi & Mason (2011) found that scientific texts that invalidate the errors of individuals facilitate learning and Çetingül & Geban (2011) found that conceptual change texts positively affected analogical thinking in students.

3. The data in Table 4 shows that there is a significant difference between the scores of students from the last test of the three-stage test ($U = 103$, $p < 0.05$). When the rank sums were considered, it can be seen that the post-test scores of the students in the experimental group were found to be higher than those of the students in the control group. This result shows that the use of web assisted conceptual change texts in the experimental group increased the student success when compared with the use of conceptual change texts in the control group.

In answer to the third question of our study, it can be seen that the use of web-assisted conceptual change texts in eliminating conceptual errors is more effective in eliminating the conceptual errors of students when compared with the use of traditional conceptual change texts. Similarly, Beerenwinkel, Parchmann & Gräsel (2011), Akbaş & Gençtürk (2011), Sen & Yılmaz (2012) and Kıngır & Geban (2012) in their study found that conceptual change texts were more effective than traditional methods in terms of eliminating conceptual errors and increasing student success. In addition, Köse, Kaya, Gezer & Kara (2011) transformed their conceptual change texts to computer environment. In addition to these, Köse, Ayas & Taş (2003) found that web-assisted conceptual change texts were more effective than traditional methods in terms of eliminating conceptual errors. The results of these studies are in parallel with the results of our study.

4. The data in Table 5 shows that there is a significant difference between the scores of students from the permanency test of the three-stage test ($U = 67$, $p < 0.05$). When the rank sums were considered, it can be seen that the permanency test scores of the students in the experimental group were higher than those of the students in the control group. This result show that the use of web-assisted conceptual change texts in the experimental group affects keeping knowledge in memory more than the use of conceptual change texts in the control group. When the percentages of progress in table 3 were analyzed, it can be said that this rate was 61% in the experimental group while it had regressed to 3.8% in the control group.

In answer to the third question of our study, it was found that researchers such as Özmen, Demircioğlu & Demircioğlu (2009) and Özmen (2011) also found that web-assisted conceptual change texts positively affected permanency. This result is in parallel with the results of our study. In addition, Durmuş & Bayraktar's (2010) study showed that traditional conceptual change texts positively affected keeping information in mind.

Recommendations

Three-stage tests can be added among the techniques used for the determination of conceptual errors caused by students' experiences and their insufficient or incorrect learning. Three-stage tests are recommended especially for the simultaneous and objective determination of the conceptual errors of great number of students.

Conceptual change texts and web-assisted conceptual change texts can be used for eliminating the students' conceptual errors, even if they don't have a success of 100%. Through the use of web devices such as pictures, video, animation and simulation of especially concrete and difficult to reach concepts can decrease the formation of errors.

In order to prevent the formation of conceptual errors in students, necessary precautions can be taken with the pre studies that determine the conceptual errors of students studying in upper grades.

It is believed that keeping conceptual errors in mind while preparing science text books can help prevent the conceptual errors in students. At the same time, it is thought that the visualization of texts will decrease errors.

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