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Full Length Research Paper

Elaborating the purpose and content of professional development plan for preschool teachers

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Professional development of educators, especially in preschool years has been neglected in Iran. The purpose of this study was to investigate the viewpoints of experts and teachers about the purposes and content of the professional development plan for preschool teachers. This research is a descriptive-analytic study conducted through both qualitative and quantitative methods. The statistical population included academic members of universities, PhD students, psychology instructors and teachers of preschool curriculum and education. In the qualitative part, the sample was selected via purposeful grid methods and the teachers were selected through stratified random sampling. The data were collected via semi-structured interview and researcher-made questionnaire. To estimate the validity of the interview and the questionnaire, content validity method was used, and to estimate their reliability, Cronbach's alpha was utilized. Qualitative findings were categorized using content analysis; quantitative findings were analyzed via inferential and descriptive statistics. The results of the Friedman's test demonstrated that, according to teachers, becoming an active and responsible teacher has the highest importance in the development plan, while identifying parents' and societies' expectations as well as interacting with them has the lowest importance. In the content, professional development of teachers, class management and settling problem in class are the first items in terms of importance; yet familiarity with contagious diseases in childhood and controlling them have the lowest level of importance.

Key words: Preschool, educators' professional development, curriculum, purpose, content.

INTRODUCTION

In order for children to succeed in their preschool years, the main requirement will be their teachers' professional development and high levels of knowledge and skill.

Huge efforts have been made in this area and their major focus is to recognize common professional development through teaching educators to learn how to learn and

transmit the learnt so that students could develop practically (Avalos, 2011). Thus, novel approaches toward professional development are in favor of lifelong learning and claim that professional learning could not be a short-term intervention. In these approaches, professional development is a long-term activity ranging from training school children and university professors to individual in-service educational plans for teachers (Richter, 2011).

Professional development, in spite of its form, is a purposeful effort, and content has an effective role in clarifying the path to achieve purposes. In this line, the present study aims to investigate the purposes of teachers' professional development as well as decent contents of their professional development.

Development and teaching are identified as two main purposes in teacher training. Training includes understanding the main concepts and principles used in teaching, the ability of teachers to present principles and methods in class, general development that is not focused on a special work, but on long-term goals and facilitates development of teachers (Richard and Fall, 2005). In fact, it can be noted that training causes learning and subsequently learning causes change in an individual. Purpose determines the direction of learning content and is used as an evidence for success.

Educators should try to develop constantly so that they can be specialists in their work. Hoy and Miskel (2005) believed that professional teachers are experts in their work area and are perfect in all professional and specialized subjects related to their fields. For professional development of educators, curriculums should be well planned. Curriculum is considered as the heart of education. In fact, purpose is the evidence and criterion for selecting and organizing the contents of education (Abbaszadegan, 1991). Amini (2004) explained the importance of purpose in selecting and organizing the content and stated, that content serves the element of purpose; in other words, authorities in the area curriculum planning should determine the content based on certain purposes. Without purpose, learning cannot induce educational development. This element is so important for the curriculum that decision making at any stage of curriculum planning would be impossible without it.

Studies conducted in the field of pre-school education, have investigated the purposes of this period; however, the purposes of professional development are generally neglected. Thus, there is not a single pattern that can be relied on and these purposes have dispersedly been discussed. The purposes of pre-school curriculum and activities derived from the purposes embedded in pre-school education ratified by Supreme Council of Education based on pupils' age are as follows: 1- Training motor-physical skills; 2- training emotional behavior and feeling; 3- training intellectual skills; 4- training moralities and social behavior based on Islamic values; 5- companionship with Quran and interest in learning the holy script; 6- training artistic and aesthetic appreciation; 7- training religious views and religious interests; 8- training national identity; 9- training Persian language skills; 10- promoting health and immunity; 11- familiarity with environment and interest in nature and to maintain it.

Results from some of the studies on these purposes are consistent with the present research. For instance, Amani (2006) concluded that 70% of educators and 77% of managers have stated that mid-term tests cover the content and purposes of the educators' teaching periods. In another study by Noorian (2007) on analysis of the content of Persian books in elementary school (first grade) in Iran, revealed that half of the minor purposes of the curriculum are not consistent with the theoretical model of the study on learning purposes of reading and writing and can lead to educational problems for students.

Noori (2012) investigated innovations and new solutions of teaching in preschool levels in America, Canada, Australia and England and concluded that the final purposes have changed and the increase in learning specially in the advanced skills have augmented motivation in students. In a study by Sajadieh and Azadmanesh (2013) titled, "study of interpretive purposes of pre-school activities in curriculums of the Islamic Republic of Iran from the Islamic approach of practice" demonstrated that the first point neglected in the purposes of pre-school education is ignoring develop-mental and psychological traits of children at these ages and disregarding religious beliefs and values.

In order to realize predetermined purposes, educators should teach their learners materials. These materials are in fact the same contents determined by curriculum authorities. Eisner (1994) believes that the purposes should be elaborated on since they indicate the ends toward which the curriculum is moving. Selecting and organizing content is facilitated when purposes are stated clearly. According to some theorists, content is considered as the first step to achieve purposes. Thus, content is identified as an important element in curriculum. According to Maleki's (2006) definition, content includes a set of concepts, skills and interests that are selected and organized by planners.

Different countries emphasize different components of the curriculum with time period considered for them based on the content of the first preparation programs for teachers; however, they often deal with period of education and experiences, training material, the basis for educational period, professional studies (like periods of education), children's development and pragmatism (Ben- peretz, 1995; Cobb, 1999).

In specialized textbooks of the field, discussions emphasize on the content or research. More countries in the 90s were interested in training contents of initial preparation of teachers, passing training periods for employment of new teachers like other opportunities of

professional development (Baker, 1999). Meanwhile, many countries still focus on content without pedagogy and/ or practice. For example in Ethiopia, as in many other African (Bekalo and Welford, 1999) and Latin American countries (Villegas- Reimers, 1998), McDonnell (1999) believes that preschool teachers should be knowledgeable in 12 fields: 1) base, 2) child development, 3) curriculum, 4) health, safety and nutrition 5) children's supervision, maintaining records and evaluation, 6) providing a suitable environment for children, 7) principles and guiding children, 8) cultural variety, 9) special needs, 10) relationship between family and society, 11) professional development and 12) management and supervision.

Teachers should be trained to acquire these skills so that contents of preschool years include familiarity with Quran, story, poetry and song, manual work, game, painting, creative presentation, discussion, observation of experiment, field trip, watching film and familiarity with mood of using modern technologies. This was ratified in the 77th meeting of supreme Council in 15 July 2008 (Educational Planning and Research Organization, 2010). Regarding the purposes and content of pre-school education, it is expected that content of the course be decided so that their knowledge increases. The following are the results from different studies:

Hajizadeh (2004) studied educational needs of preschool centers teachers in eight fields of planning, psychology, management, occupational skills, human relations, supplementary devices, skills of immunity, health. Children literature needs education higher than intermediate level and their need in the field of management and human relations is in the intermediate level.

Mahmoudi (2007) evaluated the content of the books for preschool centers based on Lorestan Department of Education. The results showed that the content of Quran books do not match with the properties of children and the purposes were weak. The other books are in the intermediate level; and the books were weak regarding purposes. In his study titled "assessment of in-service training periods for managers and teachers of preschool centers", Ghahfarokhi (2008) concluded that teachers have higher needs in religious fields, concepts and practices of behavior modifications, training art concepts, methods and creation provision, application of instruments and technology and managers in the fields of human relationships, occupational skills and management functions.

Ervine's research (cited in Deraman, 2014) showed that the quality of educational materials of preschool centers enhances linguistic and mathematical skills and increases children's experiences. Thompson (2001) confirms that if these types of education are implemented in school and teachers participate in designing, management and implementation according to schools'

needs, they will be very successful. According to Price (2009), success of educational content is one of the reasons for technical vocational organizations.

Jovanava-Mitkovska (2010) in a research titled "need of teachers' continuous professional development" demonstrated that the (personal and professional) development of a teacher is a continuous process that is initiated by a person and remains until the end of his/her life. It may also be a process involving different methods including in-service training. For this reason, it has significant effect on beliefs of teachers, learning of students and education reforms; it affects teachers' improvement in teamwork and cooperation in class, teaching and learning tasks, and change in teaching methods, strategies, changes and role of mental factors in the learning processes.

Curriculum systems are expected to be consistent with innovations in science and technologies and determine purposes and contents proportional to these changes. In this research, in order to study purposes and contents relative to professional development curriculum of preschool teachers, four questions are investigated:

1. What is the viewpoint of academic members, instructors and experienced educators about purposes suitable for preschool educators' professional development In Iran?
2. According to educators, what are the purposes of professional development curriculum for preschool educators in Iran?
3. What is the viewpoint of academic members, instructors and experienced educators about contents affecting preschool educators' professional development curriculum in Iran?
4. According to the viewpoint of educators, what are the contents of preschool educators' professional development curriculum in Iran?

METHODOLOGY

Research design

The present study is analytic-descriptive. In the different sections of this study, two qualitative and quantitative approaches were applied. In order to collect data from academic members, PhD candidates and graduate students, qualitative method was used and to collect data on teachers, quantitative method was used. Findings of qualitative section were obtained from interviews with experts in addition to responding to research questions. Suitable items were extracted regarding purposes and content of professional development programs and were embedded in the related areas in the questionnaire (Clark et al., 2008; Creswell et al., 2007: 62-72).

Participants

Statistical population includes two parts: academic members of

Table 1. Frequency distribution of preschool teachers.

Population	Isfahan	Fars	Total
Education	1500	1500	3000
Welfare organization	1100	1200	2300
Total	2600	2700	5300

universities constitute one part of the statistical population. Preschool teachers form the second population of the research in two provinces of Fars and Isfahan. Frequency distribution of preschool teachers in two provinces of Fars and Isfahan is shown in Table 1.

Stratified sampling method was used for selecting academic members, experienced teachers and educators (Creswell, 2007). In other words, people who had valuable information and were considered as typical sample of the research were selected (Williams, 2006:79). In addition to stratified sampling, grid sampling was used in the interviews (Noy, 2008:32). In this method, the interviewees were first asked to identify other people who could be interviewed about the subject of the research. For the academic members, teachers and experienced educators, the sample size was not calculated as qualitative. In qualitative researches, very big or small sample is not recommended, but criteria like data saturation and repetition of information are allowed (Onwuegbuzie and Leech, 2007:242; Guest et al., 2006, 59). Therefore, in this research, semi-structured interviews were conducted with 20 individuals of academic members, teachers and experienced educators. These interviews began in August 2015 and ended in October. Average time of each interview was 60 min.

To select the teachers, random sampling was utilized to select the sample from Isfahan and Fars provinces of Iran. Moreover, to allocate sample, the optimal allocation method was used; each class was determined based on size of population. So, teachers were selected based on their number in each population.

The size of selected sample of preschool teachers with regard to the statistical population was 357 based on Morgan table. In order to increase the validity of the findings, sample size was doubled. Thus, 700 questionnaires were distributed and 566 of them responded (81%).

Data collection tools

In this research, two instruments of semi-structured interviews and a researcher-made questionnaire were used. The authors interviewed academic members, teachers and educators to obtain the expert views. Since there is no standardized questionnaire on the subject of this research, researcher-made questionnaire was used to collect data on the teachers.

To determine the reliability and validity of the interview and the questionnaire, content validity was used. To measure the interview reliability, first, eight individuals were interviewed. After objectively applying and summarizing important opinions and their classification, all written materials, summary of materials and determined categories were provided to the advisors and also two experts in research methodology. They also confirmed the summaries and categorizations by applying suitable changes and corrections.

To estimate reliability of the questionnaire, Chronbach's alpha coefficient was used. After performing preliminary study and analyzing the questionnaires, it was determined that reliability of purposes was 90% and that of the content was 90% as well.

Data analysis

To analyze the data collected from interviews, various methods were used (Creswell, 2007: 177-147; Campbell et al., 2003: 125; Mason, 1994: 91-96). To analyze the data obtained from the interviews in this research, some steps were taken: data preparation, data organization and data condensation in the framework of components through concentrated coding and combination of codes and finally presentation of data (Creswell, 2007: 148).

To analyze the quantitative data, descriptive and inferential statistics are used. In the descriptive level, mean and frequency were calculated. In the inferential level, in terms of two specifications of normality and variances, homogeneity was first studied. In cases where data have these two specifications, parametric test and otherwise the non-parametric test was used. Tests used in this research include Freidman's test, single-t Test, one-way variance analysis and Levine's test.

RESULTS AND DISCUSSION

In this section, findings of the study are represented. The first and the third questions were answered using qualitative data and the second and forth questions' answers were provided through quantitative data.

Question 1: What is the viewpoint of academic members, instructors and experienced educators about purposes suitable for preschool educators' professional development curriculum In Iran?

To all the interviewers (20 individuals), authorities of preschool education, child psychologists and prominent professors of university working in the center for publication of educational books have done a proper job in compiling the purposes of preschool educators' professional development curriculum and they are satisfactory.

The main problem encountered in the implementation of these purposes is the lack of time for transferring them and low educational level of teachers. In these centers, concepts are taught theoretically in spite of the fact that in preschool levels, teaching should be practical and applicable. Moreover, the interviewees gave their comments on problems and barriers of actualization of the purposes. These comments are presented here in two separate parts:

Methods used to actualize the purposes

Barriers on the road to actualization of professional development of educators could easily be done through some simple step so that the proper ground is provided to reach the purposes.

Rewards for passing education periods

Since educational periods are short-term, just one good

teacher is not enough; teachers' knowledge level should be increased. A scoring system should be set for passing in service teaching periods of the teachers. Increase in knowledge level and number of scores indicate work quality. This knowledge level increase should affect their rights (interviewee 1).

The need for presenting content experimentally: Educators have to gain the ability to attend classes in their best possible form after passing in-service training courses. These courses aim to do this (Interviewee No. 11)

After passing these education courses, teachers should practically present in the class with complete susceptibility to purpose of these courses (interviewee No.13). The purposes of curriculum are taught theoretically but not practically. This causes challenge to the teachers. Teachers should be taught to actualize concepts in the class and skills should be practiced more (interviewee No.11).

The need for the presence of managers in education periods

Since managers of the centers are absent in the educators' teaching periods, they lack enough skill and attitude, are not familiar with the purposes of teachers' development, and do not pay attention to teachers. At least one education period should be regarded for managers and intervention in selection of the content and manipulating the determined content by authorities should be treated more scientifically.

Proper presentation of content

Marginal problems like history of preschool education, its definition, review of the literature in the field and redefining teaching methods should be avoided and nurture the sense of creativity and innovation along with application of teaching methods (interviewee 9). Interviewee No. 15 believed that teaching skills of teachers should be improved and at the same time, changes should be made in their attitudes.

Obstacles to achieve the purposes

80% of the interviewees believed that the purposes are well written; however, due to lack of awareness about purposes and content of preschool education, authorities are unable to create proper content for educators and this has become a major problem in the field. Here are some of the ideas extracted from interviews:

Problem of implementation

The purposes of education compiled for preschool teachers have the potential to be implemented effectively in this period of education, and their effectiveness depends on their implementation; the serious problem in implementation here is that no supervision is imposed by state organizations on implementing methods that aim to realize purposes (interviewee No. 2).

Attending classes just for acquiring a certificate

One of the problems inhibiting learning purposes is that teachers think they are being compelled by managers of the centers to attend these classes just to obtain a certificate; and as a result, they do not learn and they work according to the opinions of the managers after they receive their certificate.

Low salary of teachers

Examining the problems of teachers' professional development, they first refer to their low salary. They believe that they should have income to provide requirements of their development. All interviewees believe that teachers can be professionally developed through salary increase. Interviewees No. 9 stated that there has been many teachers that worked well and met all expectations from preschool teachers; yet, since their salary was so low that they even could not purchase books to increase their knowledge or participate in courses to improve their skills and update their information, they left and found another job.

Low period of training and educating teachers

Three interviewees from education and welfare organization believed that insufficient time given for education makes the teachers not to understand its purposes. Interviewee No. 5 believed that when certain purposes are given to teachers, education period should be determined.

Lack of certain work books for teachers

In terms of writing books, a huge effort is made for preschool and kindergarten years. Many books and workbooks for teachers of this period in the market are published by welfare organization, but they are not used.

Table 2. Results of Friedman's test for ranking purposes of curriculum.

S/N	Area of curriculum purposes	Mean	Standard deviation	Mean of rank priority	Chi square
1	Developing to level of an active and responsible educator	4/60	0/58	7/02	
2	Promotion of knowledge level of teachers about preschool according to new science	4/59	0/56	6/91	
3	Training responsibility feeling against self and beginners	4/55	0/63	6/81	
4	Creation of positive attitude to teaching occupation	4/54	0/63	6/69	
5	Recognition of modern education methods and procedures	4/52	0/61	6/56	
6	Recognition of teaching principles and regulations	4/51	0/63	6/55	
7	Ability to work with colleagues and group	4/50	0/45	6/54	122/801* Sig: 0.000
8	Familiarity with the newest specialized resources of preschool education	4/49	0/64	6/47	
9	Making teachers able to identify issues of beginners and solutions to remove them	4/47	0/62	6/33	
10	Internalize creation and critical though in teachers	4/45	0/67	6/25	
11	Ability to use technologies related to preschool	4/44	0/67	6/15	
12	Recognition of parents' expectations and society from teachers and interaction ability of them	4/39	0/71	5/75	

*$p<0.05$

There is no program to train teachers before new academic year begins and workbooks are not introduced to them, making certain purposes to be avoided (Interviewee No.1).

Lack of a connecting bridge between students and preschool centers

One of the applied dimensions of education is establishment of the relationship between students and preschool centers that guide students' activity practically (Interviewee No.8). Lack of emphasis on theoretical dimension and emphasis on practical dimensions of the determined purposes give teachers the opportunity to enter these centers, obtain information and knowledge on working with children and learn purposes practically. Familiarity of teachers with types of games and related works make them be interested in new games and works (Interviewee No.1).

Question 2: According to educators, what are the purposes of professional development curriculum for preschool educators in Iran?

In order to study the levels of the purposes of professional development curriculum, Freidman's test wass used. The results of this test are presented in Table 2.

According Table 2, chi-squared statistic is used to study the significance of the ranking at p <0.5 level. Based on the results, developing the level of being an active and responsible educator, increasing the knowledge of teachers in the area of science and training them to be responsible are in priority 1 to 3 in the area of curriculum purposes; and recognition of parents' and societies' expectations and the interaction between them came last. It should be noted that the mean of all items is higher than the presupposed mean of the research, indicating that all parameters are important and should be considered.

Table 3. Test of comparison of the mean grade of teachers' viewpoint in the area of preschool teachers' professional development purposes with the determined supposed criteri).

Statistical indices Variable	Mean of variable	Standard deviation	Supposed mean	degree of Freedom	T value	Sig
Curriculum purposes	4/50	0/45	4	565	26/79	0.000

In addition, single t-test is used for comparing the mean grade of the purposes of preschool teachers professional development with presupposed criteria to determine attention paid to this area, from the teachers' viewpoints. Moreover, in the present study, the mean of the special attention given by preschool teachers is 4.

In Table 3, the t value in the area of purpose of curriculum is more than the critical t value in the error level of 5 and 565% of degree of freedom. In the test, H0 is rejected and the mean of the population is higher than four. Therefore, it can be said that preschool teachers paid attention to the purposes of professional development curriculum.

In addition to the mentioned analyses, variance analysis revealed that the difference between viewpoints of preschool educators regarding purposes of the professional development program is not significant in the case of indices of education, field of study, years of experience and attending courses in the province or the organization.

Question 3: What is the viewpoint of academic members, instructors and experienced educators about contents affecting preschool educators' professional development curriculum in Iran?

According to 80% of the interviewees (16 people), content is compiled well; yet the people representing it cannot do a good job for preschool teachers for they lack enough knowledge on pre-school education and this becomes an insolvable problem.

The next important problem is expectations teachers and parents have from managers of the centers. Managers send teachers to these centers to receive a certificate, and since there is no systematic attitude toward parents, assistants and managers of the centers, teachers try and not what they are taught (interviewee No.8) to present the written content well, some cases are presented below:

Presentation of applied contents

Interviewee No.18 believed that if content is presented in a way that makes education operational. This will help teachers not be confused while teaching in classroom. According to his opinion, content should concentrate more on making teachers capable in different skills and

teachers should be forced to practice games and do handwork.

Using ideas of managers, teachers and experts on presentation of content

Managers have an important role in the presentation of content to teachers. If these contents are not well presented to teachers, they cannot apply them in their teaching. Therefore, managers and teachers should state their opinions about presentation of content and be satisfied with these contents.

On the other hand, experts of education and welfare organization who present the content should completely understand the preschool period and should know that teachers refer to obtain information about this period (Interviewee No.2).

Homogenizing contents in the country

Contents of curriculum presented by Education and Welfare Organization and Quran Science Institution are completely different from each other. For example, teachers in Quran centers are taught in a way that reading and writing and alphabet teaching was emphasized and tried to teach writing and reading Quran in an age that according to many scientists is very early for teaching, reading and writing. Reading at these ages should be limited to reading pictures not reading words and text. However, teachings under supervision of education ministry are in complete contrast with these teachings. Interviewee No. 6 stated, "I believe this disagreement in contents can cause disorder in beginners' learning, and when I stated my opinion in our meetings they stated that since the purposes and activities are the same, we have no problem. Nevertheless, I believe that when students start the first grade, teachers face three classes of students. One class that does not pass the preschool period, one class that has not learned alphabet and one class who has learned it. If preschool education is supervised by the ministry of education, we will be more successful in terms of content".

Question 4: According to the viewpoint of educators, what are the contents of preschool educators' professional

Table 4. Results of Friedman's test for ranking content of curriculum.

S/N	Curriculum content	Mean	Standard deviation	Mean of rank priority	Chi square
1	Training mood of managing class and settlement of cause disputes in the class	4/60	0/58	8/42	
2	Training efficient methods to respond children' responses	4/53	0/60	7/89	
3	Behavioral problems of children in the preschool level	4/51	0/64	7/84	
4	Necessary educational psychological discussions like methods to change behavior and application of psychology in education	4/52	0/64	7/77	
5	Training communication skills special for teachers	4/50	0/64	7/67	
6	Learning disorders in child period	4/49	0/66	7/66	
7	Practical familiarity with types of individual and group games	4/48	0/64	7/65	654/198* Sig: 0.000
8	Practical familiarity with indirect and objective training in preschool	4/47	0/64	7/64	
9	Practical familiarity with application of art in the preschool education	4/44	0/66	7/38	
10	Problem solving application in content of preschool education	4/43	0/66	7/33	
11	Training how to improve emotional intelligence skills in children	4/42	0/64	7/29	
12	Familiarity with different types of storytelling methods	4/40	0/70	7/20	
13	Familiarity with poems related to children	4/37	0/69	6/99	
14	Familiarity with types of contagious diseases in children periods and ways to control them	4/23	0/77	6/25	

*$p<0.05$

development curriculum in Iran?

In order to study the status of these factors in terms of determining the priority and ranking of these factors in the content of professional development, Friedman's test was used. The results are presented in Table 4.

In Table 4, the result of Friedman's test was used along with chi-squared statistic shows that the classification in $p<0.5$ level is significant. According to the results obtained, teaching teachers how to manage the class, settle disputes in class, use efficient methods to respond children's questions and solve behavioral problems of children in the preschool level are in positions 1-3 in the content area while familiarity with types of contagious diseases in children and ways to control them hold the last rank. The mean of all these items is more than presupposed mean of the research and this indicates that

all of them are very important and should be considered. Besides, single t test was used to compare the mean of content score in the professional development area with supposed criteria determine level of attention paid to this area according to the viewpoint of these teachers. Results of this test are presented in Table 5.

In Table 5, in the area of content of professional development curriculum, showed that t value is more than critical t value of the table in the error level of 5% and degree of freedom 565. According to the test conducted, H0 is rejected and as a result, mean of the population is higher than four. Therefore, it can be said that preschool educators have paid attention to the contents of preschool educators' curriculum more than the determined criteria. In other words, proposed contents of curricula should be highly regarded according

Table 5. Test to compare mean of educators' score in the content area of preschool educators' professional development curriculum with determined supposed criteria (single sample t).

Statistical indices / Variable	Mean of variable	Standard deviation	presupposed mean	degree of freedom	t value	Sig
Curriculum purposes	47/4	0/54	4	565	20/75	0.000

to preschool educators' opinion.

In addition to the mentioned analyses, variance analysis test was used to study mean difference, preschool educators' viewpoint in the field of preschool educators' professional development content in terms of studies, field of study, service record, and organization and its type. Results obtained from variances analyses showed that there is no significant difference between preschool educators in the field of preschool educators' professional development content in terms of variable of studies, field of study, service record and hour of attending periods.

Conclusion

This study investigated the purposes and contents suitable for teachers' professional development. As people in the society pay more attention to preschool period, teachers' professional development in this level needs purposes and content that takes them closer to the desired professional development.

Results of this study explain purposes and content suitable for professional development of preschool teachers and analyze the problems that inhibit realization of these purposes and methods to achieve these purposes. These results state the problems that could be solved. A closer look and a wiser decision could facilitate this problem solving. Besides, results of this study show that purposes in the field of professional development of teachers are well developed and an update could make the educators more active as their main problem is inactivity in classroom context. This update could fill the gaps in the classroom and prepare teachers for an efficient presence in their classes.

While most preschool teachers have teaching certificates, only very few of them have enough knowledge in this regard. The reason is the lack of attentive teaching materials in training periods and participants' focus on receiving a certificate. Studies (Amani, 2006) have shown that teachers who are taught observe educational standards more and their teachings have higher qualities. In addition, there are other problems including problem to execute methods that realize purposes of the research, low salary of teachers, limited time for training, training teachers, lack of certain work book for teachers and lack of a bridge between learners and preschool centers.

Noori (2012) showed if authorities regard certain methods and focus on implementation of methods to realize purposes, these problems will be eliminated. Attention of authorities to available problems can enhance promotion level of teachers and more standards in their training were observed.

Most preschool teachers do not a very high salary and this causes teachers to leave this work while they have a lot of experience and knowledge. They are generally encouraged to work in elementary school or do other works with higher incomes. Thus, teachers' replacement increases and limited time of teaching does not let them have any time for professional development. This makes teachers lack experience in starting work in this area and achieving professional development becomes more difficult for them. In other words, professional development purposes are seldom realized. Therefore, facilities should be provided for teachers to try harder with more desire to realize their predetermined purposes.

In order to solve such problems, sufficient costs should be allocated for professional development of teachers so that desirable results could be obtained. Besides, if content is set relative to purposes, achieving purposes will become much easier.

This study showed that educational system in Iran needs more practical content in the field of teachers' professional development. As researches have shown (Hajizadeh, 2004) lack of contents like child's psychology, children disorders and psychology in the teacher training periods, causes major problems in teacher development plans. If teachers know children more and learn such contents, teachers communicate better with children and as a result, the quality of their class and teaching rises and children develop more.

Results showed that the presence of applied and practical contents and proper presentation of them by authorities can prepare teachers to conduct a high quality of education. Teachers could manage class with high quality when he or she is developed professionally. Studies (Thompson, 2001) have shown that using managers' viewpoint in presenting content can help authorities in their programs for teachers' professional development for educators and managers know their weaknesses and are able to offer the content based on their shortcomings.

A deeper look at the results obtained from this study

reveals that offering contents like class management and teaching them to use efficient methods can reduce probable problems in their classes. These results can help authorities in their decision making process in the field of presenting content so that they can prioritize the indices obtained from this study.

This study necessitates further attention of authorities to better allocate time and money to eliminate problems and provide educators with better professional development programs, furthermore, a homogenous and well organized content throughout the country. This homogenous content, even if it is not very well developed can reduce the problems in the coming levels.

Finally, this article presents the proper content and purposes required by teachers for their professional development and offers decent solutions for eliminating their problems. While authorities' knowledge is limited to the field of preschool teachers' professional development, they refer to the content and purposes of preschool courses.

This article provides novel information for authorities in the field of preschool teachers' professional development purposes and contents that can be utilized to remove problems inhibiting realization of purposes using those problems as models. This information could be given to countries that have fundamental problems in this regard and use the same content as preschool courses to teach teachers.

Conflict of Interests

The authors have not declared any conflicts of interest.

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Educational Research and Reviews

Full Length Research Paper

Science teacher trainees' microteaching experiences: A focus group study

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Microteaching is widely used in many countries to prepare trainees for the complexity of the actual classroom environment but has limited use in Turkey. The main objective of this action research was to evaluate and increase in the effectiveness of microteaching, and determine the contribution of microteaching to trainees from their own perspectives through their reflections on their own experiences. Semi-structured focus group interview was carried out with 10 trainees out of 55 trainees who attended microteaching practices. The results ensured that against all the odds of microteaching, it is worthy to use microteaching practices to integrate theory and practice and train qualified teachers. Instead of just concentrating on its visible limitations, it would be better to concentrate on its advantages.

Key words: Microteaching, science education, teacher education, focus group interview.

INTRODUCTION

In the process of becoming a qualified teacher, many aspects of the trainees must be developed. Trainees come to teacher education institutions equipped with a range of different knowledge and skills like: personal characteristics, interpersonal skills, motivation, educational experiences and Subject Matter Knowledge (SMK) depending on their pre-training schooling years. At the end of their training, a qualified teacher is expected to have developed a range of knowledge and skills. These differences are: challenging personal characteristics, interpersonal skills, focused motivation, acquisition of general professional knowledge and understanding of systems, practical experience of teaching, gaining additional SMK and particularly Pedagogical Content

Knowledge (PCK). This development is essential but, there is an uncertainty in the process of becoming a teacher (Shulman, 1987; Bennett, 1993, Gödek, 2002) and how trainee 'develops the ability to transform knowledge of science content into a teachable form' (Veal et al., 1999: 3). Moreover, processes and outcomes are seldom studied systematically (Korthagen, 2011). Since Dewey's (1904) in Korthagen (2011) notification, the gap between theory and practice has remained the central problem of teacher education world-wide. From this perspective, understanding the domains of the knowledge base for teachers is a prerequisite in improving the quality of teacher education and in formulating the ways in which the process of becoming a

teacher can be supported better by teacher education institutions and their partnership schools. In this process, the support provided to trainees by teacher education institutions needs to be analysed.

Microteaching is a widely used technique in many countries but still has limited use in Turkey in preparing trainees for the complexity of an actual classroom environment (Bulut et al., 2016). In this study, microteaching was applied in the scope of Special Teaching Methods- II course in the Department of Primary Science Teacher Education, in a Turkish State University. The main objective of this action research was to evaluate and increase in the effectiveness of micro-teaching, and determine the contribution of microteaching to trainees from their own perspectives through their reflections on their own microteaching experiences.

Knowledge base of teachers and reflection

In the literature, the research tradition (process-product research) which focused on the characteristics, behaviours and effectiveness of teachers, by examining the relationship between teacher characteristics (process) and students' achievement (product), is criticised since it focuses on teacher behaviour rather than teacher thinking with the focus on 'process'. Researchers (Wilson, et al., 1987; Aubrey, 1997; Shulman, 1999; Kılıç, 2010) suggest that, teacher education should focus on 'how' teachers teach, rather than 'what' they teach.

In the research on teachers' professional knowledge for teaching, there are various categories of knowledge base generated by researchers (Elbaz, 1983; Wilson et al., 1987; Shulman, 1986; Shulman, 1987; Grossman, 1990; Furlong and Maynard, 1995; Carlsen, 1999; Turner-Bisset, 1999; Gödek, 2002). Still, there seems no clear understanding as what constitutes teachers' knowledge base. Shulman (1986, 1987) who introduced the term 'Pedagogical Content Knowledge' (PCK), regards it as a vitally important element of teachers' knowledge base and defines it as it 'represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented and adapted to the diverse interests and abilities of learners, and presented for instruction (Shulman, 1987). Even though researchers agree that PCK is an essential element of successful teaching, there seems no consensus as to exactly what it is made up of (Shulman, 1987; Grossman, 1990; Marks, 1990; Geddis et al., 1993; Cochran et al., 1993; Fernández -Balboa and Stiehl, 1995; Magnusson et al., 1999; Turner-Bisset, 1999; Gödek, 2002). The complexity of the nature and the ambiguity in the content of teachers' knowledge base and PCK, may explain the reason of preparing teachers is such a complex process.

There are various views concerning the development of teachers' professional knowledge base. For example, for Fuller (1969), the transformation of SMK into PCK is not the concern of trainees, since, in the process of becoming a teacher, trainees progress through four different stages in terms of their concerns, which are 'no concerns at all', 'survival concerns', 'teaching concerns' and finally 'pupils' learning concerns'. In contrast, Wilson et al. (1987) believes that even beginning teachers do 'invent' PCK. For Grossman (1990), 'classroom observation as a student' and 'as trainee and their own memories'; 'disciplinary education during their first degree'; 'professional education/teacher education programs' and 'classroom teaching experience' are the sources of teachers' knowledge base. On the other hand, 'learning from experience' Cochran, 1992 in Coble and Koballa, 1996: 468 Gudmundsdottir, 1995), 'trusted colleagues' (Appleton and Kindt, 1999: 3), 'observation of classes', 'disciplinary education', 'specific courses in teacher education -knowledge of pupils' conceptions as well as knowledge of specific representations or teaching activities', 'classroom teaching experience' (Van Driel and De Jong, 1999: 3), contribute to the development of PCK.

Even though teaching experience seems to be one of the major sources of teachers' knowledge base, simply 'having to teach' does not seem to guarantee the development since, the transformation of SMK into PCK and the development of PCK do not seem to be an automatic or mechanic processes (Lederman and Gess-Newsome, 1992, Fernández-Balboa and Stiehl, 1995; Veal and MaKinster, 1999). In this process, 'pedagogical reasoning' seems to be crucial (Wilson et al., 1987). Pedagogical reasoning involves 'a cycle through the activities of comprehension, transformation, instruction, evaluation and reflection. The starting point and terminus for the process is an act of comprehension (Shulman, 1987: 14). Therefore, learning from experience might be achieved if teachers engage in the processes of pedagogical reasoning and reflection (Shulman, 1987; Wilson et al., 1987; Bennett et al., 1993). Reflective thinking enables one to learn from her/his own experiences, makes her/him to be aware of the sources of its own unconscious behaviour (Korthagen, 2011: 36). Therefore, trainees should be supported in teacher education institutions to gain experience and learn from their experiences.

In this respect, the use of technology to view and listen to one's teaching performance is a precious experience because by 'analyzing a recording of the dynamics of your classroom, you can check the accuracy of your perceptions of how well you teach, identify those techniques that work and those that need revamping' Gross-Davis, 1993: 34 in Donnelly and Fitzmaurice, 2011: 6. Thus, one of the ways of providing experience for trainees is 'microteaching'. Microteaching enables trainees to observe each others' performance by analyzing and reflecting on their experiences. It also

helps trainees to be aware of their own deficiencies in their Subject Matter Knowledge and develop their Pedagogical Content Knowledge (Akanbi and Usman, 2014).

Microteaching

Microteaching was first developed by Allen and Ryan at Stanford University, California in 1963 to improve teaching skills by providing trainees with a reliable training environment in which they could practice before taking up actual classroom teaching (Allen, 1967). Allen and his colleagues defined microteaching as 'a scaled-down teaching' in which 'the trainees are exposed to variables in classroom teaching without being overwhelmed by the complexity of the situation'. Allen suggested limiting the class size to one to five students and class time from five to twenty minute lessons. Microteaching has been developed to serve three purposes: '(1) as preliminary experience and practice in teaching, (2) as a research vehicle to explore training effects under controlled conditions, and (3) as an in-service training instrument for experienced teachers' (Cooper and Stroud, 1966 as cited in Allen, 1967:1).

Since its inception, microteaching has been used as a powerful tool for teacher education and each teacher education institution developed its own concept of microteaching (Seidman, 1968). Therefore, there are various definitions and practices of microteaching. For example; Seidman (1968) evaluated microteaching from behavioural psychology perspective and defined microteaching as an application which supports trainees in terms of predetermined minimum teacher behaviour. Since microteaching is based on the assessment of behaviours, it can be used in the evaluation of the development phases of professions such as; trainees of technicians, consulting, engineering and teaching, during their pre-service period (Ülper et al., 2015).

Currently, microteaching could be defined as the implementation of the knowledge and skills related to teaching in a controlled class and a limited time, identification and overcoming the deficiencies through the use of feedback. Microteaching aims to reduce the complexity of the actual classroom environment by limiting content, time and the number of students (Akanbi and Usman, 2014; Marulcu and Dedetürk, 2014), to support trainees to become familiar with the teaching profession, and to learn from their experiences (Kuran, 2009).

It should be noted that microteaching should not be assumed as just video recording of the event and then (transmitting to people) having someone to watch it. Rather, the feedback is one of the most crucial and integral parts of microteaching (Bulut et al., 2016). The original model of microteaching consists of six interrelated stages: planning, teaching, observation-criticism, replanning, re-teaching and re-observation-criticism (Allen, 1967; Arsal, 2015). So that, microteaching leads and requires trainees to do reflective thinking which enables one to learn from its own experiences, make her/him to be aware of the sources of its own unconscious behaviours (Korthagen, 2011: 36). In other words, microteaching prepares trainees for the pedagogical reasoning.

Inspite the fact that Allen and his colleagues suggested using video recording as optional, the video feedback is considered to be attractive and valuable (Kazu, 1996; Ülper et al., 2015). In microteaching, trainees are given the opportunity to watch and analyse their teaching, and reflect on their experiences, then develop their own teaching performance. Furthermore, through watching and analysing their classmates' teaching, trainees also have the opportunity to learn from others performance (Görgen, 2003; Bilen, 2014). When evaluating the trainees without watching the video recording, trainees seem to be easily offended, whereas after watching their own performance, they exhibit a more realistic attitude and assess themselves objectively (Kazu, 1996; Arsal, 2015).

The proliferation of microteaching is relatively new in Turkey. It was first implemented in 1989 and used for the first time in 1990-1991 in a two-hour class at the Technical Training Faculties as part of the YOK/World Bank Second Industrial Training Project (Uşun and Zorlubaş, 2007 in Bakır, 2014). Then, it was involved in teacher training programs in 1996 by the same project (Kazu, 1996). Currently, in Turkey, Faculties of Education are responsible for teacher education. Training period of primary science teachers is four years in the Faculty of Education. Field courses, teaching profession courses and general education courses are included in the curriculum. Special Teaching Methods I-II courses are essential for trainees to learn teaching methods. One of the course contents of Special Teaching Methods-II course is microteaching practice (Atav et al., 2014).

In spite of its various proved advantages, the use of microteaching is not that widely spread in Turkish teacher education institutions. For example, in a survey to examine the implementation of microteaching in three well-known Universities (Gazi, Anadolu and Hacettepe) in Turkey, Çakır (2000) asked teacher educators about their views and thoughts regarding the use of microteaching. Teacher educators claimed that they knew about microteaching and were giving teaching methods courses. However, they seemed to be reluctant in giving attention to microteaching and in implementing it in their lessons, due to the limitations in the universities, deficiencies in resources and trainees' lack of recognition of the value of method courses.

In the last two decades, studies carried out in Turkish teacher training institutions on microteaching are

promising. There seems to be tremendous increase in the research on microteaching in Turkey, in different subject areas including early childhood teacher education (Taşdelen et al., 2009), computer education and instructional technologies (Can, 2009), mild mental disabilities teacher education (Deniz, 2010), music teacher education (Koca, 2013), science teacher education (Kartal, et al., 2012; Canbazoğlu et al., 2014; Bakır, 2014; Karaman, 2014), biology teacher education (Atav, et al., 2014), elementary mathematics teacher education (Bilen, 2014), mathematics and information technologies teacher education (Ülper et al., 2015), Turkish language teacher education (Bulut et al., 2016).

In the literature, numerous studies aimed to identify the applicability of microteaching in Turkish teacher education system (Kazu, 1996), to reveal the impact of microteaching on the aspects of trainees' instructional behaviours (Görgen, 2003; Güney, 2008; Erdem et al., 2012; Uzun et al., 2013), reflective thinking (Güney, 2008; Dervent, 2015), critical thinking dispositions (Arsal, 2015), conceptions, attitudes and abilities (Karaman, 2014), changes in beliefs (Görgen, 2003); the problems encountered during teaching and their solutions (Gürses et al., 2005; Baştürk and Taştepe, 2015), teaching skills (Kuran, 2009; Deniz, 2010; Chamundeswari and Franky, 2013; Bilen, 2014; Bakır, 2014), competencies (Taşdelen Karçkay and Sanlı, 2009; Kılıç, 2010; Saban and Çoklar, 2013), speaking skills (Bulut et al., 2016), and self-awareness in improving verbal lecture skills (Ülper et al., 2015).

Some studies also focused on the trainees' reflections on microteaching (Can, 2009; Koca, 2013; Hacısalihoğlu Karadeniz, 2014; Duban and Kurtdede Fidan, 2015), to point out its positive and negative sides, its difficulties and the advantages (Atav et al., 2014; Bilen, 2014; Bakır, 2014), to determine the opinions towards technology-enriched microteaching activities by considering Technological Pedagogical Content Knowledge (TPACK) framework (Canbazoğlu Bilici and Yamak, 2014), and to evaluate and develop microteaching courses, and its procedures (Marulcu and Dedetürk, 2014; Yangın Ekşi and Aşık, 2015).

METHODOLOGY

In this qualitative research, action research as a theoretical framework was utilized. Action research not only aims to describe the existing situation but also aims to improve the practice (Yıldırım and Şimşek, 2005). Action research is 'an orientation to knowledge creation that arises in a context of practice and requires researchers to work *with* practitioners' (Huang, 2010: 93). In this action research, the researcher who is the course instructor, worked *with* trainees, with the aim of both evaluating and increasing the effectiveness of microteaching, and determining the contribution of microteaching to trainees from their own perspectives through reflections on their own microteaching experiences.

One of the four basic methods that can be used to collect the

data in qualitative research is focus group interview. In the literature, the terms of 'focus group interview', 'focus group discussion' and 'focus group study' are used. In this study, the term, focus group interview was used. In the focus group interview, participants' knowledge, experiences, feelings, perceptions, thoughts and attitudes are more important than reaching the generalization; therefore, it is aimed to describe the views and perspectives of the participants (Çokluk et al., 2011). Hence, in order to reveal and describe the participants' views in-depth, a semi-structured focus group interview was used. Focus group interview first emerged in 1930 alternative to interviews (Gizir, 2007). Focus group interview could be defined as carefully designed environments in which the individuals freely reveal their ideas (Casey and Krueger, 1994). In the focus group interview, the main aim is to understand people's thoughts, feelings (Taşdere, 2014), 'ideas and attitudes as they develop through group interaction and exchange' (Kelly, 2003).

Participants

This study was carried out in the Department of Primary Science Teacher Education, in a Turkish State University. Prior to the semi-structured focus group interview, the researcher (the course instructor) informed trainees about the aim of the study, explained the focus group interview process, and asked for their voluntary participation. Ten (six men and four women) out of fifty five trainees in their fourth year voluntarily participated in the focus group interview session. In order to protect the identity of participants, pseudo names were used.

Data collection

This study was carried out in the scope of Special Teaching Methods-II course by the researcher (the course instructor) with the participation of a research assistant (Hakan- pseudo name). In the beginning of the term, trainees were given information on the content of the course and microteaching practices. Trainees were also given an opportunity to watch and assess some examples from previous years' microteaching practices. Each trainee was given a concept/topic from 6th, 7th and 8th grade Primary Science Curricula. A timetable was agreed on for each trainee's microteaching practice.

1. Trainees prepared approximately 40 min of lesson planning in accordance with constructivist theory through 5E learning method.
2. In the microteaching practice, trainees were expected to explain and teach the concepts/phenomenon rather than simply lecturing.
3. They were free to choose and try different teaching techniques, demonstrations, experiments, models or analogies in accordance with their topic.
4. They were asked to mimic, as if they are teaching at the actual class. So, a trainee pretended to be a classroom teacher, the classmates and the course instructor pretended to think like pupils.
5. Each session took about 20 min and was recorded by a video camera.
6. Each record was watched together in the classroom in the following weeks. The trainee was first asked to evaluate herself/himself, and then evaluations of the classmates were taken. Final evaluations were made by the course instructor and the research assistant. All evaluations were made orally.
7. The original model of microteaching consists of six interrelated stages; however, due to the intensity of course content, class size and time limitation, six stages of microteaching could only be applied to approximately one fourth of the trainees. For the rest of

trainees, microteaching consisted of three stages: planning, teaching and observation-criticism.

8. All trainees' lesson plans were also individually evaluated and a written feedback was given by the course instructor.

One of the ways of improving the quality of education is by providing student satisfaction concerning the educational services (Özçakır Sümen and Çağlayan, 2013). Teacher educators, who are aware that reflection is also crucial for them, should give importance to student satisfaction, evaluate their own teaching through the feedback from their students, and re-construct their teaching. So that student satisfaction surveys can be prepared to determine the quality of educational services; individual or focus group interviews should also be carried out by taking into account students' feedback to determine the course content (Şahin, 2009).

Therefore, in this study, the researcher aimed to evaluate and increase the effectiveness of microteaching in the scope of Special Teaching Methods-II course, and to determine the contribution of microteaching to trainees through their reflections on their experiences from their own perspectives.

The sub-problems of this study were:

1. What are the positive and negative experiences of trainees concerning microteaching?
2. How were crticism (feedback) perceived by the trainees?
3. What are the contributions of microteaching to trainees?
4. What are the concerns of the trainees during their microteaching practices?
5. What are the suggestions of trainees regarding microteaching practices?

Prior to focus group interview, the participants were asked for their permission to record the interview with a video camera. The researcher mainly asked 12 open-ended questions. During the interview, the researcher allowed group interactions so that the conversation took place among all participants as they interact with each other in a friendly environment. Therefore, participants talked in depth, chose their own words and freely revealed their own views. Participants felt more comfortable being with others as they were familiar with each other in the same class or in the same department for four years. The interview took place in the faculty's science laboratory and took approximately one and a half hours.

Data analysis

Data collected through focus group interview, were transcribed into written texts and then analysed by using descriptive analysis. For this purpose, based on the interview questions, the coding and categories which were primarily serving the research objectives were determined. Responses were analyzed by using open coding which is the part of analysis that pertains specifically to the naming and categorizing of phenomena through the close examination of data (Yıldırım and Şimşek, 1999). To determine the inter-judge reliability, the data and the categories were examined by two independent experts from the department of Primary Science Education.

Through discussions, a common agreement was reached on coding and categories as suggested by Lincoln and Guba (1985). Data were described and interpreted by addressing cause and effect of relationships. In order to reflect participants' ideas effectively, direct quotations were also provided. Finally, two previously designated experts examined the findings in order to see whether they confirmed the findings and interpretations (Yıldırım and Şimşek, 2005).

RESULTS

In this study, the results drawn from the data collected through focus group interviews were analysed in five categories. These are:

1. Trainees' positive and negative experiences concerning microteaching,
2. Trainees' perceptions concerning the critiques,
3. Contributions of microteaching,
4. Trainees' concerns during microteaching,
5. Suggestions of trainees regarding microteaching practices.

Trainees' positive and negative experiences concerning microteaching

In this study, trainees were asked about their experiences concerning their microteaching practices. They stated that they had both positive and negative experiences (Table 1). Half of the trainees stated that microteaching was an artificial environment. Teaching their classmates created difficulty for trainees.

"… at the moment it looks difficult, because everybody has subject knowledge. You don't know what you are teaching, because everybody knows, I mean, it is worrying" (Hasan).

"I absolutely agree with the artificial environment. It creates tension" (Funda).

For Funda, it was difficult to watch herself and take the criticisms.

Funda: *"I hate mirrors!"*
Researcher: *"Why?"*
Funda: *"Watching myself looks like mirror feature".*
Researcher: *"Is it because of seeing the reality?"*
Funda: *"It is because of taking the criticisms".*

Despite the negative experiences pointed out by trainees, all of them remarked that they had positive experiences. Microteaching allowed them to gain some experience:

"…it provides great experience in the suppression of excitement" (Hasan).

It helped them to realise their own mistakes:

"…for the first time, we had a class facing each other and you have no other choice than that the camera is recording you and you're going to watch yourself. You can really see your mistakes. 'Oh, I'm like! I'm doing this! My voice was like! I'm standing like this!', so it was nice. It

Table 1. Trainees' experiences concerning their microteaching practices.

Experiences		Frequency
Negative experiences (5)	Artificial environment (peer group, high level questions and teaching to the group who knows)	5
	Difficulty in watching her/himself and taking the critiques	1
Positive experiences (10)	Microteaching allowed to gain some experience	5
	It was useful to realise own mistakes	3
	Microteaching gave opportunity to observe unconscious behaviours	3
	Microteaching allowed to feel like a teacher	3
	Being criticised and detecting the mistakes were useful	1
	Microteaching allowed to be more careful and not to make mistakes	1
	It was useful to be prepared for the classroom management	1
	Learned how to manage time	1

was really nice to see ourselves" (Funda).

"… we saw our deficiencies. We had some inputs from our friends' deficiencies. More or less, we had communication, we had different things. We corrected their deficiencies and also learned from that. So it was good, not only ourselves, we evaluated everyone. As a class, we came to a common conlusion" (Ayşe).

Microteaching gave opportunity to observe own unconscious behaviours:

"…when a teacher looks at the classroom, he/she should see the deficiencies, I think if some pupils are talking or some are fighting, at the moment I do not see them. The video showed me that. If I am going to explain something, I have only this in my mind, I don't see anything else. So the video showed me that. I hope that I can change these in the future" (Ali).

"…at the end of microteaching, I felt like I have acted unconsciously, I even did not see the students next to me, I mean, even though my actions were purposeful, I could not see anyone, but I felt like I was just myself. So, it was like I was acting unconsciously, I was explaining but it was like self-developing, I was talking but I was not controlling it, it was like that" (Bahar).

"…during the lesson, the things behind the classroom, people talking, none of them took your attention. But someone spoke there, one stood up and went somewhere but you do not interfere in any of them, you do nothing. You just explain the topic. For example, you can see it in microteaching. For example, someone is talking; somebody is breaking something, maybe doing something. You only explain the topic. Rather than see

them, you are only talking. The most important point is this; for example, you only see them when you watch yourself. You can say 'why and how did I not see it?' For example, you do not realize it when you are teaching [during microteaching]" (Hasan).

Microteaching allowed trainees to feel like a teacher:

"The fact that in my four-year university life, this was an effective course in which I felt myself as a teacher, was good ... I had the joy of being a teacher" (Umut).

"For the first time in my life, it was real teaching experience for me" (Ali).

"For the first time, in this lesson, we felt like a teacher" (Osman).

Trainees individually indicated that being criticised and detecting the mistakes were useful, microteaching allowed them to be more careful and not to make mistakes, it was useful to be prepared for the classroom management and it helped them to learn how to manage the time.

"Both self-evaluation and peer evaluation, as well as the evaluation by faculty members. I think it is very important. This, I think is the most important feature of microteaching…. It is crucial to be observed and criticized by others and to accept and tolerate the criticisms. I think it was very nice in this sense. … I was nervous about microteaching. …I started to prefer not to say anything wrong in microteaching. Perhaps the biggest factor was being recorded" (Bahar).

"Regarding class management, if we would directly face

Table 2. Trainees' views concerning to think like a pupil during microteaching.

Was it difficult?	Frequency
Yes, it was difficult	5
Yes, it was difficult but it was a nice experience	1
No, it was not difficult, but it rather was useful	4

the pupils, we would have trouble with it. In fact, it was such a preparation. First, share something at your level, explain, then, when we start teaching, this [experience] will provide a great advantage to us" (Hasan).

"…microteaching taught us that in 20 min, a topic could be taught, even though it is short, microteaching taught us to give the essence of the topic, this is the aimed" (Emel).

Trainees were asked how they felt when they first watched themselves. They described this experience as "nice feeling which gives happiness, makes them proud, like comedy, amazing-weird and frightening".

"Actually, it is likely to see a provision of your labor, such as growing a tree; you see the tree is growing. For example, it is also very very different, when you share your recording with your mother, father or a friend, and watch yourself, you feel so proud of you and say 'this is me!' ... when my father said, 'Yes, that's my boy! He became a teacher!' I was very happy. At that moment, you do not care about subject knowledge, you see that your father is watching you wearing a suit and teaching, your father's watching makes you already happy" (Hasan).

"Mine seemed to me like a comedy, when I was watching myself, I felt like that but I saw my gestures and facial expressions against the reactions throughout the 20 min, I said that 'oh yeah, I can manage this work in some points but I still have some deficiencies in some points. I need to pay more attention, I need to go back to review something to go further'. At first, you have an upright position. In fact [you think that], I can manage this class…' but towards the end of the video you feel buckled. You no longer manage the class rather the class directs you. Towards the end of the video you feel fed up" (Umut).

"…at first, it is scary, so you're scared. You see yourself there [on the video], you think 'what did I do wrong?', but when you go on watching, you see that you did the opposite, sometimes you do not like it when you get the reactions" (Emrah).

Trainees were asked whether they found it difficult to

think like a pupil when they are attending microteaching practices (Table 2). For most of them, it seemed difficult to show empathy and think like a pupil at the level they were going to teach. Their knowledge concerning the pupils was either higher or lower than the level of pupils that they were going to teach.

"…it was very difficult for me. Eventually, it was something that I knew. When I asked the questions, it seemed to me as if it was nonsense. If I know something why should I have asked it again? So, I could not think personally, as I went behind the camera for recording. I said, 'I should record'. I said that 'I should not ask a question" (Ali).

"Either participation in the lesson or participation of students, I tried to ask questions but I thought that some silly questions were ahead of us. It sounds ridiculous to us. We were thinking about 'how should I ask a question', but even though we knew, we could not manage it. Sometimes, some friends were asking some questions, we were replying 'how such questions [silly questions] could be asked anyway" (Emrah)?

"…When we experienced it, we had to think in a childish manner. Nonsense! Even when we are watching, 'how such question could be asked?' When our friends were asking, we thought that 'how such question could be asked? How a child would ask such questions as if he/she is 5 years old" (Funda).

Osman too found it difficult to show empathy with pupils but stated that it was a nice experience.

"Ultimately, you play the role, but besides the difficulties, it had some nice parts. 'I wonder what I should teach. Do I need to teach it like that?' So, these are nice thoughts" (Osman).

Three participants pointed out that thinking like a pupil at the level they are going to teach was easy for them because, their observations during the "School Experience Course" was useful to them. For example,

"In fact, I think it is not difficult but the greatest factor is that teaching practice classes of the 'School Experiences Course' were useful. If we did not have this [opportunity]

and we tried to do this lesson with our third year knowledge, it would be much more difficult. Of course, there are some friends who cannot emphatize [and think like pupil], but I think it was useful" (Bahar).

For Hasan, thinking like pupil and asking questions at their level were also helpful for his friends who were teaching at that time.

"It was easy for me. For example, I tried to ask questions like an elementary school student would. To help my friends, for example, I was doing it on purpose. Normally, it sounds ridiculous to me, but innerly, there is a person who is presenting a topic and when something is going wrong, you need to intervene. I was asking some easy questions to give some time and provide an opportunity to think. It was easy for me to achieve but also beautiful" (Hasan).

Trainees' views concerning the critiques

Trainees were asked about the stages of microteaching they found most useful. The evaluation stage was indicated by the majority of them (seven) as the most useful stage. At this stage, they seemed to start to reflect on their experiences.

"…evaluation was the most beneficial part because, I made two presentations, okay, in the first I was inexperienced... when I watched myself and the reactions from my friends and from you [the course instructor], I think that they were so useful, because I saw my mistakes and in the second presentation, I tried not to make those mistakes again" (Emel).

"…for me too, the most important phase was the evaluation phase. Because if someone receives the critiques, even though it is hard or good, when I have been criticised, I had a paper in my hand and I noted both negative and positive of your [the course instructor] criticism and I looked at all of them and I looked constantly and read them, when I read them and watch myself and evaluated myself, when I recon these are my weaknesses and these are my strong points, I mean, when I did self-criticism, the problem is slowly disappearing and turns into experience, seems it will be transformed" (Osman).

Trainees, individually also pointed out that other stages of microteaching were also useful.

"I give great importance to the preparation stage because in order to give something [teach], I researched so deeply and so broadly. … For me, at the last point of the fourth year, as a university student, it directed me to make

research. …some deep questions, critical questions were asked and you feel that you need to answer those questions, therefore, I tried to collect the information both from the Internet and from faculty members; this reminded me that I am a university student" (Umut).

"I think, the things made by the student are more important in terms of the memorability in mind. ... Well, without knowing there will be no assessment, I mean, you have to give a good foundation, I mean the explanation phase" (Sinan).

"I think different, indeed it constituted a whole, it was a whole, I think all parts were important, I could not choose the most important part, I think all were important" (Hasan).

Trainees seemed to show different reactions in accepting the criticisms. Hasan and Emrah stated that in the beginning, it was difficult to accept the criticisms so they showed emotional reactions.

Hasan: *"For example, I have been highly criticized, either it was good or bad, at first, you think emotionally, and you are flying, 'how come he/she says this:*
Researcher: *"First, you have already reacted".*
Hasan: *"Yes, I've already lashed out. Then again, when you watch yourself you realize it after watching ourselves. 'Well, actually, it happens, it is right, a legitimate criticism', and you think ... From this point, initially, you approach emotionally, then, when you watch yourself and after a little thought, you realize, you say 'yeah, something like that and they are right!"*
Researcher: *"Was it constructive?"*
Hasan: *"*Sure. First, it is offensive but then you notice that it is constructive but first you should not think emotionally".*

"But sometimes we are defensive, immediately want to interfere and give an answer. On one hand, it is nice. On the other hand, first, we want to be objective, but that is nice too. After a certain time, when you think about it, you justify it. Madam, for example, when I am doing wrong in problem solving, all the time I think the same way but when I get help from someone, I develop a different thought or different method of problem solving. So that, you can solve the question in that way. In this sense, it is very important" (Emrah).

Despite their initial emotional reactions, trainees also seemed to learn to accept the criticisms. For Funda, learning to accept the criticisms was a process which requires cognitive conflict.

"Madam, what I said previously we did, it was lecturing, not explaining. What we saw were just the grades. So

that, we were not open to criticisms but in order to learn, there should be a conflict in our minds, it is similar to that. First we got angry with the course instructor then, we said 'oh yeah, they are actually right' (Funda)!

"About the criticisms, I stood up in front of the class, first you [the course instructor] gave the criticisms ... then my friends criticised me. During the criticisms ... I felt resentment, but at the same time I thought, 'these are things that are actually mine and you [the course instructor] were actually pointing on my weaknesses. What you [the course instructor] are saying should not hurt me. Moreover, this should come as a warning to me'. I learned not to be offended while being criticised and take them as a warning. I noted the criticisms as I said earlier" (Osman).

"One of the values of microteaching was to measure a person's stamina against criticisms. I think none of the criticisms were needless. Some might hurt but to be offended may vary from person to person. After all, you give great effort and perhaps you're faced with unwelcome criticisms" (Bahar).

"Madam, I think the criticisms were normal. ... I did my own criticisms more than you [the course instructor] did. So, I pointed out 12-13 criticism for myself then you [the course instructor] did add no extra criticisms. Therefore, I did not see any harm" (Ali).

"While we are teaching, we only focused on the topic. We were not fully aware of everything outside, but our friends told us that they had more experience. For example, our friends who observed us externally, had a better view than us, and said that 'you did this and that wrong'. The criticisms made by the instructors were constructive for our development and important to see our weaknesses" (Sinan).

Furthermore, Ayşe, Hasan, Funda and Sinan indicated that it was difficult to accept the criticisms due to the kind of criticisms made by course instructors who concentrated on PCK and the research assistant (Mr. Hakan) who concentrated on SMK. Therefore, they felt in a dilemma. For them, the criticisms should be made on PCK rather than SMK. Actually, the dilemma pointed out by them seemed to be related to their concerns.

"In the beginning, being criticised made me feel a bit weak. I said 'okay. I should compensate for the second practice'. I also noticed that I could not express myself and my subject knowledge seemed incomplete. For the second practice, to be honest, I did not want to prepare at all, at first, a reluctance was developed for the course. Then, preparing a material came to my mind. Then, when I was preparing the materials, I thought that explaining the topic might be a bit more enjoyable. I thought that my

materials might entertain a bit. I thought that my performance would enjoy myself too. …That's why I came to the second practice a bit more enthusiastic because of the materials. … Criticisms were a bit disheartening. So, I did not expect this much because I felt like that. You [the course instructor] evaluate pedagogically. Mr. Hakan [research assistant] evaluates in terms of subject knowledge. I said this repeatedly that we are feeling a dilemma. When I was planning, I also felt this dilemma" (Ayşe).

"The contrasting situation is that during the lesson, there are questions related to subject knowledge but during evaluation, this was not the case. No, while I was asking a question, he could look at my gestures. My responses to the students, how I try to save the day? … Am I able to give answers that will satisfy the students? It would be nice, in the evaluation; pedagogical assessment would be more useful rather than subject knowledge assessment…. So, at this point, the reality goes beyond this because in real class environment, there are not much questions because the teacher had to intervene after a while. My presentation went through in the form of questioning and answering. Inevitably, you feel that you need to respond because Mr. Hakan [research assistant] evaluates your subject knowledge" (Hasan).

Umut, Emrah, Sinan and Hasan pointed out that due to criticisms made on their SMK; they had to focus on SMK. They felt that they had to answer all the questions asked by their classmates, so that they had some deviations from their lesson plans.

"We thought the method only in the report [lesson plan] in the planning phase but while teaching, you do not stick to the lesson plan. You want to explain something or want students to discover something; but then someone asks a question then you feel like you have to answer that question; at that time what you're trying to do and your plan completely changes" (Umut).

"What you are saying and the plan you prepared, do not match with each other" (Emrah).

Particularly, on their second teaching, trainees felt that they have to shape their lesson plans according to the questions asked in their previous teaching. Therefore, they felt that they were restricted.

"In the first one, it is your established order; you're doing it yourself, you're determining the direction of the lesson, in the second, in line with criticisms, you feel like you are entering in a mold, so it seems a bit dull" (Sinan).

"In the first presentation, it went so funny and beautiful, but in the second presentation, it was completely a different format. I turned 180 degrees. … For example,

you set a plan or program based on the criticisms and experiences, and obey that plan. For instance, in the second presentation, this was my fault, you say that you are not going to do that, but you do not have the same excitement and improvisation like in the first presentation" (Hasan).

In contrast to these views, Funda indicated that in her first microteaching practice, she felt that she was in the middle of *"a devil's triangle"*. However, in the second microteaching practice, she felt herself very comfortable due to criticisms as she knew her strengths and weaknesses.

"For a moment, I felt as if I was in the middle of a devil's triangle, 'where am I?', 'where is Mr. Hakan [research assistant]?', 'where is the classroom?'. For a moment, you stop, wait a moment, calm down, get a grip on yourself, on where are we? Yes, let's continue, where were we? But in the second presentation, it is different, you are so comfortable, you are familiar, you know your weak points, you know how to make them quite, 'be quite', 'see you later', … I don't bother with class management. … I feel comfortable in my class and have eye contact with everyone, I know their existence… [after the evaluation]. This time, you already did your plan, you have control of the subject. Because you know your mistakes [you say to yourself], 'okay I can do it', they say this, you know, 'ok, I will not do this next time', you predict the questions more or less, you feel comfortable. In the second practice, we did not study that much, personally I took a glance, corrected my plan, so I was comfortable (Funda).

Negative but objective criticisms were useful to see the reality.

"Friendship is something, business is another. While being criticised, the truth is spoken. They said the truth that 'you did something wrong at this point" (Sinan).

"For example Ali, a close friend of mine, at the points you [the course instructor] found me positive, Ali dragged me through the mud. Then what happened? I said 'thank you my brother, how happy I am that you could say that'. In this respect, it is good. For example, some friends whom I do not have any contact with, criticised me positively. My best friend dragged me through the mud. In this respect, it is a beautiful experience. For example, imagine that you evaluate something positively but your friend might evaluate it negatively. Here, we see how useful the criticism is" (Hasan).

"I always tell my close friends that when you evaluate me, please always tell me my weaknesses. Even though they are my friends, I don't want to hear words that would

flatter me. I really would like to have a sincere critique. I really like microteaching, I enjoyed it a lot" (Bahar).

It was interesting to reveal that trainees also prepared for the criticisms. They had rehearsals at their home.

Ali: *"Madam, we have also made preparations for the criticisms. Bahar came to our home and could not eat anything. My grandmother said that 'it is enough!' then, stopped us. I asked her a lot of questions"*.

Bahar: *"I was in the preparation stage. It was two days before my microteaching practice. We were in Ali's house. 'Ready?' he asked. 'Well, yes' something like that. Suddenly, he started, the questions were repeatedly asked, and I was doing 'hum and haw', little bit faster and faster. It was really an exercise for me. I was ready for the criticisms the day before my microteaching practice"*.

"Madam, in a similar way, in our living room, Hasan or Yıldırım were pretending to be Mr. Hakan [research assistant], or someone was pretending to be you [the course instructor]. We were doing rehearsals" (Osman).

"…for example, before you [the course instructor] evaluate us, we evaluate ourselves in advance. ... We are trying to assess ourselves from your [the course instructor] perspective. When you [the course instructor] start to evaluate us, we say that 'yes, we had made them'. … When doing our own assessment, we predict your [the course instructor] criticisms. In that respect, most of the time, before the evaluation phase, we have already evaluated ourselves" (Hasan).

At the end, for trainees, taking the criticisms meant that the class took them into consideration.

"If no one criticizes you, it means that you have fallen on deaf ears. 'Well, I have not been listened to in this class. They have not listened to me so that they do not make any criticism" (Funda).

Moreover, for trainees, the criticisms made by their classmates were useful since the criticisms created a friendly and supportive environment:

"Some friends to whom I never talked in the class ... I said to myself, 'Ok, I'm in this class, I've been here with this friend, but we did not have any conversation for four years". I had my microteaching practice, then, she was evaluating my teaching and telling me some positive things. I said 'okay, no matter how we do have no contact'. … We evolved into an environment of companionship. This made me very happy. While in the classroom, nobody ever said that 'I do not talk to her/him; there is no need to talk about her/his teaching'. Even

Table 3. Contributions of microteaching.

Contributions	Views	Frequency
Pedagogical content knowledge	We learned different teaching techniques from our classmates' teaching (4) We applied different teaching techniques (1) We have learned to look at critically different techniques (1) I have a doubt concerning the applicability of some techniques (1) I learned about the constructivism (1) I started to question and learned that it is important to guide pupils to reach the knowledge rather than transmit the information (1)	7
Professional awareness	Self-teacher attitude, teacher confidence and sincerity are important (4) Increased awareness concerning continuing professional development (4) It is important to express her/himself, use language correctly, and create own style (1) Our perspective towards pupils has changed (1) Our perspective towards profession has changed (1)	6
Subject matter knowledge	We realized the necessity of strong SMK (3) We realized our weaknesses in SMK (1)	4

though we did not have any communication, people expressed 'what was nice and what was bad'. I liked this very much. I really liked those things which did not happen in my four years but happened in the course" (Umut).

"While a friend was teaching, we always tried to be the savior. ... There was excitement, the camera, everything was effective. We were asking questions which already had answers. "Teacher, was it like this? Then, just when we showed her/him the way out, some sort of a union formed amongst us in the classroom" (Ayşe).

Contributions of microteaching

Trainees were asked whether microteaching had any contribution to their knowledge base. Their views indicate that they seem to make reflections on their experiences. The contributions identified can be summarised in terms of Pedagogical Content Knowledge, professional awareness and Subject Matter Knowledge (Table 3).

Trainees pointed out that through microteaching, they had a chance either to try or experience different teaching techniques.

"In the course of 'Conceptual Perceptions in Science' we learned the card sorting technique. … I wanted to do something different, for example. … I thought that it would be different to use a 'V-diagram' which has not been used in this course. It was a technique which has

not been used in our class. I chose to be different. They were very nice to me. I do not know whether it captured attention of my friends" (Bahar)?

"Concerning our friends' teaching, there were some techniques which I thought 'well, it would be better if he/she taught in this way' or 'yes, I am going to use this method in my teaching'. Either it was an experiment or a technique. I thought that I will also use it in the future" (Emrah).

"For example, Prediction-Observation-Explanation, I know-I wonder, then Card-sorting technique used by Ayşe, they all pleased me so much" (Umut).

"...for example, we said that 'it would be better if we did like this'. ...there were some which we hold up as an example" (Osman).

Despite these views, Hasan was doubtful concerning the applicability of the techniques in actual classrooms.

"To be sure, we are going to be teachers, I hope we all really will. I think that none of these activities [methods and techniques] are going to be used. What is a Card Sorting or Word Association Test? … How are you going to use them? We've got a lot of topics to teach. In the Teaching Practice School, the teacher taught and finished the unit of evolution in 40 min, then switched to a different unit. We hardly described the concept in only 20 min. Keep using the V-diagram in it. I do not believe that they [these methods and techniques] could be applied in

real life" (Hasan).

Funda commented that she has learned to look at critically different techniques.

"…the use of teaching methods is nice, and we also could say that 'he/she used this method, but it did not suit this topic' or 'at this stage it would have been nice if he/she had done this" (Funda).

Umut pointed out that he started to question, and learned that it is important to guide pupils to reach the knowledge rather than simply transmit the information.

"I would say for myself, I gained a lot. ... For example, we're talking with Emrah about electric current. It stems from a magnet. Emrah said, 'What are the properties of that magnet?' So I asked Mr. Hakan [research assistant]; 'Why magnet pulls iron, nickel and cobalt but does not pull other substances?'. Then, we started a research on magnets. 'How is the structure of a magnet?' We went to get the answer from other faculty members. After a little time, such questions as 'why the electrons move?', 'How come the electrons are moving?' arose. I have studied the research carried out by scientists including Faraday and Maxwell on this issue. Increasingly, I realised that I knew nothing about electricity. 'Why electrons move?', 'why magnets pull them [some substances]?', 'What substances are in nature?' We were not directed to research. … Beginning from elementary school till now, we observed that teachers directly transmit the information to the pupils, and then they take their notes and memorize it. Teaching was this, but what happened, we came here, you are expected to guide the pupils to gain the knowledge" (Umut).

Six trainees indicated that microteaching contributed to their professional awareness. As they specified, due to their microteaching experience they started to believe that "self-teacher attitude, teacher confidence and sincerity are important".

"On the board, you should posses a self-teacher attitude. I grasped that. You should stand on your feet in front of the board, then, you should instill confidence that as an individual you are confident. Some of my friends were too passive in front of the class, but a teacher must be able to stand upright on the board" (Umut).

"At least, we've noticed the things that we knew as incorrect. A child does not care, does not want to listen or pretends to be listening to the teacher who is fainthearted even though he is fully confident in his subject area. But even though he does not know the answer of the question, his upright posture; I mean, 'ok, I am going to search and then give you the answer', … 'you should search too', 'let's search together', when you give that

trust, a child will be waiting for you and say 'my teacher knows everything'. If the teacher proves himself for several times, even though he does not know the answer, the child will not perceive him as he doesn't know. The child will subsequently say 'yes, my teacher knows!'" (Funda).

Furthermore, Ayşe indicated that using the correct language and teachers' own style of teaching is a necessity.

"Madam, I recognised that no matter how much you know, no matter your subject knowledge is strong, expressing yourself is very important. As I watch myself, I understand that ever more. I said that 'I must learn standard Turkish language'. In fact, [on the video] I was using inverted sentences. … Also, each teacher has his/her own style and way; that's certain! They [classmates] all reflected their own style. … You should have your own mind, not a paper. This is really important" (Ayşe).

Trainees also seemed to believe that continuing professional development is a necessity.

"We have learned that we need to follow the current events. We also know that it is not teaching but the education system in which we have, I mean, this was the way it was thought. In the present, the system has changed and we recognised that we also need to change ourselves, this is due to microteaching" (Emel).

"…New teachers have to constantly renew themselves. Awareness is of upmost importance" (Bahar).

Furthermore, Hasan also indicated that his perspectives towards pupils and the profession have changed.

"… For example, my perspective towards pupils is changing. My perspective towards the subject is changing. 'When I become a teacher, I will do that'. In terms of the profession, you say that 'I should do this'. I should develop myself" (Hasan).

Four trainees expressed their views regarding the contributions of microteaching in terms of Subject Matter Knowledge.

"In fact, pupils feel whether their teachers know or not. From my observations, I noticed on the issue of circumlocution that, pupils actually expect an immediate answer, rather than statements such as 'let's investigate together!', which would deem the conversation into a circumlocution. Should we always respond? No, we also need to orient pupils to conduct research, but I think they [pupils] feel [whether teacher knows or not] what Is going

on" (Bahar).

"…At school, there are such pupils in 6th grade. For example, Emrah said that they [children] do not ask higher-level questions, but a child went and searched for the topic. Then he said, 'I heard that there is helium in space. What is Helium?' he asked. The teacher replied 'don't go there!' Because he [teacher] does not know actually. That child was asking such different questions, that I asked him: 'Where did you learn these?' The boy replied 'I did research in the internet'. I said 'well done! continue to ask these kinds of questions" (Osman).

Trainees' concerns during microteaching

For all trainees, microteaching practice was exciting together followed by a mix of anxiety or happiness.

"I recognised that the time is inversely proportional to emotions. As time goes by, something was even growing inside of me. Overall, I reconed, that my roommates said so. Each week, some of my friends were teaching, day by day; we were thinking 'what are we going to do?', 'how are we going to do?', and a sense was growing inside of me. I think it was exciting; the feeling that I can do something makes me happy" (Osman).

"Emotionally, it was exciting, because passing over something to people, giving something to people, experiencing something like that was very exciting" (Umut).

"Emotionally, it was distressful" (Bahar).

"It was not what I thought at the preparation stage. So I was afraid" (Emrah).

Trainees made some criticisms concerning the questions asked during the microteaching practice. Hasan and Emrah found the questions asked by their classmates, as "irrelevant in relation to the topic".

"There were so many silly questions. Our friend, who is teaching, was also faltering. I thought about it, I told the class [friends] that 'please do never ask such silly questions!' I mean, there were such ridiculous questions which are irrelevant to the topic" (Emrah).

It seemed that Bahar was not sure about the level of the questions that could be asked by pupils. For her, the level of the questions asked by her classmates was higher than the level of the questions that could be asked by pupils.

"Are such high level questions being asked in the academic context? Or should it really stay at the level of school students" (Bahar)?

On the other hand, Umut had difficulty in "time management". Prior to his microteaching, he prepared to increase his SMK in the topic of "electricity current". He prepared a short lesson plan to allow some time for those questions which could be asked by his friends. However, no questions were asked at all, therefore he felt "like a fish out of water".

"I went to the class and thought that during my teaching, my classmates would ask questions too, thus 20 min passed pretty quickly. I started teaching, and there were no questions. My planing allowed me to teach for only 6-7 min. After the 7 min, I started to think what I should do to fill the the rest of the 20 min?... I prepared for how I can explain better at the 6th, 7th grade level, but when no questions were asked, at that moment I felt like a fish out of water" (Umut).

Trainees were asked whether they were worried during their microteaching practice (Table 4). All of them mainly seemed to worry about their Subject Matter Knowledge:

"Madam, I was stressed! I focused more on Mr. Hakan [research assistant] rather than the classroom … I thought about the kind of questions he was going to ask. … I was thinking and thinking, I mean, I could not sit down and write the plan, I had so many things going on in my head. If I could not write a little longer, I was going to cry. At the end, I came to that point because I was stressed since Mr. Hakan assessed our subject knowledge" (Emel).

"The topics were distributed and I got 'electricity current'. When I first heard my topic; I told myself that 'we had the same topic in Science Laboratory Course last year. I had these kinds of questions in that course before. I wonder how much I still know about it.' I asked myself. I realized that I do not have sufficient knowledge about electricity current so, what could I possibly teach the children? I tried to improve myself in that matter. There are magnets. I wondered how magnets can bring electrons to vibrate and create an electric current. I made researched about this. A university student should not accept everything; they should make research and develop themselves. Through this course, for the first time I went into research" (Umut).

"… We know more or less a bit from all topics, but we have to know our topic in-depth. ... At least, we should have knowledge on creating a question in the minds of our students. This leads me to feel pretty flurry. Emotionally, I was shaking. How will I manage this? What should I do? Would it be more accurate to say it there? No, no, I should say this. In the beginning, I was excited

Table 4. Trainees' concerns during microteaching.

Concerns	Frequency
Worried about subject matter knowledge	5
We had some deviations from our lesson plan due to the questions asked	4
In general, I prepared for the questions to be asked	1
Strong SMK brings self-confidence	1
Teaching method	1
Failure	-

Table 5. Trainees' suggestions concerning microteaching practices.

Suggestions	Frequency
All teacher trainees should definitely experience microteaching	10
The aim of microteaching should be the development of PCK rather than SMK	10
There should not be any restriction on the choice of teaching methods	5

... I got even more excited. I was good in the classroom [during teaching]" (Bahar).

"At the moment we are still teacher trainees. How can we possibly know for what and how long we are going to be assigned to teach in the next year? The preparation phase has always been about subject knowledge; as to those issues such as what I know and how I am going to convey them accordingly. I first prepared that, then I was going to learn the topic and how I am going to convey it. My preparation did not focus on those kinds of questions which could be asked and blah blah blah, you know the drill. If I know the topic, I can answer the questions. I just went on this way" (Ali).

Trainees were asked whether they had any concern of failure however, none of them mentioned that they worried to fail.

"Madam, to tell the truth, I had no worry about the grades because [I believed that] we spend a great effort and we would get rewarded for that effort. I did not get concerned because of the grades so that perhaps the course also got enjoyable" (Umut).

The only concern mentioned by Bahar is that she only worried about whether her microteaching was going to be widely accepted.

"I was not concerned about the grade I would get, but rather I was worried about whether my presentation will be good or not, and whether it is going to be accepted or not. I did not have any concerns regarding the grades" (Bahar).

Trainees' suggestions

Trainees pointed out some suggestions concerning microteaching practices (Table 5). All the trainees agreed that microteaching should be applied to all teacher trainees due to advantages of microteaching.

"I think microteaching definitely should continue, because it really adds a lot of great things to you. I've also told you, last year I was not be active in Special Teaching Methods class due to school-related and personal problems. Even I can say that I have not seen the full 5E method. I can only say that I just know its name. Even being such a student, I reckon that I am quite ahead at the moment, both being critical and using it [5E model], it was very good. I absolutely think that all teacher trainees should receive a micro-teaching course at least once" (Bahar).

Trainees suggested that there should be focus on PCK rather than SMK so that, their SMK should not be the focus of evaluation rather, their PCK should be evaluated.

"Madam, for me, the evaluation of subject knowledge was not suitable for this course.   Questioning subject knowledge is indeed a very important issue…. but I think in this course, subject knowledge should not come to the forefront. In all our speeches, the first thing that we mentioned was that we actually prepared for the subject and subject knowledge. The primary purpose of this course is not subject knowledge. Certainly, we must know and ...it is very good for us to see our weaknesses. Everyone agrees with this, but if the aim of this course is

methodology, we should evaluate this more" (Ali).

As mentioned earlier, trainees were asked to prepare their teaching in accordance with the 5E model. Even though they were free to use teaching techniques, trainees suggested that no restrictions should be made in choosing the teaching methods.

"There should be no method restriction, everybody should use whatever method they wish. You should be able to select the method depending on the topic. Even though everyone had different topics, some were using the same methods. Some methods were not suitable for other topics" (Emrah).

"Then any methods except lecturing should be expected" (Funda).

"Or you should give some specific methods. For example you should leave five methods to choose from. Because like 5E, as they say, maybe I'm using it because I was forced but it is not my style and this might reduce my performance. That's why I would say that this is a much better method [then I choose it]. Maybe my performance might increase" (Ayşe).

DISCUSSION

This study aimed to evaluate and increase the effectiveness of microteaching and determine the contribution of microteaching to trainees through their reflections on their experiences from their own perspectives.

Trainees' positive and negative experiences concerning microteaching

The findings showed that trainees reported having some negative experiences in their microteaching practices. They had to teach their classmates who know as much as themselves so that they perceived microteaching as an artificial environment. They found it difficult to watch themselves and take the criticisms. In literature too, artificial environment is pointed out by researchers as one of the most disadvantages of microteaching since teaching trainees' classmates rather than real students disrupts the essence of the microteaching practice (Külahçı, 1994; Çakır, 2000; Bakır, 2014; Bilen, 2015). Bakır (2014) found that during microteaching, a tension occurred because it was an artificial environment, there was limited time, having a video recording the session, excessive stress during the first lesson presentation, the fact that it was boring to teach the same topic for the second time, tension caused by peer critiques, and

pupils' roles were exaggerated. Atav et al. (2014) pointed out that some trainees were stressed due to being recorded. Duban and Kurtdede Fidan (2015) also revealed that the classmates' attitudes and lack of empathy caused some problems for trainees.

All trainees noted that they had mainly positive experiences in their microteaching practices. They regarded it as a 'difficult but useful experience' since it allowed them to gain some experience and to feel like a teacher, helped them to realise their own weaknesses, and gave the opportunity to observe their unconscious behaviours. It was also perceived as useful to be prepared for the classroom management since microteaching helped them to learn how to manage the time. Similarly, in Görgen's (2003) study, microteaching practice was affective in decreasing trainees' worries in terms of 'not to make a mistake, not to know how to correct the mistakes, failure to provide fluency, inability in classroom management, tone of voice, the inability to adjust the speaking rate, teaching in front of the classroom, inability to take the students' attention and the general interest on the topic, to forget what to say, not knowing which teaching method to use, inability to control their emotions, not knowing how to conclude the lesson. In Hacısalihoğlu Karadeniz's (2014) study, mathematics trainees were worried about preparing for microteaching and for that, their teaching would be watched by their classmates and the course instructor. But at the end of their performance, they reported increased self-confidence. Trainees observed their own weaknesses, they tried to overcome their weaknesses in line with the suggestions of the course instructor, and finally, they felt better in the teaching of mathematical concepts.

In this study, trainees reported that they felt a mixture of feelings when they watched themselves in videos: including "nice, feeling which makes me happy, makes me proud, like comedy". For some trainees, watching their recordings were "amazing-weird and frightening". Kazu (1996) pointed out that being criticised and watching the recordings may not be useful for everyone in the same degree. Some of trainees may regard this experience as frightening, threatening and frustrating. On the other hand, Bakır (2014) found that for trainees, it was boring to watch the videos. However, in this study, none of the trainees mentioned this kind of experience. Rather, they reported that they found it very useful to watch their videos to identify their weaknesses. Accordingly, in Wakwinji's (2011) in Canbazoğlu Bilici and Yamak (2014) study, one of the most crucial impacts of microteaching mentioned by trainees was that microteaching gives the opportunity to watch their own performance.

The evaluation stage was found to be the most useful stage by the majority of trainees. It allowed them to start to reflect on their own experiences. Correspondingly, feedback was considered as one of the most important

factors of microteaching by Allen and Ryan (1969) in Arsal (2015). As Arsal (2015) points out, in his study, trainees shared their knowledge, ideas and experiences with each other by means of discussion activities in microteaching. At the evaluation stage of microteaching, in a positive classroom climate, cooperation and the sharing of ideas on teaching performance among the trainees might be the factors that contributed to the increase in their critical thinking dispositions.

Trainees' perceptions concerning the critiques

Trainees showed different emotional reactions in accepting the criticisms. It was properly indicated by a trainee that learning to accept the criticisms is a process which also requires a cognitive conflict. Despite their initial emotional reactions, trainees eventually seemed to learn to accept the criticisms. It was also difficult to accept the criticisms due to the kind of criticisms made by the course instructors, since one concentrated on PCK and the other on SMK. Therefore, trainees felt themselves in a dilemma. Actually, the dilemma pointed out by them seemed to be based on their concerns. Fuller (1969) indicates that the transformation of SMK into PCK is not the concern of trainees. Even though, strong SMK is crucial for trainees, concentrating on both their SMK and PCK seems to be difficult for them. Consequently, some trainees pointed out that criticisms made on their SMK led them to focus on SMK. Then, they felt that they had to answer all the questions asked during the lesson, and this led to some deviations from their lesson plans. Therefore, some trainees prepared for their second lesson plans in line with the questions asked in their previous teaching. So that they felt that they were restricted. In contrast to these views, a trainee indicated that in her first microteaching practice, she felt that she was in the middle of "a devil's triangle". However, in the second microteaching practice, she felt very comfortable due to the fact that the criticisms provided her the knowledge of her strengths and weaknesses. On the other hand, Hacısalihoğlu Karadeniz (2014) found that trainees watched their own video recordings, identified and tried to overcome their own weaknesses, benefited from the critiques of their friends and the course instructor; therefore their second microteaching practice was more successful than the previous one.

In this study, it was revealed that negative but objective criticisms were found to be useful to see the reality. For trainees, taking the criticisms meant that the class took them into consideration. They had rehearsals at their home and some trainees also prepared for the criticisms beforehand. Similar to this finding, Hacısalihoğlu Karadeniz (2014) reported that in her study, she carried out microteaching practices in the scope of "Teaching Practice" courses taught in practice schools. In order to overcome the difficulties, prior to their microteaching,

trainees went to their practice school and got some information about the school, the teachers and the pupils. Furthermore, they communicated with their mentors, carried out a preliminary study concerning the topic that they are going to teach, and they made presentations to their friends without video recording.

Moreover, for trainees, the criticisms made by their classmates were found to be useful since the criticisms created friendly and supportive environment. In contrast to this finding, in Canbazoğlu Bilici and Yamak's (2014) study, it was pointed out that one of the reasons of the disadvantages of microteaching was related to interpersonal relationships. Researchers indicated that, some problems occurred between the trainee who is teaching and the classmates who watch and criticise her/his performance. On the other hand, in Erdem's et al. (2012) study, most of the trainees regarded the video recording and critiques as beneficial, while others stated that the video recording and critiques made them to become nervous, and they suggested that microteaching would be more beneficial if it were conducted at the schools where they did their school practice.

Contributions of microteaching

According to trainees, microteaching contributed to trainees' Pedagogical Content Knowledge, professional awareness and Subject Matter Knowledge. Overall, the most crucial contribution of microteaching might be that it provides trainees with some experience for reflective thinking which enabled them to learn from their own and friends' experiences, and made trainees to be aware of the sources of their own unconscious behaviours.

Concerning Pedagogical Content Knowledge, microteaching allowed trainees both to try and experience different teaching techniques, and to look critically at them. In other studies (Görgen, 2003; Atav et al., 2014), it was reported that microteaching also gave opportunity to gain experience by observing others' teaching. Accordingly, in a study to examine trainees' views concerning the impact of microteaching on teaching skills, Küçükoğlu et al. (2012) found that trainees, who exhibit their teaching skills through microteaching, experienced less difficulty. Deniz (2010) reported that microteaching brought about positive changes within the trainees' views towards teaching skills. Correspondingly, Canbazoğlu Bilici and Yamak's (2014) indicated that microteaching contributed to trainees' knowledge concerning teaching strategies, methods and techniques with the opportunity of self-assessment as well as peer assessments. Whereas, Bakır (2014) revealed that microteaching had positive effects in the following areas: lesson introduction, concluding the lesson, teaching a lesson effectively, classroom management, seeing one's own deficiencies, self-improvement, gaining experience, self-confidence,

planning and effective communication. In Atav's et al. (2014) study, microteaching contributed to trainees' teaching skills, classroom management skills and helped them to develop both verbal and nonverbal communication skills. Bilen (2014) pointed out that trainees enjoyed microteaching through which they gained knowledge concerning teaching skills, whereby their self-confidence and teaching skills increased.

Trainees indicated that microteaching contributed to their professional awareness. For them, self-teacher attitude, teacher confidence, sincerity, the use of correct language and teachers' own styles are important in teaching profession. It was pointed out by a trainee that he started to question and learned that it is important to guide pupils to reach the knowledge rather than simply transmit the information. Furthermore, continuing professional development was perceived as crucial. A trainee also pointed out that due to microteaching, his perspectives towards pupils and the profession have changed. Atav et al. (2014) found that due to microteaching practices, trainees developed positive attitudes towards their profession. Even though microteaching provides trainees some experiences in a supportive environment, it should be taken into account that they still need further experience concerning the profession. For example, despite his positive attitudes towards teaching methods and techniques, a trainee was still in doubt concerning the applicability of the techniques in actual classrooms. Even though they used or experienced various teaching methods and techniques, he still seemed to develop a belief that different techniques would not be used in actual classrooms. The reason for this belief seems to be based on his lack of teaching experience as well as his perceptions of the concepts of learning and teaching.

Trainees also expressed their views that microteaching contributed to their Subject Matter Knowledge since they realised the necessity of strong SMK, and their own weaknesses in their subject area. Whereas Duban and Kurtdede Fidan (2015) indicated that trainees had problems with regard to the course instructor, themselves and their classmates. Problems arising from the course instructor were; no clear instructions of the course instructor, lack of feedback and expectations based on constructivist theory.

Trainees' concerns during microteaching

All trainees mainly worried about their Subject Matter Knowledge. Concentrating on both their SMK and PCK seemed to be difficult for them. Some of the trainees seemed to have a lack of knowledge about pupils. Even though, some trainees pointed out that their observations during "School Experience Course" helped them in thinking at pupils' levels, they still had some assumptions

that the level of the knowledge of pupils would be either higher or lower than the level of pupils that they are going to teach. So that, for trainees, it seemed difficult to show empathy and think like a pupil at the level they were going to teach. Therefore, some trainees found the questions asked by their classmates, as 'irrelevant with the topic' or 'higher than the level of the questions which could be asked by the pupils'. This finding is in line with other researchers (Bakır, 2014; Duban and Kurtdede Fidan, 2015), as they found, during microteaching, pupils' roles were exaggerated due to trainees lack of knowledge about pupils. Some trainees were concerned about time management. Similarly, in Atav's et al. (2014b) study, trainees encountered difficulties in time management and in reviving the interest of the classroom.

In this study, none of the trainees reported to have been worried about failure. Rather, one indicated that she was only concerned about her teaching as she was worried whether her microteaching was going to be widely accepted or not. In contrast to this finding, In Duban and Kurtdede Fidan's (2015) study, the biggest problem expressed by trainees was the tension created due to excitement and concern of failure during microteaching practices.

Suggestions of trainees regarding microteaching practices

All trainees agreed that microteaching should be implemented to all teacher trainees due to their advantages. Correspondingly, in Fernandez and Robinson's (2006 in Bakır, 2014) study, most trainees stated that this method is worth the time spent and that it was a beneficial learning experience, and that the most notable benefits of this exercise are practical application of theory, cooperation and reflection.

Even though trainees were free to use teaching techniques in the scope of 5E learning method, they suggested that no restrictions should be made in choosing the teaching methods. Trainees also suggested that their SMK should not be evaluated in microteaching; rather their PCK should be evaluated. In accordance with this suggestion, Görgen (2003) points out that in microteaching, the aim is not teaching a subject rather, it is applying a technique. It also aims to improve trainees' research ability and personality. Even though it is an artificial environment in which there is a relatively minimum risk of failure and high possibility of achieved teaching ability, trainees gain professional experience. In addition, by minimizing the fear of making mistakes, microteaching contributes to trainees' self-confidence (Görgen, 2003). Similarly, Kazu (1996) points out, the main aim of microteaching is to create an experimental environment to help trainees to gain teaching skills and

increase experiences when it is difficult to create natural practical environment for them. Therefore, microteaching creates a well controlled laboratory environment and a practical environment prior to trainees teaching in real classroom settings.

In the literature, researchers suggest that microteaching should be used to train more qualified teachers in all pre-service teacher education programs (Kazu, 1996; Hacısalihoğlu Karadeniz, 2014; Atav et al., 2014), especially in the practical lessons of teacher education programs (Taşdelen Karçkay and Sanlı, 2009) and also in-service teacher training (Görgen, 2003; Atav et al., 2014). Microteaching contributes to trainees' teaching skills and attitudes towards the profession, so that more space should be given for microteaching in the teacher training programs (Atav et al., 2014). Since it is so effective in helping trainees to gain teaching skills, microteaching should be conducted not only in the fourth year of university but in the preceding years as well (Bakır, 2014). Trainees must have at least three microteaching practices prior to their teaching practice in order to know about the profession (Çakır and Aksan, 1992).

Conclusion

From the findings of this study, it could be concluded that there are some limitations but there are various advantages of microteaching. Microteaching had some limitations for trainees because trainees taught in an artificial environment in which time limitations, being recorded and being criticised may prevent their real teaching performance. However, before teaching in an actual classroom environment, microteaching allowed trainees to feel like a teacher and helped them to gain some practical experiences. According to trainees, microteaching contributed to their PCK, professional awareness and SMK. Microteaching allowed them both to try and experience different teaching techniques, and to look critically at them. Trainees started to question and learn about the profession. They realised the necessity of strong SMK, and their own weaknesses in their subject area. Overall, the most crucial contribution of microteaching might be that it provided trainees with some experience for reflective thinking which enabled them to learn from their own and friends' experiences, and made trainees to be aware of the sources of their own unconscious behaviours.

Even though trainees showed different emotional reactions in accepting the criticisms, negative but objective criticisms were found to be useful since they created a friendly and supportive environment and helped trainees to see the reality. During microteaching, all the trainees mainly worried about their SMK; therefore, concentrating on both their SMK and PCK seemed to be difficult for them. Some seemed to have a lack of knowledge about pupils, and some were concerned about time management. None of them reported been worried about failure.

All trainees suggested that microteaching should be implemented to all teacher trainees due to their advantages. They suggested that no restrictions should be made in choosing the teaching methods and their SMK should not be evaluated in microteaching; rather their PCK should be evaluated.

Ultimately, this study reemphasized that against all the odds of microteaching, it is worth to use microteaching practices to integrate theory and practice and train qualified teachers. Instead of just concentrating on the visible limitations, it would be better to concentrate on the advantages.

Suggestions

The suggestions of this study are;

1. Microteaching requires some technological and laboratory sources. Therefore, in teacher education institutions, some technologically supported classrooms must be built up to support teacher educators who are willing to implement microteaching.
2. In microteaching, teaching in an artificial environment, time limitations, being recorded and being criticized increase the tension of trainees. Keeping this limitation of microteaching in mind, teacher educators who would like to implement microteaching should provide a supportive environment with the focus of ensuring positive experiences of teaching, trainees' knowledge base development and self-confidence, rather than threatening them with the risk of failure.
3. In order to reduce the tension of trainees, only one aspects of trainees' knowledge base should be evaluated in microteaching.
4. In microteaching, constructive criticisms are crucial for trainees' knowledge base development. Therefore, constructive criticisms should be taught and given to trainees.
5. Finally, but much more crucial, despite all limitations, there is a need for teacher educators to be more willing to benefit from microteaching for the quality of teachers and for the quality of teacher training institutions.

Conflict of Interests

The author has not declared any conflict of interests.

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Interview questions

1. How was the microteaching practice?
2. How did you feel when you first watched yourself?
3. How was the preparation, especially in terms of emotional experience?
4. Was it difficult to pretend to be and think like a pupil? Especially, thinking like a pupil while watching your classmates' performance and asking questions that a pupil can ask? How does it feel to ask questions thinking like a pupil?
5. Which part of the microteaching was the most useful?
6. What do you think about the criticisms made by the course instructor? Do you find them constructive or offending?
7. What do you think about the criticisms made by your classmates?
8. Do you think this course affected you in terms of teaching methodology?
9. Do you think that this course affected you you in terms of professional awareness?
10. Do you think that this course affected you in terms of subject matter knowledge?
11. From the beginning of the course, have you ever had any concern for grade?
12. Do you have any recommendation concerning microteaching practice?

Educational Research and Reviews

Full Length Research Paper

Students' thinking process in solving combination problems considered from assimilation and accommodation framework

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This study aims to explain the thinking process of students in solving combination problems considered from assimilation and accommodation frameworks. This research used a case study approach by classifying students into three categories of capabilities namely high, medium and low capabilities. From each of the ability categories, one student was chosen as a research subject. The results of this research showed that the student in high ability category, in understanding, planning, implementing and checking the problem solving used assimilation thinking process and they also used accommodation thinking process in solving a problem. The student in the category of medium ability, in understanding, planning, implementing and rechecking problem solving used assimilation thinking process. The student in the category of low ability, in understanding, planning and implementing problem solving used incomplete assimilation thinking process, and in rechecking the results of problem solving he was not able to do the thinking process of assimilation and accommodation.

Key words: Thinking process, combination, assimilation, accommodation.

INTRODUCTION

Combination material is a difficult material for students and is a prerequisite material for studying opportunity and statistics (Garfiel and Ahlgren, 1988). Combination is a part of Discrete Mathematics which has many usefulness in everyday life and is closely related to the real context (Abrahamson, 2008). Permutation and combination is one of the materials in Discrete Mathematics course (Susanna, 2004). However, in reality the students of Department of Mathematics, Universitas Negeri Malang still have mistakes while solving permutation and combination problems (Sukoriyanto et al., 2016).

Students do thinking process when solving problems (Frenke and Kazemi, 2001). In the thinking process, there is a process between incoming information and scheme (cognitive structure) in a person's brain (Subanji and Supratman, 2015). Experience or new information received will be adapted through the

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process of assimilation or accommodation (Simatwa, 2010).

Cognitive process that occurs when a person integrates perceptions, concepts or new experiences into an existing scheme in his mind is called assimilation (Subanji and Supratman, 2015). While accommodation is the process of integrating the new stimulus through the creation of a new scheme or change the old scheme to adjust to the problems encountered (Subanji and Supratman, 2015). According to Hoppes and Segal (2010), accommodation can happen in two ways, namely to modify the existing scheme to match the stimulus given or to form a new scheme that matches the given stimuli.

To track the type and the mistake location done by the students in solving combination problems, the lecturers need to know the thinking process of students in solving combination problems. By knowing the location and type of mistakes of the students in solving combination problems through tracking thinking process, the lecturer can design an appropriate learning which is suitable with students' thinking process. Students require high thinking level in solving the problem. The steps of problem solving according to Polya this consists of four steps:

1. Understand the problem
2. Devise a plan
3. Carry out the problem, and
4. Look back (In'am, 2014).

Students are expected to develop their problem-solving abilities to face challenges by adopting various perspectives (Tai and Lin, 2015). To give the students experience in using the knowledge and skills possessed can be done through a process of problem solving (Can, 2015).

Students perform process series of thinking in solving problems (Saragih and Napitupulu, 2015). Similarly, when the students solve the combination problem they need to perform series of thinking process. If the students' thinking process in solving combination problem does not get the attention from the lecturer, there may be an impact on students' learning outcomes. Therefore, the disclosure of students' thinking processes in solving combination problems needs to be done to know the students' thinking structure. Based on the problem stated earlier, the problem in this research is "how is the thinking process of students in solving combination problems considered from assimilation and accommodation frameworks?

METHODOLOGY

The research subjects were 22 students of 3rd semester,

Department of Mathematics, FMIPA, Universitas Negeri Malang. The subjects were those who took Discrete Mathematics subject, whose ages ranged from 19 to 21 years. Furthermore, the subjects were asked to work on the problems associated with combination. The results of the student work were assessed by using score from 0 to 100. The abilities of students were classified into three categories based on the results of test scores. They were in low-ability category if the test scores ranged from 0 to 55; the students were in medium ability category if the test scores ranged from 55 to 80; and the students were in high ability category if the test scores were between 80 and 100. Furthermore, the researcher selected one student from each category to become the research subjects. The selection of research subjects (low, medium, high) was done with the reason that the thinking process of all ability categories could be searched.

Answer to each subject (categories of low, medium and high) in solving the combinations problem was identified based on the stage of problem-solving according to Polya. Stages of problem-solving by Polya consist of four steps, namely:

1. Understand the problem
2. Devise a plan
3. Carry out the problem, and
4. Look back.

At every stage of problem-solving according to Polya, students' thinking processes is identified by using a framework of assimilation and accommodation according to Piaget. The main instrument in this research was the researcher himself equipped with problem relating to combination, video tape recorder, and interview sheet. The problem related to the combination was as follows:

In how many ways can you divide 6 students into 3 groups with 2 members of each group?

RESULTS AND DISCUSSION

Based on the results of the students' works in solving combination problem, the division result of the students' ability categories were obtained as in Table 1. Based on the three categories of students' abilities earlier stated, one student from each category was chosen namely subject A for the high ability category, subject B for medium category, and subject C for low category. Analysis of thinking process based on the written data and interview data in solving permutation and combination problems based on the problem solving steps according to Polya that included understanding the problem, devise a plan of problem solving, implementing the plan of problem solving, and looking back at the results of problem solving were as follows:

Subject A that has high ability category

At the stage of understanding the problem, subject A was able to identify that the problems encountered were related to combination. At the time of the interview, subject A could reveal that the problem was combination

Table 1. Categories of students' ability to solve combination problems.

S/N	Categories of students' ability	Range of scores (x)		Number of students	Percentage (%)
1	Low	0	x < 55	12	54
2	Medium	55	x < 80	6	27
3	High	80	100	4	19

$$_6C_2 \times {}_4C_2 \times {}_2C_2 = \frac{6!}{4!\,2!} \times \frac{4!}{2!\,2!} \times \frac{2!}{0!\,2!} = 15 \times 6 \times 1 = 90$$

Figure 1. The work of subject A in solving combination problem.

problem. But after being tracked further, subject A doubted that the problems faced was combination problem that should be associated with the other problems. After the student was given the opportunity to think, the student revealed that the problem encountered was the problem associated with the combination of multiplication rule. It showed that in understanding the problem, subject A integrated a new stimulus through the establishment of new schemes to adjust to the problem encountered. Thus, subject oA used accommodation thinking process in understanding the problem (Hoppes and Segal, 2010).

At the stage of arranging plan for problem-solving, subject A was able to relate the problems faced and the problem of combination and multiplication rules. When it was traced through interview, it was found that subject A was able to link the key components of the problems that was the number of students were six, the students were divided into three groups and each group consisted of two students. A subject was able to identify that the division of the group in which each group had two students did not need to pay attention to the order so that the problem used was combination problem. However, subject A had a difficulty in determining the relationship of the division among the first group, the second group and the third group consisting of two people. After being searched further, subject A revealed that the division of the first group, the second group and the third group was interrelated events so it was necessary to apply the multiplication rule. It showed that in making the plan of combination problem solving, subject A modified the existing scheme so it matched the stimulus given. Thus subject A used the accommodation thinking process in preparing a plan for combination problem solving (Reinking and Labbo, 2000).

At the stage of solving combination problem, subject A was able to apply the concept of combination and multiplication rules. At the stage of determining the members of group 1, subject A was able to finish it by using combination 6C2. In determining the members of group two and three, subjects A was also able to finish it by using combination 4C2 and 2C2. However, when determining the final answer, subject A actually was already able to apply the multiplication rule, namely 6C2. 4C2.2C2 = 90 but subject A made a mistake when considering that the result should be divided by 3! The work of subject A can be seen in Figure 1.

From the interview, it could be seen that in determining the final answer, subject A felt doubtful on the final answer. Subject A tried to translate the existing problem by making an example: when the students were A, B, C, D, E and F, then subject A constructed three groups in which each group consisted of two students. Subject A attempted to think about what happened if one of the group arrangements was AB, CD and EF. The thinking structure of subject A was that AB, CD, and EF did not need to pay attention to the arrangement because AB, CD, EF and CD, AB, EF were the same, so that subject A decided that the correct answer should have been divided by 3! It showed that in arranging a plan of combination problem-solving subject A integrated perception, concept or new experience into an existing scheme in his mind when solving the problem. But when it was traced through an interview, subject A constructed a new thinking structure that in determining the final result, it should have been divided by 3! Thus subject A in implementing problem solving used assimilation and accommodation thinking process (Reinking and Labbo, 2000).

By examining the work done by subject A, it seemed that subject A did not write 'recheck' on the result of problem solving obtained. However, based on the interview subjects A rechecked the problem solving result obtained by matching the command about the problem resolved. It showed that in rechecking the

$$6C_2 = \frac{6!}{2!(6-2)!} = \frac{6 \cdot 5 \cdot 4!}{2 \cdot 4!} = 15$$

Ada 15 cara

Figure 2. The work of subject B in solving combination problem.

problem-solving result, subject A simply linked the concept or experience possessed related to the answer obtained from the problem with a simple command on the problem solved. Thus subject A in rechecking the result of problem solving used assimilation thinking process (Simatwa, 2010).

Subject B which has medium ability category

The difficult problem of Subject B at the stage of understanding to decide the problem faced was combination problem. At the time of the interview subject B was confused whether dividing six students into three groups in which each group had 2 students was a problem of combination or permutation.

After being given the chance to think subject B revealed that the problem faced was a combination problem because dividing the group did not need to pay attention to the order. It showed that in understanding the problem, subject B in stimulus integration just went through the establishment of a new scheme to adjust to the problem encountered.

According to Hoopes and Segal (2010) subject B used accommodation thinking process of in understanding the problem. At this stage of arranging problem- solving plan, subject B was only capable of linking the problems faced with the combination problem without linking the problem with the multiplication rule. At the time of the interview subject B had a difficulty to find a relationship between the number of the groups and the members of each group having two students. After being given time to think, subject B said that the problem faced was combination problem 6C2. Subject B gave the reason that for dividing six students into three groups in which each group consisted two students was the same as counting 6C2. It showed that in making the plan of combination problem solving subject B modified the existing scheme so it matched the stimulus given. Thus, subject B used accommodation thinking process although he was wrong in arranging a plan of combination problem-solving (Hoopes and Segal, 2010).

At this stage of combination solving problem, subject B made a mistake in accordance with the steps taken during the problem solving plan. Subject B only determined a lot of ways to divide the groups by using 6C2 without noticing that the group should be formed into three groups. The work of subject B can be seen in Figure 2.

Based on interview subject B had a difficulty in linking the problem encountered with the concept or another experience related to the multiplication rule. It showed that in arranging plan of the combination problem-solving subject B attempted to modify the existing scheme in mind and it was forced to match the stimulus given. Thus subject B used accommodation thinking process in implementing problem solving (Hoopes and Segal, 2010).

Based on the work and interview, subject B had already rechecked the result obtained. Rechecking the result of problem solving was done by linking the final result of work obtained by reading back the problem. It showed that in rechecking the result of problem solving subject B only related the concept or the experience owned and related to the answer obtained from a problem with a simple command on the problems solved. Thus, subject B in rechecking the result of problem solving used the assimilation thinking process (Simatwa, 2010).

Subject C who has low ability category

Subject C had difficulty in understanding the problems related to a given combination problem. From the result of examining the student's work and the result of interview, it was obtained a description that subject C considered that the problem of dividing six students into three groups with two members in each group was a problem of permutation with the same elements. Subject C at the time to understand the combination problem given was interference with the understanding of permutation with the same elements. It indicated that subject C when understanding the problem used accommodation thinking process (Hoopes and Segal,

Figure 3. The work of subject C in solving problem combination.

2010), although he was wrong and subject C had an interference with the understanding of permutation.

At the stage of arranging plan of combination problem-solving, subject C arranged a plan of problem solving based on the understanding owned by him. Because subject C was interfered at the time to understand the problem that was the combination problem seen as a permutation problem, so when arranging problem solving, subject C related the existing key concept in the problem that the students were six, divided into three groups and each group consisted of two students. It was a permutation problem with the same elements. It showed that in making the plan of combination problem solving subject C tried to modify the scheme existing in his mind and was forced to match the stimulus given.

Thus, subject C used accommodation thinking process in preparing a plan for solving a combination problem (Hoopes and Segal, 2010), although he was interfered with the permutation problem. At this stage of solving a combination problem, subject C was able to solve the problem based on the accomplishment plan that had been made, but the result was still wrong. The work of subject C can be seen in Figure 3.

Based on the result of examining the work and through an interview, it was found that subject C considered that the problem about the six students that would be divided into three groups with 2 members of each group was recurring permutation. Subject C said that 6! was gotten from the number of students (six students) while 3! was gotten from the number of groups (3 groups), then 2! was gotten from the number of members in each group (2 students). Thus, subject C in solving combination problem used the following calculation:

$$\frac{6!}{3!2!2!} = \frac{6.5.4}{4} = 20.$$

It indicated that subject C in solving combination problem was interfered by permutation problem. Subject C also made a mistake in doing calculation operation: $\frac{6.5.4}{4} = 20$.

It should be 30. At this stage of solving combination problem, subject C tried to modify the scheme existing in his mind and was forced to match the stimulus given. Thus, subject C in solving the combination problem used accommodation thinking process (Hoopes and Segal, 2010), although he was wrong. Based on the result of examining the student's work and interview, it was found that subject C at the stage of rechecking the result of problem solving did it by matching the result of the work to the question which was asked. Subject C said that there was confusion at the time to understand the first problem so that the checking carried out was just based on matching the answer to the question in the problem. Thus, subject C was used in rechecking the result of problem solving used as assimilation thinking process. Based on the description earlier describe, students' thinking process in solving combination problem could be tabulated as shown in Table 2.

The results of this research was supported by the opinion of Simatwa (2010) who says that assimilation is a cognitive process in which a person integrates perceptions, concepts or new experiences into the scheme or pattern that already exists in his mind. Additionally, it was supported by Hoppes and Segal (2010) who says that a person when implementing assimilation thinking process does not need to change the existing scheme. Therefore, when the students do the thinking process of assimilation, the students do not need to change the existing scheme.

The structure of the problems encountered is in accordance with the thinking scheme owned. The accommodation thinking process done by all subjects at the stage of understanding the problems, planning the problem and implementing problem solving is supported by Reinking and Labbo (2000) who says that accommodation transforms the existing information into the new one.

The process of assimilation and accommodation lasted until there is equilibrium conditions (Fajemidagra. 2015). When the student has obtained a combination of problem solving, but not satisfied with the solution, then that person is still going disequilibration. These conditions will encourage students to hold a reflection of the answers that have been obtained. Conversely, when

Table 2. The students' thinking process seen based on assimilation and accommodation framework.

S/N	Ability category of students	Troubleshooting steps			
		Understanding the problem	Completion planning	Implementing the solution	Rechecking
1	High	Accommodation	Accommodation	Assimilation and Accommodation	Assimilation
2	Medium	Accommodation	Accommodation	Accommodation	Assimilation
3	Low	Accommodation	Accommodation	Accommodation	Assimilation

the students have been satisfied with the answer, then the process of thinking has already reached equilibrium conditions (Piaget, 1952)

Conclusion

Students with high ability category in understanding the problem, arranging a problem solving plan and implementing problem solving used accommodation thinking process while on the stage of rechecking the result of problem solving, the students with high ability category used assimilation thinking process. Students in medium ability category, in understanding the problem, planning problem-solving, implementing problem solving, used accommodation thinking. Students with low ability category, in understanding a problem, planning problem solving and implementing problem solving used accommodation thinking process even though subject C was interfered by the concept of permutation while in rechecking problem solving stage the student with low ability category used assimilation thinking process although he was wrong.

Conflict of Interests

The authors have not declared any conflicts of interests.

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Educational Research and Reviews

Full Length Research Paper

A research on future mathematics teachers' instructional explanations: The case of Algebra

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In this study, explanations of future mathematics teachers about algebra were analysed according to the levels of understanding used by Kinach (2002). The participants for the study were 101 teacher candidates attending the final semester of a teacher training program. For data collection, a form containing four scenario-type items were administered to the participants. In addition, interviews were carried out on six participants selected through purposeful sampling technique. The findings of the study showed that the participants mostly provided content-level explanations based on procedural understanding. The second frequent type of explanation was at the concept level. The problem solving-epistemic level explanations were found to be used less. At the level of content, the explanations were mostly related to rules while at the level of concept, the explanations were based on inductive reasoning.

Key words: Future mathematics teachers, pedagogical content knowledge, instructional explanations, levels of understanding.

INTRODUCTION

One of the desired characteristics of educational programs is that they should reflect changes and innovations. It is one of the reasons for the ongoing revisions in educational programs. On the other hand, teachers are the key to the success of these programs. It is certain that teachers shape their teaching practice based on their professional knowledge.

Nowadays, the assumption of "who knows teaches well" is not valid anymore and instead, it is argued that teachers should also have the knowledge of teaching (Baki, 2012; Ball et al., 2008; Shulman, 1986). Although the knowledge of teaching has been defined in different ways, there is an agreement over somebasic principles

(Grossman, 1990; Hill et al., 2005; Ma, 1999). In the context of mathematics teaching, the knowledge of teaching includes the knowledge of processes underlying mathematical operations, awareness of the needs of learners and the knowledge of pedagogical issues such as strategies, teaching methods and techniques (Baki, 2012).

It is certain that the knowledge of teaching is an essential keystone for the teaching profession. On the other hand, the definition of this knowledge base is necessary to identify strategies, methods and techniques while training future teachers. Besides, it gives us an opportunity to focus on specificbases to evaluate

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Table 1. Definitions of understanding levels.

Level	Definition
Content level	Knowing related terms in the subject-matter, using algoritms properly and having procedural skills
Concept level	Having information and experience about concepts and ideas
Problem solving level	Using general or specific strategies and heuristic schemes
Epistemic level	Using proper verification methods
Inquiry level	Searching for new information

possessed knowledge types ofteachers or candidates. Therefore, we may make inferences on the quality of in-service or pre-service teacher training activities. There are various national and international projects to evaluate the knowledge of teaching such as Teacher Education and Development Study in Mathematics (TEDS-M) and Mathematics Teaching in the 21st Century (MT21).

Within the scope of such large-scaled projects involving hundreds of teachers or teacher candidates, mathematics teaching knowledge which captures content knowledge and pedagogical content knowledge was measured in whole subject areas (combination of numbers, algebra, geometry and data). Another recent development was to evaluate the knowledge of teaching in a specific learning domain (Doerr, 2004; Ferrini-Mundy et al., 2003; Li, 2007). This tendency is quite explicit in some rationales. General frameworks give researchers a snapshot of the general picture, however, the picture is seen to always be low resolution and weak on reflecting details. In this study,future mathematics teachers' knowledge of teaching was analysed in the context of algebra, which is one of the significant parts of mathematics.

THEORETICAL FRAMEWORK

In the study, the framework for levels of understanding by Perkins and Simmons (1988) was employed. It was developed to classify understandings in a specific discipline and was used by Kinach (2002) to reveal the quality of instructional explanations and the depth of the subject-matter knowledge. This model argues that in each discipline, understanding is composed of five different levels: content level, concept level, problem solving level, epistemic level and inquiry level (Table 1).

Kinach (2002) related these levels to instrumental and relational understandings in mathematics developed by Skemp (1978). Kinach (2002) argued that content level equals instrumental understanding while the levels of concept, problem solving and epistemic refer to relational understanding. Kinach (2002) further argued that relational understanding does not include inquiry-level understanding. From this point of view, one can make inferences about the depth of understanding by considering the levels without content level.

Kinach (2002) used this classification to analyze the instructional explanations of classroom and future mathematics teachers about procedures involving integers within the context of subject-matter knowledge. She concluded that the majority of the participants focused on mathematical procedures and had instrumental pedagogical content knowledge. Toluk-Uçar (2011) analyzed the subject-matter knowledge and instructional explanations of classroom and teacher candidates about fractions using the levels of understanding. It was found that the majority of both groups had an understanding of mathematics at the instrumental level and that their explanation was mostly at the same level. Baki (2013) analysed the content knowledge and instructional explanations of primary teacher candidates about division in natural numbers. The study concluded that the majority of the participants did division incorrectly and that the division-algorithm related explanation of those participants who did division correctly was insufficient. Less than half of the participants provided proper instructional explanations in which division algorithm was properly given. All these studies focused on the learning domain of numbers.

This study deals with the future mathematics teachers' understanding about algebra based on the *levels of understanding*. In the study, instructional explanation is analyzed using three levels, namely;

1. Content level,
2. Concept level and
3. Problem solving -epistemic levels.

Although the levels of concept, problem solving and epistemic are all related to relational understanding, the differences between these levels are significant in terms of instructional explanations. Therefore, the levels of problem solving and epistemic are regarded as independent from the level of concept. Given that the participants were not expected to provide explanations about teaching practice, the level of inquiry was excluded.

Aim of the study

The aim of this study is to analyse the quality of

Table 2. Items used in the data collection form.

Items	Variable
1.	While studying exponential numbers you recognized that some students wrote the value of 0 for 2^0. How would you explain them that the correct equation; $2^0 = 1$?
2.	Reyhan teacher wrote the following equation on the blackboard and asked students to solve it. **-x<7** Kübra used -1 to divide the both parts of this equation and found the solution as x>-7. Another student asked that why the equation changes its direction when a negative number is used. What would be your answer to this question?
3.	In some textbooks, coordinate system is used to solve equations. For instance, two linear equations are given on coordinate system. Here {-1} is the apse of the intersection point of the graphics of y= 3 x + 5 and y= -4 x – 2 and is the solution for the equation of 3 x + 5 = -4 x – 2. Yilmaz thinks that this method works only when there is unknown variable x on both sides and doesn't work when there is a constant on one side. (for instance, this method is invalid for 2x + 7 = 9) Is he right? What would be your answer to Yilmaz? (Adapted from Li, 2007)
4.	Melike teacher provides the following equation and wanted her students to solve it. $2x - 4y = 8$ $-x + 2y = -4$ One of the students solve it as follows: $2x - 4y = 8$ $+ \quad 2(-x + 2y) = 2.(-4)$ _____ $0 = 0$ so the solution is IR. Is this solution correct? If it is not, what would you do to avoid your students such incorrect solutions?

instructional explanations given by mathematics student teachers on algebra.

METHODOLOGY

Participants

The participants of the study were 101 student teachers attending the fourth grade (final semester) of a teacher training program. Specifically, they were attending middle school mathematics education division of this program.

Data collection

The data of the study were collected through a test in which four open-ended scenario-type items were asked(MoNE, 2013). In developing scenarios, the learning domain of algebra at the level of middle school[1]educationwas taken into consideration. Therefore,

scenarios concerning basic algebra patterns, equation and inequality) were developed by considering studies in the literature (e.g. Grossman, 1996; Li, 2007).The items were reviewed and answered by five PhD students in mathematics education. Based on these reviews, the items were reorganized and presented (asked) to 30 student teachers who were independent from the participants of the main study. Following the pilot study, the items were finalized as shown in Table 2.

In each item, the participants were given a problem-solving situation and asked how they could explain it to their students (Table 2). The goal was to reveal their potential explanations in case they are faced with the given situation in a real classroom setting and to explore the quality of these instructional explanations.The other data collection tool was interviews; six student teachers were selected to represent different types of level and were asked to explain their solutions to the given items.

Data analysis

The data were analyzed using the theoretical framework employed by Kinach (2002). As stated earlier, the quality of the answers given by the participants was analyzed in terms of the levels of content, concept and problem solving-epistemic. The level of content refers

_____
[1] In some education systems, middle school level is named lower-secondary or classified as a part of primary education.

Table 3. Distribution of explanations based on the levels of understanding.

Levels	Content level		Concept level		Problem-solving and epistemic levels		Either incorrect or no response	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
1 item	44	43	27	27	20	20	10	10
2 item	27	27	40	39	16	16	18	18
3 item	40	39	21	21	16	16	24	24
4 item	10	10	7	7	4	4	80	79

While studying exponential numbers you recognized that some students wrote the value of 0 for 2^0. How would you explain them that the correct equation; $2^0 = 1$?

I would probably teach it as a rule : The zeroth power of any number is 1.
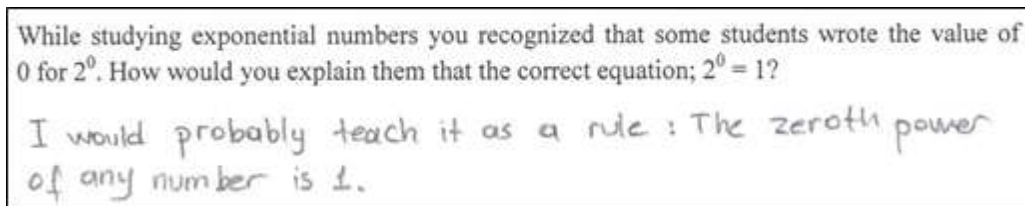
Figure 1. Answer of P_{33} to the first item

to the skills of the participants on rules, algorithm and procedural skills and covers explanations without any reasoning. Such explanations are regarded as the indication of content level understandings of the participants. Their explanations about conceptual definitions and basic characteristics of concepts were coded as concept level understandings. The problem solving-epistemic level understandings were related to the different representations of concepts, relations and reasoning.

Coding was separately undertaken by both authors. For coding which lacked mutual agreement, additional reviews were made until an agreement was reached. The data obtained from interviews were used to support the quantitative findings and to exemplify relevant cases. "Here, the interviewees were coded as *Px* in reference to the study ethical considerations." sentence via "The participants were coded as "*Px*" and the researcher "*R*" in reference to the study ethical considerations."The data presented in the study, both students' written and oral responses, were translated from Turkish into English, while maintaining the essence of their meanings.

RESULTS

Table 3 indicates the distribution of participants' explanations based on the levels of understanding used by Kinach (2002). Table 3 showsthat the explanations providedbytheparticipantstothefirst and third scenarios are similar. However, the rate of incorrect answers or no responses to the third scenario is found to be higher than for the first scenario (25 and 10%, respectively). For both scenarios, the most frequent level of understanding is content level, followed by the levels of concept and problem solving-epistemic. With regard to the second scenario, the participants provided mostly concept level explanations (39%), followed by the levels of content and

problem solving-epistemic. Concerning the last item, majority of the participants (79%) incorrectly thought that the solution of the problem was right or provided no response. Answers to each item are discussed in detail as follows:

First item

As stated earlier, the explanations given to the first item were mostly at the level of content. It was found that although the participants knew the equation of $2^0 = 1$, they could not provide deeper explanations for it (Figure 1).

Figure 1 shows that the participant provided an explanation that the equation should be taught as a rule. The following statements support this explanation:

P_{34}: …If my students have some incorrect views about this topic, I will tell them that in mathematics some points are made up of acceptance such as the zeroth power of a number equals zero.
P_{65}: …Up until now, I have not questioned why the zeroth power of any number is one. It was just taught to us like that…

Explanations regarding this item which were at the level of concept are generally based on inductive reasoning (for instance, Figure 2).Figure 2 shows that the participants looked for a pattern for positive integer exponents of 2 and reached a generalization based on this pattern. The explanations based on the levels of
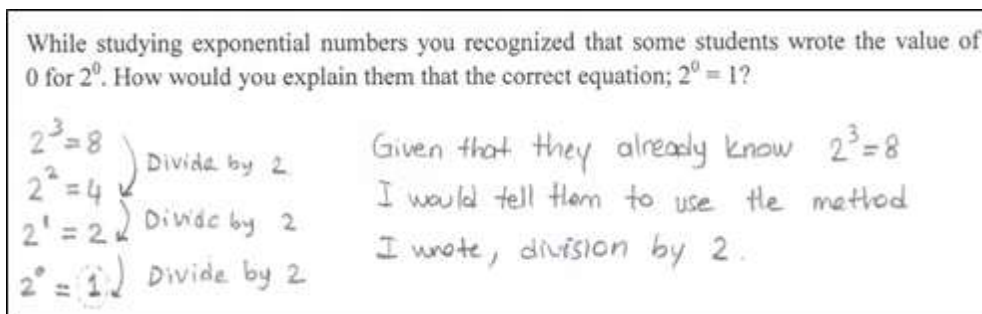
Figure 2. Answer of P_{56} to the first item.
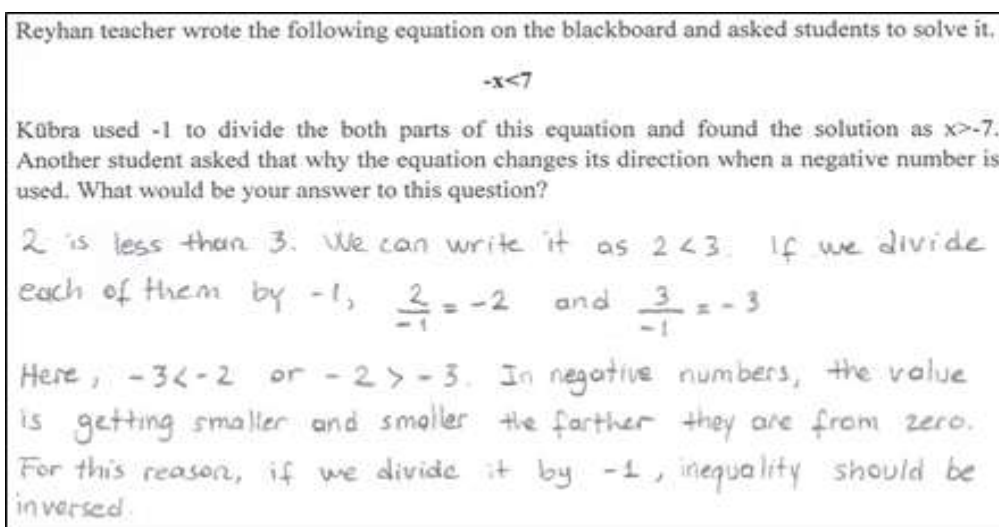
Figure 3. Answer of P_{14} to the second item.

problem solving-epistemic were about algebraic charac-teristics of these numbers and the participants used these characteristics to account for the correctness of the equation. One fifth of the participants solved the item as follows:

$$2^{a-a} = \frac{2^a}{2^a} = \frac{1}{1} = 1$$

Second item

Explanations of the participants on this item were mostly at the level of concept. However, explanations at the level of problem and epistemic were found to be less. Concept-level explanations used the basic characteristics about the order of numbers and compared numbers based on this characteristic.

As can be seen in Figure 3, two numbers were compared in terms of order and this feature was used to

support the correctness of the claim. At this level, student's written response evokes specific heuristic strategy while other student responses consisted of similar answers. For instance, elements chosen from a specific set of numbers and explanations rely on comparing their greatness. The following excerpt is from the interview with a participant who provided a problem solving-epistemic level explanation to the item:

P5: If it was explained through examples, it would be limited. So I taught it as an equation.
R: How?
P5: Like in equations in an inequality, we may add a number to both sides. For instance, I added -7 to each side. This resulted to −x-7 <0 . I added x to each side and had -7<x which means x>-7.

In the earlier mentioned example, the student teacher based his argument on inequality axioms and tried to prove the correctness of the claim. On the other hand, the number of incorrect or no response to this item was

Kübra used -1 to divide the both parts of this equation and found the solution as x>-7. Another student asked that why the equation changes its direction when a negative number is used. What would be your answer to this question?

I would tell them that, at the end of a war between negative and positive numbers (this war can be thought as division or multiplication) negative numbers are always the winners. Thus I would make it easier to remember.

Figure 4. Answer of P_{94} to the second item

In some textbooks, coordinate system is used to solve equations. For instance, two linear equations are given on coordinate system. Here $\{-1\}$ is the apse of the intersection point of the graphics of $y = 3x + 5$ and $y = -4x - 2$ and is the solution for the equation of $3x + 5 = -4x - 2$.
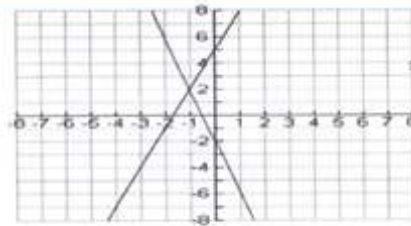
Yilmaz thinks that this method works only when there is unknown variable x on both sides and doesn't work when there is a constant on one side. (for instance, this method is invalid for $2x + 7 = 9$) Is he right? What would be your answer to Yilmaz?

The view of Yilmaz is incorrect. Because using proper algebraic procedures, a constant in one side can be transferred to the other side and it gives us a conventional equation. I would teach it to the student through giving the solution and through drawings.

Figure 5. Answer of P_{32} to the third item.

higher. Such incorrect explanations mostly included improper analogies. Figure 4 shows an example of incorrect explanation for the item. As seen in Figure 4, the participant used an analogy to explain a mathematical statement. However, the explanation has nothing to do with the mathematical content.

Third item

In the third scenario, a solution was presented by using graphs on a coordinate system to solve an equation. Afterwards, it is asked whether the solution works with another equation or not. The explanations for this item were generally at the level of content (39%). Such explanations mostly argued that the view of the student was incorrect. However, no adequate explanation was given with regard to why it was incorrect. In general, the participants ignored the graphical solution given in the figure and employed conventional equations. They reported that the equations 2x+7=9 and 3x+5=-4x-2 have similar algebraic solutions. Figure 5 gives an example of the explanations for the item.

Figure 5 shows that ST_{32} provided an explanation based on an algebraic solution of the problem. Nearly one-fourth of the participants (24%) gave incorrect or no response to this item. They incorrectly claimed that the view of the student was correct and that the proposed geometric approach was improper for the solution of the item. The following statement shows such incorrect explanations.

R: You stated that the view of the student was correct. Why?
P_{65}: In the first equalities there are two equations. But

Figure 6. Answer of P$_{58}$to the fourth item.

thereare no two equations here.
R: How?
P$_{65}$: It is 2x+7=9. It is already an equation. But here, it refers to 3x+5=-4x-2 and there are two unknowns.

ST$_{65}$ had a similar view with the student in the scenario. His argument "*In the first equalities there are two equations. But there are no two equations here*" actually means that in the first statement, $y = 3x + 5$ and $y = -4x - 2$ are two equations which can be drawn on a coordinate system independent of each other. However, the participant thought that the second situation equation $2x + 7 = 9$ can be represented via only one linear line. This explanation implies that the graphical solution cannot be used. This shows that the knowledge of the participants about horizontal and vertical equations is limited. Concept-level explanations included different observations. For instance, some participants stated that the intersection point for the line $9 = 2x + 7$ and $x = 1$ line gave the value of $y = 9$, then the solution would be $x = 1$. Although this solution is correct, it cannot fully account for the situation and therefore, it was regarded as a concept-level explanation. On the other hand, the problem solving and epistemic-level explanations argued that the apse of the intersection point for the lines would be the solution. This explanation fully accounts for the case at hand. 16% of the participants provided this explanation.

Fourth item

The last item which inquires the solution of an equation system with two variables was the most difficult problem for the participants. Majority (80%) of the participants provided either incorrect or no response for this item. It suggests that the participants did not have the necessaryconceptual background to understand the topic at hand. In other words, lack of content knowledge prevented participants from making correct instructional explanations. All explanations in which real numbers were given as the solution for the item were regarded as incorrect. The other type of incorrect explanations was that the view of the student was incorrect and that this problem cannot be solved (Figure 6).

The content-level explanations (10%) recognized that the lines given overlapped, but were not sufficient. The rate of concept-level explanations was lower (7%). Such explanations argued that all ordered double equation systems were not the solution. The rate of the problem solving and epistemic level explanations was also lower (4%). Such explanations included the assumption that in R^2, there were infinite number of solutions and that these solutions were related to the line represented by equations. The following is an example from the interview with a participant who provided a problem solving-epistemic level explanation for the item:

R: You stated that the solution was incorrect. Why?
P$_{44}$: Because if we use 0 for x and y, it is incorrect.
R: Then what is the correct answer?
P$_{44}$: For instance, x= 6 and y=1. Or x=0 and y=-2.
R: From this, how many solutions can we find?
P$_{44}$: We may find infinite solutions.
R: Then why is the solution incorrect?
P$_{44}$: The infinite solutions do not require that x and y should be real numbers.
R: Why?
P$_{44}$:Because there are infinite solutions based on the parameters. However, the parameters do not require that x and y should each take real value.

As earlier mentioned ST$_{44}$ identified the student's incorrect answer and gave an example. The participant

also provided an adequate explanation forwhy the solution was incorrect by indicating that there were infinite solutions to the problem.

DISCUSSION AND CONCLUSIONS

The current study focused on future mathematics teachers' explanations of the basic concepts in algebra and investigated their quality. For this aim, the levels of understanding used by Kinach (2002) were employed. It was found that the participants mostly provided content-level explanations. The level of problem solving-epistemic was less used in explanations in contrast to the levels of content and concept. Questions that were about the conceptual basis of equations (see 3nd and 4th) were found to be more difficult for the participants to solve. Although problems involving equations can be solved, it becomes harder when the conceptual basis is questioned. Previous studies also indicated that teacher candidates failed to provide the conceptual basis for problem-solving process in which equations were employed (Ferrini-Mundy et al., 2003, 2005; Li, 2007).

Within the scope of this study, some fundamental algebra concepts were examined in each item. By virtue of scenario type questions, mathematical background of the concepts and their properties were used to challenge future teachers' pedagogical content knowledge. Although we directed cases to teacher candidates taken from middle school mathematics education program, many of them had difficulties on basic concepts partaking curriculum. In addition, these scenarios are those which can be frequently seen and used in daily life. The participants mostly provided content-level explanations. Similar findings were found in previous studies by Ball (1990), Bütün (2005), Ma (1999) and Toluk-Uçar (2011). The content-level explanations reflect a procedure-based perspective and emphasize conceptual understanding. The other frequent level of understanding was concept. However, the concept-level explanations given by the participants were not sufficient. Although teacher training programs try to improve problem solving and epistemic level understandings, the findings showed that the number of such explanations was less.

Although, teaching knowledge was limited to PCK, the responses provided were to make inferences about participants' content knowledge. It was mostly indicated that content knowledge is an essential base of mathematics teaching knowledge (Ball et al., 2008; Even, 1993). However, the results showed that participants' lack of content knowledge affected their knowledge of teaching and the explanations they made. For instance, those who had limited knowledge on exponential numbers mostly argued on teaching the zeroth power of a number by memorizing instead of unfolding its mathematical underpinnings.

As stated earlier in this study, future mathematics teachers' explanations about the basic concepts in algebra were analyzed. Their explanations on other topics (such as probability and statistics, geometry, numbers) can be analyzed in relation to different topics, including knowledge of learners and knowledge of teaching. Such studies are crucial in educating qualified future teachers due to their informative role for teacher training programs.

Educational Implications

Pedagogical content knowledge is a special knowledge type which separates a mathematician from a mathematics educator. In other respects, it "goes beyond the knowledge of subject matter per se to the dimension of subject matter for teaching" (Shulman,1986). However, the results show that teacher candidates had difficulties in conceptualizing even basic mathematical statements such as 2^0 and generating explanations about teaching it. The question is not only "What should we teach future teachers?" but also considering the question of "How should we teach to teach mathematical concepts?" Therefore, it is very crucial for teacher training programs to educate future mathematics teachers to acquire knowledge and experience about concepts in school mathematics. At this juncture, such education can be systematically provided in some courses such as special teaching methods or school practice implementations so as to include fundamental mathematical concepts.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

What makes a mathematical task interesting?

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The study addresses the question of what makes a mathematical task interesting to the 9th year students. Semi-structured interviews were carried out with 15 students of purposive selection of the 9th year. The students were asked to recall a task they found interesting and engaging during the past three years. An analysis of the tasks was made with respect to the context, cognitive demand, and task structure, while interview data were analyzed using the Theory of Didactical Situation (TDS) and Mathematical Task Framework (MTF). The students recalled a total of four teacher-designed tasks. All of the tasks offered a high level of challenge, elements of sharing and some freedom of choices related to the aspects of the tasks. The results showed that in most cases the students pointed out the target knowledge as the reason for a task to be interesting and engaging, followed by the way the content was dealt with in the classroom.

Key words: Mathematical tasks, interest and engagement, 7-9th year, Theory of Didactical Situation (TDS), Mathematical Task Framework (MTF).

INTRODUCTION

Mathematics teachers do not merely want their students to learn, but also to *enjoy* learning. The starting point of this study is the idea of optimizing the conditions necessary to bring about subject-related aspects of interest and engagement. In other words, the study is designed to explore content-related student interest and engagement. Interest and engagement are motivational factors (Ames, 1992), essential for learning (Dewey, 1913). Throughout the study, interest and engagement are treated as mutually supportive, to open up a wider range of associations and to draw up a richer body of research. Despite the importance of these elements, there is a decrease in interest and engagement in mathematics, starting from grade 5 in the Swedish school context (Skolverket, 2003). There are many studies on interest and engagement in school settings (Hidi, 1990; Michelsen and Sriraman, 2009), however, there is a lack of studies relating to the concepts to mathematical content, especially from a student perspective. Recent findings show that teachers' strategies to enhance engagement often focus on the general aspects rather than task specific mathematical content (Mitchell, 1993; Nyman and Kilhamn, 2015). Based on that, research seeks to study the students of a teacher who deliberately intend to interest and engage them by focusing on mathematics the light of theoretical

Overall, the aim is to capture students' views on tasks in relation to interest and engagement. This is done in framework deriving from Brousseau (1997) using terminology from the Theory of Didactical Situations (TDS), in combination with the Mathematical Task Framework (MTF), which will be taken up in greater details as the work progresses.

Aim and questions

The aim is to investigate what features of the students' tasks the 9th year identifies as interesting and engaging. The main questions are:

1. What tasks do they identify as interesting and engaging when the teacher has deliberately brought the mathematical content into the foreground?
2. What features are interesting and engaging in those tasks?

Previous research and theoretical framework

Interesting and engaging mathematical tasks

A mathematical task has been defined as a single problem or a set of problems that focuses student attention on a mathematical idea (Stein et al., 1996). The type of task used in the classroom has an influence on the level of students' engagement (Hiebert and Wearne, 1993; Smith et al., 2000). Previous research shows that specific features in the design of mathematical tasks can contribute to interest and engagement in mathematics (Ames, 1992; Sullivan et al., 2013). Mathematical tasks can be designed with the purpose of being "interesting to the students, incorporate a rationale for them to engage, provide some challenges, reduce the risk of failure, and for which success provides the motivation for further engagement" (Sullivan et al., 2013).

Task design - context, level of challenge and structure

According to Hilbert (1900), a good mathematical task that has the potential to enhance student engagement is intriguing, based on clearness and ease of comprehension but is at the same time challenging. Three different elements of task design that may influence student interest and engagement are: Context, the level of challenge, and task structure.

Context

Context is defined as a situation in which a task is

embedded (Borasi, 1986), and is one way for the teacher to enhance engagement and make a mathematical idea interesting (Sullivan et al., 2013). Choosing a meaningful context helps students to understand mathematical ideas (Brousseau, 1997). In this study, *context* is used as the choice of the situation in which the mathematical idea is embedded. This situation can either be real life related or purely mathematical. Sullivan et al. (2013) opines that tasks designed around real life contexts can make mathematics 'come alive' for students, showing them a purpose for what they are studying and making mathematics more engaging for them. Mathematics embedded in such contexts can have practical, personal and/or social relevance, and are engaging when they appeal to adolescent curiosity, an opportunity to discover their place in society, giving a sense of power and understanding of democracy (Sullivan et al., 2013). When Hodge et al. (2007) tested tasks involved in the decisions or judgment making on whether the installation of airbags in cars impacts on car safety or exploring the impact of treatments for different diseases, they found support for students' mathematical engagement and learning.

Real-life contexts do not have to be realistic. For instance, a group of tasks known as Fermi problems involve imagination and making estimates of physical quantities, such as the number of people who can fit into a classroom. This problem is an example of when "[...] the context is potentially engaging for what follows and the mathematical decisions that the students make in finding a solution" (Sullivan et al, 2013). Including real life context can be beneficial for learning (Johansson, 2015). However, as Boaler (1993) states, it is not enough to put a task in real life settings in order to engage students in mathematics.

Level of challenge

Challenging tasks can be seen as potentially engaging. Smith and Stein (1998) have developed the Mathematical Task Framework (MTF), a framework for analysing the level of challenge. This framework focuses on a task's cognitive demand, implying that the demand increases from (1) "Memorization" to (2) "Procedures without connections", followed by (3) "Procedures with connections" and at the highest stage there are tasks labeled (4) "Doing Mathematics". At the lower levels of cognitive demand, when memorizing and carrying out procedures without connections, a student can write down the answer based on the definition or on algorithms, or because they have previously seen analogous answers. Smith and Stein (2011) point to examples such as stating decimal and percentage equivalents for a fraction as tasks with a lower level of

challenge. The third level requires students to use different procedures to develop an understanding of mathematical concepts and ideas. In order to reach this level of cognitive demand, students must select suitable strategies to solve and provide explanations. Stein et al. (1996) have identified various patterns of student engagement when students worked with tasks on the highest level of cognitive demand, that is with tasks that were set up to encourage "Doing mathematics". In summary, according to MTF, a task is of the highest level, (4), if it:

1. Requires complex and non-algorithmic thinking. There is no predictable approach explicitly suggested by the task instructions.
2. Invites to explore and understand the nature of concepts, processes and relationships.
3. Demands self-monitoring or self-regulation of student's own cognitive processes.
4. Requires relevant knowledge and experience, and to make appropriate use of them.
5. Opens up for analysis of task constraints that may limit possible solution strategies and solutions.
6. Includes the unpredictable nature of the process leading to the solution(s) will require considerable cognitive effort.

A task that serves as an illustration of high cognitive demand in year 4 is: "A fourth-grade class needs five leaves each day to feed its 2 caterpillars. How many leaves each day would they need to feed 12 caterpillars?" (Smith and Stein, 1998). This task was found to be cognitively demanding by 10 year olds, based on the assessment results and the analysis of empirical data using the MTF analysis guide (Smith and Stein, 1998). The analysis showed that only 6% of pupils in year 4 found a way to solve it. It is important to remember that there are individual differences in what is seen as challenging and demanding. A task of this sort might be less demanding to students in 7 to 9th year, which indicates that a task's cognitive demand varies depending on the age group. In the forthcoming study the level of challange of the student-chosen tasks will be investigated.

Task structure

A task can also be analysed in respect to its level of openness. Emanuelsson (2001) has drawn upon a model that makes it possible to categorise tasks using a scale of 0 to 3 regarding how open they are. In a task structure of level 0 everything is given. If the task structure is on level 1 the answer is open and on level 2 both the answer and the method are open. Level 3 leaves all aspects open, the problem, the method and the

answer(s), inviting the student to make most of the decisions. The level of openness depends on the elements of investigation included in the task design.

Another part of task structure is scaffolding (Wood et al., 1976; Emanuelsson, 2001). Instead of being structured as one whole text or story, a task can be scaffold by a division into smaller parts or questions along the way, to build a bridge between what the students already know and the target knowledge. Scaffolding can be used as an aspect of task structure that enhances engagement (Henningsen and Stein, 1997).

A task can have a routine or non-routine structure, where non-routine tasks are puzzle-like rather than straightforward, very likely to be unfamiliar to students, as defined by Mullis et al. (2003) and used in the Trends in International Mathematics and Science Study (TIMSS) studies. For instance, a routine problem can be structured as "How many 3 L bowls are needed to fill a 9 L jug?" in comparison to a non-routine problem, "How can you take exactly 4 L of water out of the bowl using a 5 L and a 3 L jug?" Non-routine problems have, as in this case, a higher level of challenge and "above those needed for solution of routine problems, even when the knowledge and the skills required for their solution have been learned" (Mullis et al., 2003).

There are other variables possible to consider as influential on student engagement, for instance the teacher's personality; personal interest of the students; peer support; classroom culture, the use of ICT and so on. However, this study is aimed to maximize the chances of finding subject specific details that makes a task interesting and engaging, and connecting the concepts to mathematical ideas. Therefore, this paper focuses on students' views on content matter in relation to different features of tasks and the empirical study is limited to the tasks and what the students say about them.

Interest and engagement in light of the theory of didactical situations

Brousseau (1997) introduces the notion of the *didactical situation* in which the interplay between the teacher, the student and the mathematical task takes place. The teacher introduces a task and then steps back and refrains from interfering, by not suggesting the answer or any step in the solution of the task (Brousseau, 1997; Brousseau and Gibel, 2005). A *didactical situation* is the moment when students accept the tasks as their own. The teacher sets the students up to accept the challenge of an engaging mathematical situation whose conditions are given in advance, such as "conditions, rules, goals, and above all the criteria for success and to do it without his/her

help, but as their own responsibility" (Brousseau 1997, p. 230). The devolution of a didactical situation is the time during which the students start to treat the task as their business. When a didactical situation has devolved, the students work with the task driven by their own curiosity and ambition.

Tasks are, as shown by recent theory development within the framework of TDS (Rezat and Strässer, 2012), an important dimension in the didactical interplay. The point of departure in this study is recognizing the task as an important dimension in teaching and learning mathematics, and in the case of problem solving tasks can be a pathway into evoking student interest and engagement (Shoenfeldt, 1992). In addition to the context, level of challenge, and structure in the tasks, this study will also identify the *target knowledge in the task*, described by Brousseau (1997) as the mathematical knowledge aimed for. It is possible that the students might remember a task in connection to the specifics of the target knowledge, that is, the mathematical content dealt with in the task.

METHODS

Participants

The choice of participants were based on optimization of the conditions for researching content-related student interest and engagement within the public school system in a Swedish school of mixed ability and socioeconomic background. In the effort to investigate what students find interesting and engaging in a task, the students were interviewed and the task(s) analyzed with respect to the target knowledge and the task design. Students were chosen from two different classes with a particular skilled teacher, this is due to advice gained from studies where teachers have been identified as suitable if they are seen as highly competent by the local community (Clarke et al., 2006). The teacher in this case has been teaching for over 20 years, with PhD in mathematics education, and supervises professional development courses. According to this teacher's students and colleagues, she holds high standard lessons. Furthermore, in order to interest and engage students, this teacher puts mathematical content in the foreground. The following conditions are fulfilled to optimize the possibilities of finding interesting and engaging tasks:

1. This teacher *intends* to actively engage the students in mathematics. She chose to take on the most challenging, non-engaged classes at a school at the beginning of the 7th year and teach them through the 7-9th year. She encourages students to engage in tasks and participate in her lesson activities. The two classes had, according to the teacher, come far in their development of interest and engagement compared to when she first started to work with them in the 7th year.
2. The target knowledge is central when tasks are designed with the mathematical ideas in the foreground. The tasks are deliberately designed to be potentially engaging in order to learn the target knowledge.
3. During the interviews students rated the teacher's competence as high or very high.

The teacher was interviewed for 40 min, during which she described the students in grade 9 as engaged on a whole class level, with a range of individual variations. Her two classes were at the same level and once a week they were mixed, working in smaller groups, choosing the group themselves according to which final year grade they aimed to achieve at the end of the 9th year: A (the highest), C or E. The teacher was asked to select the student participants for this study by choosing 4 or 5 students from each group. This choice was based on the teachers' knowledge of her students' ability to verbally express their reflections. She asked them if they wanted to participate in the interview and all those asked, 5 from each group, agreed. The students were coded as A1-5, E1-5 and C1-5.

Data collection

This study was designed to reveal examples of interest and engagement in mathematical content. The data consists of semi-structured interviews with selected students (n=15). Individual interviews lasting 4 to 11 min with each student were audio-recorded and transcribed verbatim. Each interview was divided into four parts. Part one, students were asked to give an example from any lesson in the 7-9th year of an interesting and engaging mathematical task (or in some cases one or several tasks or topic areas). The key question was: *Do you remember something interesting and engaging you have done in mathematics with your teacher?* Follow up questions were about what was found interesting and engaging in the task(s). Also, the students were given an opportunity to give further examples of interesting and engaging tasks. Questions that were posed were: "*What makes the task interesting and engaging?", "What interests and engages you in a task?* In the fourth part of the interview the students were asked if they had any suggestions to how a teacher can enhance interest and engagement.

When it comes to ethical considerations, it was clarified for the students that they were not facing a test situation. They were informed that the answers or reasoning about interest and engagement or task solutions would not affect their grades or be recognizable by the teacher or the readers on an individual level. Consent forms were filled in before each interview, read out loud and explained by the interviewer to each student. The audio data was transcribed for the analysis of students' reasoning about the tasks. Parts of the transcripts involving students' reasons for choosing a certain task were selected to be analysed.

Data analysis - the three phases

The analysis of semi-structured interviews is based on treating mathematical tasks as items (Goldin, 2000). After the individual semi-structured interviews with the students, the teacher provided the tasks that the students had brought up. Those tasks were analyzed in three phases:

1. Phase one is the researcher's analysis of the tasks concerning the target knowledge, the context, the level of challenge and the task structure. The analysis was made in order to answer research question 1, that is, what tasks students identify as interesting and engaging.
2. Phase two focuses on students' utterances. The transcripts of student interviews were analyzed in order to shed light on research question 2, which is, what students identify as

Table 1. An overview of each student's task choice.

Task 1: Human size doll	Task 2: Statistics poster	Task 3: Spatial geometry	Task 4: Population
A1, A2, C2, C3, C4, E1, E3, E4, E5	A4, C1, C3, E3	A2, A3, C1	A4, A5

Table 2. Summary of task features.

Task	Target knowledge	Context	Level of challenge	Openness	Routine/ non-routine	Scaffolding
1	Scale, measurement, proportionality	Real-life	4	1	NR	2 parts, 7 steps in part 1 and 12 steps in part 2
2	Descriptive statistics, diagrams and charts, percent	Real-life	4	2	NR	5 parts (concepts, methods, communication, reasoning, problem solving), 3-6 steps in each section
3	Geometrical shape, volume, scale, use of π	Mathematical	4	1	NR	3 parts about task and assessment with small steps explaining each part
4	Estimates of physical quantities	Real-life (Fermi)	4	3	NR	2 parts (the story and criteria for the grades)

interesting and engaging in those tasks. The focus is on looking for words in students' utterances related to task features, to see if details in the target knowledge, the context, the level of challenge and the task structure will be revealed. Examples of student utterances are included in the results to illustrate what students identify as interesting and engaging.

3. Phase three is a thematic analysis, to characterize task features mentioned by the students as interesting and engaging themes devolved in an iterative process, as well as connecting features found in the first two phases in relation to TDS.

RESULTS AND ANALYSIS

In the course of 15 interviews, a total of four tasks were recalled by the students. These tasks are presented and the overall results are summarized. Table 1 illustrates individual choices of the students, and Table 2 summarizes the analysis of the task features. Thereafter, task features are analyzed and parts of the transcripts were presented, illustrating what the students found interesting and engaging in the chosen task.

The tasks identified by the students as interesting and engaging

The tasks identified as interesting and engaging are (1) the human size doll, (2) statistics poster, (3) spatial geometry and (4) population on an island. All of the tasks turned out to be designed and revised by a group

of teachers.

The human size doll

This was a geometry task from year 8, with scale, measurements and proportionality as target knowledge. This task required a doll, a ruler or similar instrument of measurement, paper and pen, calculator and what the teacher referred to in the instructions as a "quick mind". The task consisted of two parts. In part one, the students worked on their own, to produce an image of a three-dimensional doll (Barbie or Action man). A body part of the doll was chosen to serve as a unit of measurement. The students were instructed to find out what a reasonable size of that body part is in reality and calculate the scale of the measurements. From these measurements a scale was chosen. A discussion on which measurements turned out to be realistic followed.

In part two, they were instructed to choose a measurement of the doll's body as a unit. A scale based on the real human measurement of the same body part was suggested, for example for a person (180 cm) and the doll (15 cm), the scale being 1:12, since 180/15=12. The students were then instructed to use this scale through the whole task and a poster of the human size doll was made based on the scale. At the end the measurements were summarized in a table and presented to year 6 students at the same school, discussing how unrealistic the dolls were.

Statistics poster

This task was based on the topic of descriptive statistics from year 9, dealing with representations, such as different kinds of diagrams and charts. The students had a short introduction followed by five lessons to work on the task, with no additional homework during this period. Instructions were to choose a question the pair of students would like to investigate, a question statistically possible to answer. A poster was to be produced in pairs, representing the results of the investigation. Independency was encouraged at all stages of the task. After each lesson the students were encouraged to reflect over what they had done and how much advancement they had made since the previous lesson. The poster was handed in and presented in a 2-minute poster-session, in pairs, to a small group of younger students and to the teacher. The students assessed each other's work according to a list of goals and requirements they were given, for example to know what is meant by table and diagram and what the difference is, using different types of charts and graphs and position measurements. Concepts, methods, communication, reasoning and problem-solving skills were all outlined and exemplified in the description of goals and requirements.

Spatial geometry

Task 3 was a spatial geometry task from year 8, dealing with the concept of volume. It was an individual task where the aim was to create a geometrical shape with a volume of 5 L. The shape had to incorporate several different solids (cube, cuboid, pyramid, cylinder, cone, prism or others), including one that involved the use of π in calculations. The students had to make a sketch of the shape from different perspectives and present calculations in a detailed and comprehensible way. In order to get a higher grade, a sketch to scale was to be made, so that the shape could be reconstructed from the sketch. Correct mathematical language was to be used and calculations were supposed to be presented in a clear way. Materials provided were paper, glue, ruler, calculator and adhesive tape. Assessment of the task rested on the calculations of volume.

Placing the world population on an island

This was a Fermi-problem focusing on the concept of area and estimations. It was dealt with in year 7 and was one of the first tasks the teacher introduced to the students and was used for assessment. The theme was "Is the world really overpopulated?" A discussion between two girls was presented on the issue of the world population. The two girls argued about how much space it would take if the whole world population were squeezed in a small area. Is there an island where the whole world would fit in at once, the first girl wonders? No way, says the second girl. The students were asked to agree with one of the girls, by investigating if it was possible to fit in the world population on an island and present their investigation to the rest of the class.

Overall results

All of the students stated that they are, to some extent, interested in mathematics and engaged in tasks. The data presented in Table 1 includes the four tasks the students recall as interesting and engaging. There is no ranking order in which the students chose the task. Five students, A2, A4, C1, C3, E3, chose more than one task to illustrate interest and engagement, while students C5 and E2 could not name any specific tasks and are therefore not included in Table 1.

As shown in Table 1, most students could give examples of one or several interesting and engaging tasks. The target knowledge in all student-chosen tasks is within the field of geometry and statistics. However, there is evidence that other topics are interesting and engaging: Five students (A4, A5, C4, C5, E2) stated that they found probability and percentages engaging. A4 and E2 found algebra (equations) as generally engaging, A5 found it especially interesting to solve systems of equations or working with two unknown. Two of the students (C5 and E2) could not exemplify interest and engagement by describing a task they had worked on; they spoke only about interest and engagement in general, but did not come up with any examples during the course of the interview. Another student, C3, also mentioned the coordinate system, graphs and diagrams when talking about the statistics poster, and gave an example explained by the teacher on the board, about how to represent and compare the velocity of different vehicles.

Analysis of students' utterances on why tasks are interesting and engaging

The following section consists of representative student quotes analyzed thematically. Thematic analysis is used to discover patterns related to existing themes (Miles and Huberman, 1994), from TDS and MTF. The themes that emerged connect interest and engagement to the target knowledge, the didactical situation, the context the target knowledge is embedded and the aspects of task structure.

Interest and engagement in relation to the target knowledge

One particular task feature that stood out was the

target knowledge and it was mentioned most frequent, early in the students' utterances. In Task 1 scale, measurements and proportionality were brought up particularly early in their utterance by the students from all the three groups (A, C and E):

I: Can you give an example? An example of a task that was interesting?
A1: It was… What is it called? [When we worked] with scale, sort of. We got… Sort of… A Barbie doll, […] and we were sort of supposed to make it in a certain scale. We were supposed to see how proportional it was.

Similarly, to student A1, student A2 first pointed out the target knowledge, in this case scale, and only thereafter the didactical situation in which the task was dealt with:

I: What task or tasks did you find interesting? What task did you find engaging?
A2: Lets see. What was it about… That's right, it was scale. We got a Barbie doll and drew it to see if it really could be…

In the above citations from the interview with students A1 and A2, the target knowledge was to a high extent at the fore for the students, which is shown by how they described the task. This is similar to the excerpts from the same students presented earlier in this section. In the next excerpt, it is visible that the target knowledge was the primary focus in relation to interest and engagement:

I: Can you tell about an interesting task? When you were engaged?
E4: We worked with scale. A doll… Or… We had a doll. And we were supposed to draw it ten times bigger. Draw so it would be exactly 10 times bigger.

In case of E4 both the ratio of the drawing and the process of drawing itself were mentioned. The students clearly knew that the task was about scale and not about the Barbie doll. The doll was perceived as a tool in order to reach the target knowledge. So even when both the doll and the situations were mentioned, the target knowledge still appeared at some point in the descriptions:

I: What task… Or what tasks were interesting and engaging according to you?
E5: We were in a group and then we were supposed to make a doll in… Scale? What is it called? I don't remember how it was but anyway, it turned out to be 2 m tall. Something like that, really tall.
The target knowledge in Task 2, bar charts, was mentioned almost instantly, in combination with the presentation and the choice of topics:
C3: We were supposed to choose topics and make a chart, a bar chart. Also to explain the results for example

like…
Which music is the most popular on Spottily right now and eeh...

C3 mentions the chart when talking about Task 2, a task in which the target knowledge has a central position, and thereafter the context he/she chose was pointed out. It was clear in the instruction of Task 2 what type of statistical representations the students should use. Students also found Task 2 interesting and engaging due to the target knowledge from the lower-level group:

I: Why was it [the task] interesting?
E3: Actually, I do not know. Maybe because it is… about diagrams and that, I think that is pretty fun.
But if the task had more text in it I think it would be harder, because I had to pick out part that were like… important and I think it… It is harder.

This student stated that diagrams are fun, and can make the task interesting. This is an example of how the target knowledge at the fore can make the task interesting and engaging. The level of challenge is also affected if the task was perceived as interesting and engaging. Here the clear focus on the target knowledge with no superfluous text made the task manageable and therefore interesting to the student. The target knowledge in Task 3 was also recalled when the task was described, being the concept of volume and the way the student recalls working with a solid:

I: Can you tell me about an interesting task you have worked with? When you felt engaged?
A2: I think it was in 8th grade. We were supposed to work with volume.
An individual task with a shape that contains 5 L.

The geometric solids and the fact that they could chose different shapes were mentioned:

A3: In geometry we got to… sort of… different shapes.

We were supposed to build three different… You know what I mean? […] Cube, cylinder. 5 L in total.

In group C, the target knowledge of area and shapes emerged, and other details, such as 3D, π and calculations:I: Are you interested in mathematics? C1: Mm…Yes.
I: Are you engaged? Do you feel engaged during math lessons?
C1: Yes. I usually am quite engaged. […] There are some things that I am really good at, or best at, but I have missed a lot…
I: What is your best topic? C1: Best topic…
C1: It must be the one with that… 3-Dimensional…

And then you are supposed to use to… π… to calculate… What is it called? I do not know. [Shows area of a square on the paper].

The student talks about interest and engagement in relation to being successful, being good or even best at mastering the content. In connection to the target knowledge, that is the use of π, another reason for Task 3 as being interesting was the way the target knowledge was made comprehensible, as student C1 describes:

C1: …it is [interesting and engaging] when you know beforehand, such as here with π, here you know that you will multiply it. You sort of know what you are supposed to do.
In this utterance, the use of π was mentioned in connection to an interesting and engaging task. In relation to Task 4, calculation and presentation were brought up:

I: Can you come up with a similar example…With an example that made you feel like you were engaged, at least?
A5: Eeeh, it was a long, long time ago. We… How was it? Like…We had a task and we had to calculate…. If there was only one country in the world, would all the population of the earth fit in this island or in this country? Or as A4 describes the same task:

I: What was it about and why was it… Yes, why was it interesting? A4: We were supposed to present about a country, I think it was. And how big the surface was and such.

A5 mention the target knowledge, since he talks about "calculations" and A4 describes the target knowledge when talking about the area as "how big the surface was". This can be seen in light of the task instructions, where the emphasis on participation in the presentation and understanding
how to solve the task can be interpreted as being an aspect of the didactical situation rather than the target knowledge. It was said that they would be graded on mathematical creativity (showing how the task is solved); knowledge about calculation (how mathematics is used to reach the solutions); communication (how the others in the class comprehend students calculations and conclusions); and participation (how active the student is during group work).

Interest and engagement in relation to the didactical situation

In addition to the target knowledge the students brought up features of the didactical situation as reasons for interest and engagement. These features were related to the activities in the task, such as calculating, drawing and other practical aspects. In Task 1, a student from group C brought up the didactical situation and what was practically done during the lessons:

I: What task did you find interesting to work with?
C2: We were supposed to make a picture.
We had to measure different parts of a doll and make a really huge doll out of it. We measured every centimeter, in scale.

According to this student, the didactical situation consisted of making a picture. The student also talks about the target knowledge measurements, with making the picture in the foreground. The presentation of the poster at the end was one of the reasons the students were interested and engaged in Task 4:

I: Why were you engaged?
A4: I was engaged because I knew I would have a presentation later. […] It is about the task where you do not sit alone and calculate, alone, but you are supposed to maybe present later.

When the activity, the presentation, was pointed out as engaging (by the same student that brought it up in Task 2), new form of presenting was emphasized.

I: What was it about the task that was so engaging, then? A5: We were supposed to present, about a country. […] And we were supposed to present it to [teacher's name], who was a little bit new to us so…

The type of presentation was selected by the students, as stated in the instruction of the task, and that part as well as the selection of the questions to investigate, involved free choice. The fact that it involved elements of presentation is, in my interpretation of the interview data, what made it interesting and engaging. This was also noted in the descriptions of Task 1, where students drew upon drawing and calculations as interesting and engaging:

I: Why was it interesting?
C4: It was interesting because…

You had to draw so everybody had something to do every time. It [the scale] was 1 to 15. Drawing and calculating were pointed out as engaging by several students, for instance E1:

I: Why was this task interesting? E1: …because we could draw and calculate.
In the case of Task 3, first the practical aspect of the task is mentioned as one of the reasons for being engaging, followed by the target knowledge and the

description of what solids the student worked with:

C1: Because we worked… A little bit practical, so… We took some paper and made a square.

We were supposed to make an area and then form three different shapes with that. Threesome…
Triangle, cylinder and we were supposed to sort of put them together.

Interest and engagement in relation to the context

One student mentioned the context, the Barbie doll, as the reason why Task 1 was interesting:

I: Why was it an interesting task? What made it…?
E5: It was my favorite task because it was about the Barbie doll.

It was about… we were supposed to make a Barbie doll that was supposed to look like… I mean…
It was supposed to be really big.
   Even despite the real-life context, it is hard to imagine that Barbie dolls are appealing to this age group, compared to the effect it might have on initiating interest and engagement in younger children. The context provided a personal connection, a development of a mathematical model, modeling the big doll - the human size doll, and the relations between the proportions of the doll and the human body in connection to the student's own body.
   Task 3 had a purely mathematical context, the students worked with geometrical shapes, although an association to a realistic context, a water tower, was made by the illustration provided on the instruction sheet. Since the total volume of the body is to be only 5 L, the context is not real-life, but realistic in a sense of being a prototype of a water tower. It is not the context of a tower prototype the students point out as interesting and engaging, but the three different types of solids they chose. Task 3 was of high cognitive demand, with questions that allowed or required investigation through t h e use of materials, data gathering, testing and, most importantly, choice of solids and calculations. In other words, Task 3 was pointed out as interesting and engaging because it was explicitly mathematical, with the target knowledge in focus. Task 4 had a real-life context, although in comparison to Task 1 and 2 was not a realistic one, providing an imaginary situation connecting the question of overpopulation with the size of the available land. Students got to choose an existing island.

Interest and engagement in relation to cognitive demand

All of the mentioned tasks were found interesting and

engaging due to their high level of cognitive demand. Using MTF terms, Task 1 demanded complex, non-algorithmic thinking, without explicitly providing any predictable approach in the task instructions. It included exploring and understanding the nature of the concepts of scale, the process of reproducing a 3D image and how disproportional the doll is to human sizes. Self-monitoring or self-regulation of one's own cognitive processes when measuring and finding out about human size proportions is required to solve the task. Relevant knowledge and experience when reproducing an image to a certain scale, and making appropriate use of them is also an indicator of the high level of cognitive demand. What is reasonable when it comes to human size and what in measurements of the doll that limit possible solution strategies was analyzed. The process leading to the reproduction requires several steps, which meant considerable cognitive effort for the students. The students recognized this task as interesting and engaging because it was challenging:

I: Why did you… Do you like this task?
A1: I like it because… It is a really hard tasks, that… sort of… No one can solve and then… […] One really gets to work (A1). Or as another student puts it:

C2: It was hard for me, it was fun.

Task 3 includes exploring and understanding the nature of area and volume and it involves complex and non-algorithmic thinking in relation to the transition between area and volume. There was no predictable approach explicitly suggested by the task instructions; however there was an explicit instruction about working with π and some suggestion of which shapes to choose. Relevant knowledge and experience of the concepts of area and volume as well as of the shapes, making appropriate use of the concepts to end up with 5 L is a part of this task. Students had to analyze task constraints that could limit possible solutions and strategies. Task 2 was also highly demanding, since no predictable approach was explicitly suggested by the task instructions – the student had to formulate a question and chose a way of representing the answers. As a part of this task, students were exploring and understanding the nature of concepts, such as representations, percentages and using different types of diagrams and charts, processes and relationships. During the exploration, self-regulation was central. The students were given free rein to choose representations. In order to represent the answers, the students were given an opportunity to use relevant knowledge and experience appropriately. Task constraints that could limit possible solution strategies and solutions were analyzed while making the choice of diagrams and justifying the choice, as was pointed out by C3 and A4 in the interview:

C3: Up there we had… Mm… How many percent? We wanted to know how many percent and it is much easier to find out if you look at a bar chart. […]

Since there were only four categories and then it is much easier with a circle diagram. When it comes to cognitive demand of Task 2, the process leading to the solution required cognitive effort, although concepts, methods, communication, reasoning and problem-solving skills were all outlined and exemplified in the description of goals and requirements. Task 4 provided a high level of challenge mentioned as one of the reasons it was interesting and engaging:

I: So why was this task interesting, why did you engage in it? A5: It was not just… Eehm… With the help of the map. You were supposed to calculate, like…To really put your mind to it.

The task was interesting and engaging due to the high level of challenge, as student A5 explains, beyond the experience of the tasks they had previously worked with in their textbooks:

A5: The tasks in the book are just one after another, just calculate - next one calculate - next one.
This task is not like that. It makes you think, like extra.

Task 4 was of high cognitive demand, it required non-algorithmic thinking, provided no numerical values and no predictable approach explicitly suggested by the task instructions; the students had to explore the task by using relevant previous knowledge and experience of the concept of area and link it to the population size. Since no suggestions of how to make the necessary calculations are given, or even where to start, the unpredictable nature of the process leading to the solution of Task 4 requires considerable cognitive effort for the student. The students analyzed task constraints that could limit possible solution strategies and solutions, for example the choice of the island.

DISCUSSION

All of the tasks brought up by the students had the target knowledge at the fore and were of high cognitive demand, which was recognized as interesting and engaging by the students. Another aspects of interest and engagement in tasks are the didactical situations (Brousseau, 1997) in which they are dealt with, for example if elements of drawing and presenting are included in the task.
The context a task is embedded in was also pointed out as a reason for becoming interested and engaged, but no particular context was chosen over the other. For example, the most frequent selected task (Task 1) with

the target knowledge of scale and measurement has a realistic context, as well as Task 2. Task 3 was purely mathematical while Task 4 was related to real-life but not realistic. As long as the context was well-matched with the mathematics in the tasks, the students seem to find the task interesting and engaging.

If judged by the frequency, Tasks 2 and 3 are almost equally interesting and engaging. Task 4, a Fermi problem is similar to the task about how many people can stand up in the classroom (Sullivan et al., 2013) and was brought up by two students from group A. The students became interested in the tasks, by engaging in the combination of understanding the concept of area, estimation strategies and the notion of measurement errors and applying this understanding in thought experiment. This suggests that a task with such a structure has the potential of being used to enhance interest and engagement for students who already have pre- knowledge in the area and strive for challenges.

The time frame does not appear to influence students' choices, since the chosen tasks were dealt with during different periods, 0.5 to 2.5 years previously. For the past three years, these students have been working with different types of tasks, some designed by the teacher and others taken from the textbook, short routine tasks and large ones, thematic tasks that include smaller task units. However, all 15 students recalled one, or several, of the four specific tasks to exemplify their interest and engagement.

In all tasks the students brought up target knowledge rather than any other task features or aspect of the didactical situation. For instance, in Task 1 the students referred to scale rather than to the Barbie doll as interesting and engaging. In Task 2 the students put the mathematics to the fore and the didactical situation in which the mathematics is brought up more in the background. Task 2 provides an opportunity for the students to contextualize the target knowledge on their own terms, and to choose representations based on their questions and the data generated when posing them. It is also noteworthy that two of the four chosen tasks include target knowledge from geometry and that the target knowledge in all four tasks are from only two areas of mathematics. The context is in all cases a pathway, leading the students to the mathematical idea. The students are aware of this, which is shown by the most common way they describe the tasks when they bring them up, by acknowledging the target knowledge, such as scale, prior to the didactical situation. The teacher's focus on bringing the target knowledge to the fore shows up in the students' reasoning in connection to interest and engagement. In terms of TDS, the target knowledge was not only recognized as the reason for becoming interested and engaged. In other words, the meso-level of the didactical contract that is the activity level is important when enhancing interest and

engagement in mathematics (Nyman and Kilhamn, 2015). However, in contrast to the mentioned study, the qualities the teacher brings up are all mirrored in the way the students' reason about the tasks. The teacher took the target knowledge as the point of departure when designing the task and managed to engage the students in the didactical situation successfully.

The teacher designed the tasks to provide opportunities for students to make their own choices and included elements of presentation, which turned out to be interesting and engaging. The most chosen task, Task 1, provided the fewest opportunities for student choice and then only in connection to the context it, what doll to choose and which body parts to measure. Task 2 provides a choice of mathematics content, such as which diagram to illustrate the question with, though the choice is dependent on the data generated by the chosen question. In Task 3, the students chose the solids and presented them to the rest of the school by hanging them up in the hallway. Task 4 provides the choice of the island, which indirectly also leads to the choice of area on which to put the world population. Choices related to modeling also had to be made. To give the students choices might be a catalyst for engaging them, allowing the didactical situation to devolve, and for the students to make the task their own. This does mean that the task has to be as open as possible in order to be engaging. The open-ended elements of the tasks, where students made their own choices, challenged students' decision- making. As Boaler (1993) puts it, an activity can start with a context, but then be open for the context to be up to student's own development.

All of the tasks were on a high level of cognitive demand, implying that the tasks require some previous basic knowledge in arithmetic, geometry or statistics. This result supports the early assumption that in order to be engaging a task must be seen as challenging by the students (Hilbert, 1900). Of course, previous knowledge of the subject can affect the student's view on whether a task is challenging or not. This might be the reason why only students from group A, the ones aiming for the highest grade, brought up Task 4 as interesting and engaging. Also, all of the chosen tasks were non-routine tasks, strengthening the findings of Carpenter et al. (1989) that non-routine tasks are interesting and engaging.

A limitation of this study is that the students find it difficult when reflecting on what makes a task interesting and engaging. Not all of the students' could discuss details of the tasks. When addressing the second research question, it was found that the students had difficulty pointing out what made the task they suggested interesting and engaging. Attempts in the interviews to find out more details often resulted in answers like "I do not know", or "everything", about one or several of the chosen tasks. Therefore, in future studies it would be fruitful to approach this question by bringing the task back to the students and making an additional, task-based interview.

Conclusion

The study provides a student perspective on what can make tasks interesting and engaging. The analysis of the interviews shows that the students identified the target knowledge as a reason for being interested and engaged which confirms the teacher's intention. All of the chosen tasks are of high cognitive demand, require previous basic knowledge and are set in different context. They were all examination tasks with an element of presentation and sharing, and open to some extent; leaving room for student's own choices of the conditions in which the task is set.

A didactical implication of the presented results is to have the target knowledge as a starting point in task design, preferably with a well-matched context to make the mathematics visible. All student-chosen tasks had target knowledge from geometry and statistics, suggesting that target knowledge related to those topic areas can be a good starting point and a valuable source when working with interest and engagement on a general level in grades 7 to 9. Concerning the context, the results show that both tasks with purely mathematical context and with a real-life context were chosen. What the students highlighted as interesting and engaging was their influence over the context, choosing what body part of a doll to measure in Task 1, what shape to work with in Task 2, what questions to pose and what type of descriptive statistics to work with in Task 3 and what island to place the population on in Task 4. The study provides an opportunity to expand views on the nature of interest and engagement in mathematics. In future research it would be rewarding to investigate the interestingness of target knowledge of other topics areas. For instance, by interventions including the features highlighted by the students in this study (high cognitive demand, influence over context, presentation), including target knowledge from other topic areas.

Conflict of Interests

The authors have not declared any conflict of interests.

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Educational Research and Reviews

Full Length Research Paper

The awareness and educational status on oral health of elite athletes: A cross-sectional study with cluster analysis

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In this cross-sectional survey, this study aimed to determine the factors associated with oral health of elite athletes and to determine the clustering tendency of the variables by dendrogram, and to determine the relationship between predefined clusters and see how these clusters can converge. A total of 97 elite (that is, top-level performing) male handball players aged 18 to 29 years participated in the study. Two questionnaires with high validity scores were computed based on the results of the oral health of elite athletes (Geriatric/General Oral Health Assessment Index (GOHAI) and the Oral Health Impact Profile (OHIP)). The GOHAI mean and standard deviation score was 8.381±3.988, indicating a low self-perception of oral health by the allocated sample The OHIP mean and standard deviation score was 11.25±3.553, indicating a low self-perception of oral health by the allocated sample. OHIP shows low scores based on these results. According to the first sub cluster; dental floss, dental control, brushing, gingival health, age, dieting and education was found significantly related with these two indexes. The ratios of these variables were as follows: dental floss; 56.7%, dental control; 80.4%, brushing; 99%, gingival health; 96.9%, dieting; 94.8%, education; 100% and the mean age was 18.96±3.731. These results indicate positive correlations among GOHAI and OHIP indexes and positive results for elite athletes included to the current study. As a result, the variables that affect the oral health of the athletes in the study based on multivariate analysis of the clustering results were observed to be healthy at the expected level. The relationships between variables with dendrogram by using hierarchical cluster analysis was discovered.

Key words: Elite athletes, oral health, cluster analysis, dendogram.

INTRODUCTION

The expression of oral health means much more than it seems because Oral health is considered to have associations with general health and well-being. Oral health is an important determinant of the quality of life (Needleman et al., 2012). Elite athletes should follow a good diet to obtain the best performance and must have

good oral health as well. Oral health and general health are two important components. Consequently, oral health is integral to general health (Ashley et al., 2015).

There are multiple factors which causes athletes to have dental problems like the effects of energy drinks, regular tooth brushing and flossing, individual biology, the physical and socio-economic environment, personal behaviors and lifestyle, and the organization of health care (Rajapakse et al., 2007).

Dietary carbohydrate intake is one of the most effective factor for dental caries, and the acidic foodstuffs and beverages are the main factors causing tooth decay. It has been recommended that in order to reduce the occurrence of dental erosion, the amount and frequency of carbohydrate intake, a sugary fruit drinks (including sports drinks), vinegar, citrus fruits and berries should be limited (Baumgartner et al., 2009). Oral health is related to diet in many ways, for example, through nutritional influences on cranio-facial development and oral infectious diseases. Dental diseases include a number of local problems, including inflammation of the pulp (pulpitis), infection and most commonly, decay. Periodontal disease, gum disease, grinding teeth (bruxism), tooth trauma and an abnormal bite are also causes (Sheiham, 2001).

In modern society oral health has an important role in facial appearance. Physical appearance of the athlete provides a very significant impact. Tooth loss can be very hard on athletes, and at times embarrassing thing to cope with especially when it has some effects on speech. This is a situation that cannot be accepted for athletes (Moynihan and Petersen, 2004; Chen et al., 1997).

The health of oral tissues and organs are, inevitably related to the chemical, physical and physiological characteristics of foods and diets. Hence the importance of a healthy diet and nutrition are very high (Wang and Lussi, 2012). Dental caries is caused by the interaction of microbes (plaque), dietary factors and their fermentation on teeth. The acid is produced when sugars (mainly sucrose) in foods or drinks react with bacteria present in the dental biofilm (plaque) on the tooth surface (Loveren et al., 2012; Wang et al., 2002).

The increasing quality of life is associated with dental caries. Consequently, medical care and social programs are focusing increasingly upon enhancement of patients' quality of life (Natio et al., 2006). Individuals and athletes should be recommended to reduce the frequency with which they consume foods containing free sugars, limit the amount of free sugars consumed, facilitating good nutrition and physical well-being to achieve maximum sporting potential. In countries where fluoride toothpaste is accessible, individuals and athletes should be recommended to brush their teeth with a fluoride toothpaste twice a day (Bryant et al., 2011).

The study aims to determine the factors associated with oral health of elite athletes, and to determine the clustering tendency of the variables by dendrogram. It has been also interested with using hierarchical clustering method to determine the relationship between predefined clusters and see how these clusters can converge.

MATERIALS AND METHODS

A total of 97 elite (that is, top-level performing) male handball players aged 18 to 29 years participated in the study. Written informed consent was received from each participant after the aims and methods of the study were explained. Participants were free of drugs. Their physical examinations and routine laboratory analyses were in normal ranges. Smokers, individuals on medication and had muscle injuries or who have developed muscle lesions were not included to the study. Self-report questionnaire data were collected from a sample of 97 athletes. The periodontal condition was assessed by a dentist.

Study design and sampling method

The design of the study was a cross-sectional survey. 97 elite handball players selected as subjects using "Random Sampling Method" who played in Turkish handball league.

Study questionnaires

Two questionnaires with high validity scores were computed based on the results of the oral health of elite athletes. One of them was GOHAI the well-established Geriatric/General Oral Health Assessment Index. The other was frequently used questionnaires which include the Oral Health Impact Profile (OHIP) (Slade and Spencer, 1994, Atchinson and Dolan, 1990). The GOHAI has been adapted for general use, translated and tested on the samples of adults in many countries, independently or compared to other indices (Kristjansson et al., 2003).

Aiming to evaluate elderly oral health self-perception, GOHAI utilizes the original questionnaire composed of 12 items divided in 3 dimensions that address physical function, pain and discomfort, and psychosocial aspects (Atieh, 2008). Patients were questioned about the frequency at which they experience any of 12 listed problems, using a three-value scale (Table 1). The final score was classified as high (34 to 36 points), moderate (31 to 33 points) and low (≤ 30 points) self-perception. OHIP questionnaire contains 49 questions. It contains seven dimensions, with seven questions in each dimension (Davit et al., 2009).

Statistical analysis

Mean and standard deviation (SD) were calculated for continuous variables. The normality of the variables was analyzed by Kolmogorov–Smirnov test. Hierarchical Cluster Analysis (CA) of modern multivariate statistical methods was employed to find the clustering tendency of the variables. The dendrogram of the variables was found by means of the Average Linkage (between-groups) Cluster Method. Classifications are generally pictured in the form of hierarchical trees, also known as dendrograms. CA is one of the primary methods of modern multivariate analysis. Because of its utility, clustering has emerged as one of the leading methods of multivariate analysis. CA is a multivariate statistical method which

Table 1. The 12 items utilized in the GOHAI index using a Likert scale.

GOHAI index	Always	Sometimes	Never
Limit the kinds of food consumed	1	2	2
Trouble biting or chewing	1	2	2
Able to swallow comfortably	1	2	2
Unable to speak clearly	1	2	2
Able to eat without discomfort	1	2	2
Limit contact with people	1	2	2
Pleased with appearance of teeth	1	2	2
Use medication to relieve pain	1	2	2
Worried about teeth, gum or dentures	1	2	2
Self-conscious about teeth, gums or dentures	1	2	2
Uncomfortable eating in front of others	1	2	2
Sensitive to hot, cold or sweet food	1	2	2
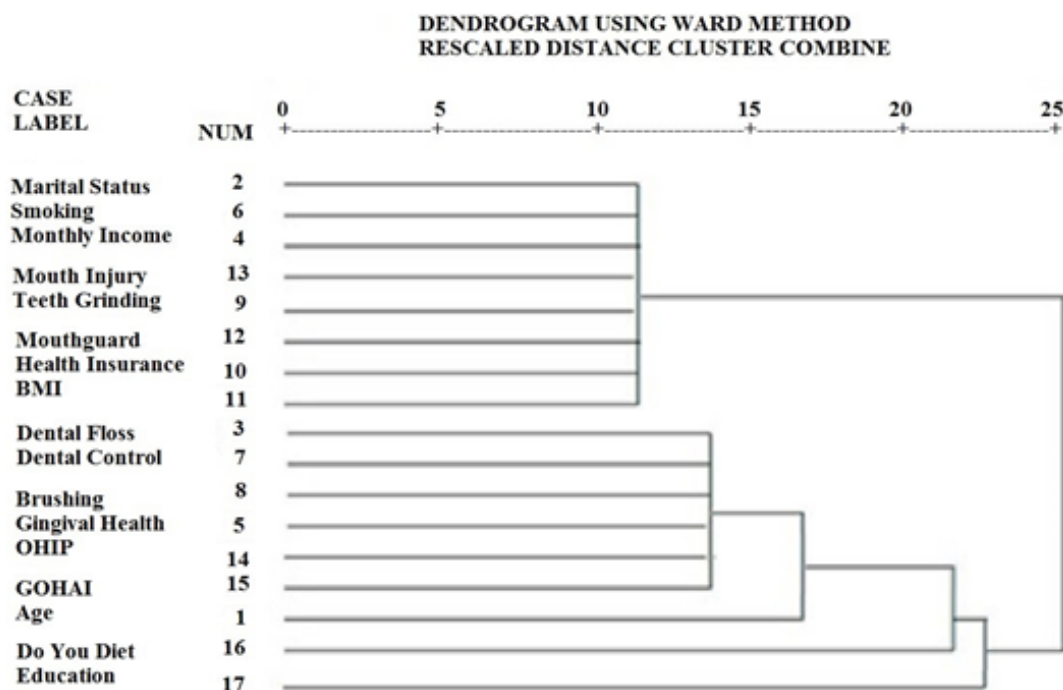
Figure 1. Dendogram shows the sub clusters of variables.

was originally developed for biological classification (Kettenring, 2006). Two-sided p values were considered statistically significant at P≤0.05. Statistical analyses were carried out by using the statistical packages for social sciences (SPSS) 15.0 for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

To indicate the connections between variables, cluster

method was used which identified two main distinct groups, with each cluster having several related features (Figure 1). These two clusters were named on the basis of their key characteristics. The first cluster included the following: Dental floss, Dental control, Brushing, Gingival health, OHIP, GOHAI, Age, Dieting and Education. The second cluster included; marital status, smoking, monthly income, mouth injury, teeth grinding, mouth guard, health insurance, and body mass index (BMI). It should be

Table 2. Descriptive statistics of OHIP, GOHAI index, age and BMI.

Variable	Mean	±SD	Min-Max
Oral health impact profile	11.25	3.553	3.00-21.00
General oral health assessment index	8.381	3.988	1.00-19.00
Age	18.96	3.731	15.00-39.00
BMI	23.95	20.21	17.28-220.2

Table 3. The frequencies of marital status.

Variable	Frequency	Percentage
Single	93	95.9
Married	4	4.1
Total	97	100.0

Table 4. The distribution of educational status.

Variable	Frequency	Percentage
High School	64	66.0
Undergraduate	32	33.0
Master of science	1	1.0
Total	97	100.0

Table 5. The distribution of monthly income.

Variable	Frequency	Percentage
≤1000 TL	50	51.5
1001-2000 TL	21	21.6
2001-3000 TL	10	10.3
3001-4000 TL	8	8.2
4001-5000 TL	3	3.1
≥5001	5	5.2
Total	97	100.0

Table 6. The distribution of the smokers and non-smokers.

Variable	Frequency	Percentage
Non-smokers	91	93.8
Smokers	6	6.2
Total	97	100.0

noted that dental control, brushing, gingival health, age and education variables was clustered with OHIP and GOHAI sub cluster. The horizontal axis of the dendrogram represents the distance or dissimilarity

Table 7. The answer of "Overall, how would you rate the health of your teeth and gum?"

Variable	Frequency	Percentage
Excellent	9	9.3
Very good	23	23.7
Good	46	47.4
Fair	16	16.5
Bad	3	3.1
Total	97	100.0

Table 8. The answer of "Do you diet?"

Variable	Frequency	Percentage
Never	5	5.2
Sometimes	35	36.1
I usually do	45	46.3
I often	10	10.3
I'm constantly	2	2.1
Total	97	100.0

between clusters. It has been found that this sub cluster was found to be closer in distance. While rescaled distance cluster combine of the second sub cluster was close to 25, the distance of second cluster was over 10 at the horizontal scale of Dendrogram as shown in Figure 1. Descriptive statistics, mean, standard deviation, min and max values were calculated and presented in Table 2. The frequencies of the variables are presented in Tables 3 to 13.

DISCUSSION

As a results of hierarchical cluster method; dental floss, dental control, brushing, gingival health, age, dieting and education variables were more related with OHIP and GOHAI indexes that all together built a same sub set (cluster). Oral health impact profile is also known as the OHIP-14 questionnaire includes 14 functional and psychosocial impacts that individuals have experienced in the previous year as a result of problems with their

Table 9. The answer of "Do you grind your teeth".

Variable	Frequency	Percentage
Sometimes	62	63.9
Often	12	12.4
Very often	1	1.0
Always	22	22.7
Total	97	100.0

Table 10. The answer of "How often do you go to the dentist?"

Variable	Frequency	Percentage
I don't	19	19.6
Only when necessary	57	58.8
Every six months	15	15.5
Once a year	6	6.2
Total	97	100.0

Table 11. The answer of "How often do you brush your teeth?"

Variable	Frequency	Percentage
I don't	1	1.0
Once a day	34	35.1
Two times a day	51	52.6
Not regularly	11	11.3
Total	97	100.0

Table 12. The answer of "Do you use dental floss or any other device to clean between your teeth?"

Variable	Frequency	Percentage
I Don't	42	43.3
Dental floss	12	12.4
Toothpick	43	44.3
Total	97	100.0

Table 13. The answer of "Do you have any oral or maxillofacial area injuries?

Variable	Frequency	Percentage
No	81	83.5
Yes	16	16.5
Total	97	100.0

teeth, mouth or dentures. It is concluded that the higher the total score, the more severe the problem and the lower the quality of life (Basol et al., 2014).

GOHAI, developed by Atchison and Dolan in 1990 was based on the following expression; oral-dental health can be measured through self-examination, oral-dental health changes from one to another, and this changing can be evidenced through the use of measurements based on the individual's self-perception, and self-perception has been determined as an oral dental health. GOHAI is based on a 12 item questionnaire with Likert-type responses (Montoya et al., 2008).

The GOHAI mean and standard deviation score was 8.381±3.988, indicating a low self-perception of oral health by the allocated sample. The maximum value was 19 points, and the minimum value was 1 point. The OHIP mean and standard deviation score was 11.25±3.553, indicating a low self-perception of oral health by the allocated sample. The maximum value was 21 points, and the minimum value was 3 points. OHIP shows low scores based on these results. It should be remembered that the higher the total score, the more severe the problem and the lower the quality of life.

According to the first sub cluster; dental floss, dental control, brushing, gingival health, age, dieting and education was found significantly related with these two indexes. The ratios of these variables were as follows: dental floss; 56.7%, dental control; 80.4%, brushing; 99%, gingival health; 96.9%, dieting; 94.8%, education 100% and the mean age was 18.96±3.731. These results indicate positive correlations among GOHAI and OHIP indexes and positive results for elite athletes included to the current study.

Oral hygiene means to keep the mouth and teeth clean to prevent dental problems. Not provide oral hygiene and not brushing teeth significantly increases oral bacteria in the saliva. In this case, saliva increases the concentration of bacteria (Langmore et al., 1998). Inflammation of the gums is induced by bacterial plaque (Shay, 2002). Infection process impairs oral hygiene. It does cause gingivitis and tooth decay (Kornman et al., 2000). As a result, evidence of this can be seen clinically with changes in tissue color from pink to red, swelling, and bleeding starts (Armitage, 2003).

Elite athletes were included in the current study were dieting with 94.8% ratio. According to the outcomes of Carole and Palmer (2009), nutritional status and dietary habits can affect and be affected by oral conditions. Addition to that, diet and nutritional factors can play important roles in oral health and disease. Especially, elite athletes also need to be aware of their nutritional goals and their meals should be checked by a dietician (Maughan et al., 2011). Epidemiological studies have shown that individuals with little or no education have much worse dental health than those with well education (Chen et al., 1997). To maintain oral and dental health routine professional care, patient education, environmental hygiene and nutrition education is required (Baker et al., 2010; Yu et al., 2001).

During athletic training and competition, the risk of injury to the teeth, arches, lips and gums increases when they are not wearing a mouth guard. Dentists should educate athletes and trainers about the importance of using mouth guard during athletic training and competition to reduce the risk of injury (Özdemir and Ersoy, 2010).

As a result, the variables that affect the oral health of the athletes in the study based on multivariate analysis of the clustering results were observed to be healthy at the expected level. It has also been discovered the relationships between variables with dendrogram by using hierarchical cluster analysis.

Oral health is directly linked with general life quality and sports performance. Therefore to genarate awareness using and educations on oral health is essential. In this study, the subjects answered GOHAI and OHIP questionaires for the first time in their life. It can be considered that via current questionaires genarating awareness on oral health and oral health education should be fullfiled to some degree.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Using Bursa folk songs for voice training in departments of music education in Turkey

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The training of a music teacher's voice, via the examples in his own culture can contribute to getting better results in music education. Therefore, it is believed that transition to Contemporary Turkish Music and then to universal music from our traditional music may be much easier. Accordingly, the use of national resources in voice training is seen to be quite important. In this context, Bursa Folk Songs, whose piano accompanied arrangements were prepared for voice training, and also were trained for one semester by the voice training instructors of three different departments of music education that train music teachers, and then those instructors were interviewed to evaluate the contributions of prepared piano accompanied Bursa Folk Songs for voice training to the field. As a result of the survey, it has been determined that music teacher candidates need to have an extensive repertory, full of examples from their own culture, the repertory of piano- accompanied folk songs is not enough in quantity, and piano accompanied folk songs have both technical and musical contributions during the voice training process.

Key words: Voice training, music education, traditional music, Turkey, Bursa Folk songs.

INTRODUCTION

The music reform, started during the first years of the Republic of Turkey (1923), being the foundation of studies during the present years (Gül, 2014). Within this scope, the concept of transition from national music education to universal music education, especially after 1960s, was suggested, defended and applied by educationalist composers, such as Halil Bedi Yönetken, Kemal İlerici, Erdoğan Okyay and Muammer Sun (Okyay, 1969; Okyay, 1973; MEB, 1966;Yokuş and Demirbatır, 2009).

You cannot root Turkish Music out from the hearts of the Turks. History, language and music blend in nations'national constitution in the way flesh, bones and blood come together in a human body. When you detach flesh, bones and blood from each other, you will get some results from the body. You will get the same results when you seperate history, language and music from each other, or take out only one of them. The disorder that takes place in the society will be similar to the one that takes place in the human body' says Angı (1976). By

saying that, Atatürk mentions his thoughts about the National Turkish Music (Angı, 1976) mentions his thoughts about the National Turkish Music, and tells that our traditional music has to be taken into consideration while forming Turkish National Music. Besides, in a part of his detailed report, Paul Hindemith, a musician appointed to contemporize the musical life and musical institutions by reorganizing them in 1935, expresses the impotance of our traditional music by saying, "the value of folk tune is not only in the musical impression, but also in the emotions which recall ethnic, regional and timewise relations". Therefore, the songs which are used in music education must be chosen among the magnificent repertory of old and strong Turkish Folk Music (Hindemith, 1985).

Thus, it is thought that the transition to Contemporary Turkish Music and then to universal music will be easier if traditional music is taken as the starting point of Turkish School Music education and is seen as an important part of our culture in an individual's music education (Helvacı, 2010; Kekeç andAlbuz, 2008; Türkmen, 2007). It is also important that music teacher training programs, which form an aspect of vocational music education, being an important kind of music education, be planned to train qualified music teachers with academic knowledge and performance skills in accordance with the objectives of general music education. Hence, seeing the training of a music teacher's voice, his most precious and effective instrument in his vocational life, as an effective process is of great importance.

'Voice training' in music teacher training is defined as 'a process of facilitating an individual with the necessary behaviours for using his voice in compliance with anatomic and physiological structural qualities so as to use it accurately, properly and effectively with a certain technic and musical sensitivity for artistic and educational purposes (Çevik, 1999). During the classes in this educational process, it is aimed that the teacher candidate uses the language properly in accordance with the basic requirements of voice training, improves his vocalization knowledge and skills in accordance with the voice training techniques, and forms a suitable school music repertory. Therefore, it is thought that, in voice training of candidates, to be music educators at departments of music education, including the examples of his own culture may yield better and easier results in their learning and skill acquisition. Within this scope, using the examples of Traditional Turkish Folk Music, which embodies national qualities, and is composed by the interaction of regional music pieces, has its own instruments, playing and singing style, tone and kinds, and is known to have an extensive repertory, is very important in the training of a music teacher's voice, his most valuable instrument (Kekeç and Albuz, 2008). İkesus (1965) states that, by abiding by the basic vocal training principles, choosing the most suitable way for

themselves for each country's people is beneficial.

However, Kekeç and Albuz (2008) state that, for the start-up phase in voice training, having a voice training with the progressions, to which the ear is acquinted, will provide convenience in advancement and motivation, and it will bring about discipline and supervision with it. They also state that the transition to Contemporary Turkish Music and then to universal music will be easier if traditional music is taken as the starting point of Turkish School Music education.

However, when the literature is examined, it has been seen that the number of 'Piano Accompanied Folk Arrangements for Vocal Training', which are prepared to be used in individual voice training, is very limited compared to our extensive traditional music repertory, and there is not an integrated work that brings together the folk songs belonging to Bursa region.

With its folkloric qualifications special to it, the folk songs and dance music of Bursa region which is thought to have a significant place in Contemporary Turkish Music are generally seen to have 2-3-4-5 and 9 beats (Helvacı, 2005). With their vivid and rhythmic structures, Güvende and Sekme Oyunları, distinctive musical productions of Bursa region, are among the favorite and most-loved folk music examples of the region (Usanmaz, 2005). There are many distinctive folk songs special to Bursa region in quantity, and there exists a substantial tradition of folk songs (Usanmaz, 2005). Thus, it is believed that the arrangement and use of examples from the extensive folk song repertory of Bursa region accordingly may contribute to the music education. Based on this thought, 'Using Piano Accompanied Bursa Folk Songs at Departments of Music Education for Individual Voice Training', which is a small scale research Project, was planned in 2014. This Project was accepted with KUAP(E)-2014 project number by Uludağ University Scientific Research Projects Unit. Within this scope, 10 folk songs, which are supposed to be used as individual voice training materials, have been chosen, and their piano accompaniments have been composed by Nedim Yıldız.

For that purpose, initially, folk song compilations of Bursa region, taken from Turkish Radio and Television Corporation (TRT) repertory, have been searched, and 30 folk songs have been chosen among this repertory. Then, another five folk songs apart from TRT repertory, composed by music educator Murat KARA, have been added to previously chosen 30 songs, and eventually, all folk songs have been examined and evaluated together.

These specified folk songs have been classified according to their vocalisation characteristics as female, male and both. Then they have been examined according to their modal and methodological qualifications, and among them, 10 folk songs have been chosen to make their piano accompanied arrangements. Handled as educational materials, these folk songs have been

transferred to two different vocal fields as high and low pitched vocal groups. With the purpose of vocalising these folk songs accurately and effectively, each folk song has been examined according to its prosody, then necessary improvements have been made without harming the form and originality of the tune. With the same purpose, exercises have been carried out to determine the places of pauses in lyrics.

In the next phase, folk songs, whose piano accompanied arrangements were made, were taught for one semester by voice training instructors from three different departments of music education that train music teachers, and then those instructors were interviewed to evaluate the contributions of prepared piano accompanied Bursa Folk Songs for voice training to the field. In accordance with the purpose of the research, these questions were asked:

1. Do instructors use piano- accompanied folk songs as educational materials in their individual voice training classes? What are their opinions about the necessity of using piano-accompanied folk songs?
2. Do instructors find the arranged piano-accompanied folk songs sufficient in terms of repertory to use in individual voice training classes?
3. What are the opinions of instructors about the contributions of using arranged piano-accompanied Bursa Folk Songs as course materials in department of music education to the general education processes of students?
4. What are the opinions of instructors about the difficulties encountered by students during the deciphering and training-learning phases of arranged piano accompanied Bursa Folk Songs?
5. What are the opinions of instructors about using arranged piano accompanied Bursa Folk Songs in technical and musical terms in individual voice training classes?
6. What are the opinions of instructors about the difficulties encountered by students during the vocalisation phase of arranged piano accompanied Bursa Folk Songs?

METHODOLOGY

In this section, information related to the design, sample and data acqusition of the research is given.

Research design

In this study, qualitative research method is used. Qualitative reserches are the researches which aim at presenting perceptions and events in a realistic and integrated way, and are the ones preferred for a better understanding of emotions and thoughts (Yıldırım and Şimşek, 2006; Ekiz, 2009). With this purpose, the data is analyzed with analyze techniques appropriate for qualitative

research by applying the interview form developed by the researcher.

Research group

In determining the sample group of the study, maximum variation sampling is used. In maximum variation sampling, the researcher selects a small number of units or cases that maximize the diversity relevant to the research question and aims to have an insight of a specific field (Büyüköztürk et al., 2016; Yıldırım and Şimşek, 2006). In this research, convenience of maximum variation sampling is chosen as the appropriate of data collection. The interviews have been conducted with one individual voice training intructor from Balıkesir University Necatibey Education Faculty Department of Fine Arts Education Chairs of Music Education, one individual voice training intructor from Mehmet Akif Ersoy University Education Faculty Department of Fine Arts Education Chairs of Music Education and three individual voice training intructors from Uludağ University Education Faculty Department of Fine Arts Education Chairs of Music Education. The genders of lecturers is of no importance. The criterian for choosing these is their expertise in voice training.

Data collection

Research data was collected by semi-structured interview technique. In semi-structured interviews, the researcher can affect the flow of the interview with questions prepared before. The researcher lets the interviewee answer the questions in any way preferred (Türnüklü, 2000). An interview form of seven open ended questions has been prepared for he purpose of evaluating the applicability of piano accompanied Bursa Folk Songs in individual voice training classes by the researcher. In order to ensure the validity of the instrument, the questions were posed to three field specialists, then the final questions were written accordingly. Interviews have been done one to one and face to face. Data are recorded on the interview forms prepared by the resercher simultaneously.

Data analysis

Descriptive analysis was used to analyze collected data through interviews. In descriptive analysis, direct quotations are often used in order to reflect the interviewees' opinions (Yıldırım and Şimşek, 2006). While quoting, the names of the interviewees are abbreviated as interviewee 1 (I1), and interviewee 2 (I2).

FINDINGS

In this section, the findings collected from the answers of the instructors taking part in the research are presented. As seen in Table 1, instructors stated that piano-accompanied folk songs are necessary course materials for their classes and they use them in their classes. Moreover, instructors believe that music teacher candidates need to have an extensive repertory full of examples from their own culture, and they give importance to both individual voice training and clarity of the language in their individual voice training classes.

Table 1. Instructors' opinions about the necessity of using piano accompanied folk songs in voice training classes.

I think they are necessary, but I try to be as selective as possible. I am especially careful about which vowel is used at high pitch notes for students I1

I certainly think it is necessary. I see that students are more successful while performing arrangements that reflect the culture of the students I2

I think they are necessary and I use them. I think it is necessary for music teacher candidates to know folk songs, which are parts of our culture, and they need to have an extensive repertory of them. I3

I think they are necessary and I extensively use them. In my classes, I especially give importance to both individual voice training and understandability of the language. I5

Table 2. Instructors' opinions about the sufficiency of arranged piano accompanied folk songs in terms of repertory to use in individual voice training classes.

I don't think the piano accompanied folk songs repertory used in individual voive training classes is extensive enough. I have trouble in finding songs suitable for students' voice and limitations. I1

When I compare piano- accompanied folk songs repertory with foreign repertory, I don't think it is enough. I2

We say that we have a very rich culture and there is an extensive repertory for every region in our country. However, I think that we don't have the repertory extensive enough to be used in individual voice training classes. I3

No. I don't find them enough. I4

Table 3. Instructors' about the contributions of using arranged piano accompanied Bursa folk songs as course material in department of music education to the general education processes of students.

I think that the diversity of folk songs' regional effect is worth to be known and sang. I also believe that the use of these folk songs in individual voice training classes in terms of understanding the differences, analysing the melodic structure and vocalising will have significant contributions to general education process. I3

I think they will have significant contributions to students' musicality. Because I see students have difficulty in vocalising the examples of foreign literature in individual voice training classes due to not being able to speak that language. Hovever, I can say that they have no difficulty in vocalising the arranged folk songs belonging to our own culture. I4

As seen in Table 2, it is seen that the instructors don't think that there is a repertory extensive enough to be used in individual voice training classes and they need folk songs to be used as education materials. As seen in Table 3, instructors state that using arranged piano accompanied Bursa Folk Songs at departments of music education in individual voice training classes has significant contributions to students' musicality. As seen in Table 4, all of the participants have stated that students had difficulty in deciphering the folk songs with odd meters.

As seen in Table 5, participants stated not only that using arranged piano accompanied Bursa Folk Songs at departments of music education in individual voice training classes has caused them no difficulty in technical and musical terms, but also that transferring each folk song to different tones have had some positive contributions to their works. As seen in Table 6, participants have stated that students have difficulties especially in rhythmical coherence during the first practices with piano accompaniment, but these problems have dissappeared after a couple of repetations. Besides, they have had great pleasure while vocalising especially with piano accompaniments.

RESULTS

In accordance with the findings of the study, we have found out that, ıt is seen that a vocational requirement for music teacher candidates to have an extensive repertory of songs belongs to their own culture. However,

Table 4. Instructors' about the difficulties encountered by students during the deciphering and training-learning phases of arranged piano accompanied bursa folk songs.

I had students having difficulty in the deciphering phase in terms of rhythm. I1
Students had no difficulty in deciphering and vocalisation. In folk songs with odd meter, there were temporary problems during the deciphering phase. I2
Students had difficulty in deciphering odd meters. I3
Abnormally, Students had difficulty in deciphering some rhythm structures.I4
Students had difficulty in deciphering and vocalising folk songs with odd meters I5

Table 5. Instructors' about using arranged piano accompanied Bursa folk songs in technical and musical terms in individual voice training classes.

Yes. I find it suitable. I2
That the folk songs had different tones for different vocal groups made my job easier in technical and musical terms. I3
I don't think these arranged songs have a kind of difficulty special to them. I think that it is the instructors' job to solve the problems in technical terms. I4
I experienced no difficulties. That the folk songs are transferred to different tones made my job easier while training different vocal groups.I5

Table 6. Instructors' about the difficulties encountered by students during the vocalisation phase of arranged piano accompanied bursa folk songs.

At first, they had difficulty in keeping up with piano in terms of rhytym, but this problem dissappeared at the end of accompanied practices. I1
They didn't have any problems at all. They enjoyed accompanied vocalisation.
They had difficulty in matching odd metered folk songs with piano accompaniments. I3
Students have difficulty in piano accompanied vocalisations of most of the Turkish songs. I have observed that they experience the same difficulties while practicing these folk song arrangements with heir piano accompaniments. I4
They had difficulties during the first trainings. However, I observed that they had great pleasure while vocalising especially with piano accompaniments. I5

when the literature is examined, it has been found out that the piano accompanied folk songs repertory used in individual voice training classes is not adequate.

It has been found out that vocalisation of piano accompanied folk songs have significant contributions to their melodic structure analysis and their musicality. With the findings of the research, it has been found out that piano accompanied Bursa folk songs doesn't cause any difficulties in individual voice training classes in technical and musical terms.

Besides, it has been concluded that transferring folk songs' arrangements to different tones have positive contributions to individual voice trainings. Furthermore, it has been found that during the vocalisation phase of the arranged piano accompaniments of folk songs, no problems have been encountered, on the contrary, they have had positive contributions to the training process in musical terms.

Students have enjoyed vocalising folk song arrangements in their individual voice training classes, and they have been observed to be more enthusiastic while practicing folk song accompaniments.

CONCLUSİON AND RECOMMENDATİONS

With the results obtained in the study, the following suggestions can be made:

1. It is of great importance for music teacher candidates to use their voices, being one of the most important instruments throughout their careers, being effective with a proper diction. Therefore, music teacher candidates need to be trained with a well-planned and comprehensive program that contributes to their careers. It is important that there be a well arranged repertory including

our folk songs. Hence, it is vital that a repertory, which is composed of our folk songs to be used in individual voice training classes, and which is arranged as educational music material, is developed.

2. The folk songs, which are arranged for voice training, should be presented as educational music materials for different vocal groups for the purpose of improving their efficiency in individual voice training classes.

3. It is extremely important for a piece of music to be vocalised with an instrument accompaniment in terms of musical precision and the effect it has on the audience. Taking advantage of piano accompanied folk songs during the training of a music teacher candidate will enable the candidate to be more equipped with vocational competency, especially by encouraging them with the technical and musical opportunities. Within this scope, it is believed that arranged piano accompanied Bursa folk songs carry a significant value and have contributions to the field in terms of art of music and culture. Likewise, it is seen very important that other folk songs chosen from other regions of the country should be evaluated, should be arranged as piano accompaniments for educational purposes, and therefore, contribute to the field by composing an extensive repertory.

4. It is thought that the presentation of these Folk Songs with the purpose of introducing them internationally via festivals, contests and other activities may significantly contribututes to the interaction of different cultures.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Relationship between philosophical preferences of classroom teachers and their teaching styles

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The purpose of this study is to examine the philosophical preferences of classroom teachers, their teaching styles and the relationship between the two variables. Participants are 301 volunteered classroom teachers who teach at the 1st, 2nd, 3rd and 4th classes in primary schools. To collect the data, philosophical preferences assessment form which was developed by Wiles and Bondi (2007) and adapted to Turkish by Doğanay and Sari (2003), and Teaching Styles Questionnaire which was developed by Grasha and Reichmann (1994) and adapted to Turkish by Saritaş and Süral (2010) were used. Analyses figure out that classroom teachers mostly prefer experimentalist philosophy and have facilitator teaching style. Examining the relationship of educational philosophies and teaching styles of teachers, there is a positive and significant relationship between the adopted educational philosophy and teaching style.

Key words: Classroom teacher, educational philosophy, teaching style.

INTRODUCTION

The basic element of learning and teaching environments is the teacher. The teacher plans the learning and teaching process by considering the variables such as instructional purposes, students' characteristics and physical conditions, moreover his/her own skills, teaching styles and educational philosophy or philosophies. In this context, it is important to know about teachers' teaching styles and educational philosophies.

In general, philosophy is a field of knowledge constructed as a result of systematic, deeply and speculative thinking on the relation of human and the universe (Gutek, 2006: 2). While Kant identifies philosophy as "a form of intellectual activity which has a claim of justifying itself based on mind"; Jasper proposes it as "being on road forever" (Arslan, 2014). Philosophy is an effort of looking at life and its problems from an overall perspective (Ornstein, 1988: 25). Ertürk (1988) defines it as process and product. He stated that philosophy as a process is an effort to comprehend the reality and its phenomenon in its integrity by gathering and reorganizing all information. Furthermore, it is an effort to investigate the sources of information methods and values, what are they and their importance. Besides, philosophy as a product is a total of "general beliefs, principles and attitudes", and values which philosophy as a process can form and which human uses as a decision base.

Philosophy helps us to be interested in personal beliefs and values, understand who we are and the reason of our existence and to some extent where we go. Philosophy is a total of connection process based on grounding the reality and products obtained at the end of this process (Demirel, 2005: 20). Just like philosophy is connected to all fields of science, they are connected to philosophy as well. Education is the science which has a close connection to philosophy in constructing a theoretical base and as well as in its practices. According to Patel (1958), philosophy needs the clear and precise expressions of education and education needs the guidance of philosophy (Doğanay and Sari, 2003). Educational philosophy can be defined as a form of applied philosophy which handles education in a philosophical manner or methods (Cevizci, 2011: 11). Educational philosophy studies the theoretical bases on which the available educational practices are based, and criticize them. Educators can only reveal and solve the strength of theoretical foundations which they strictly hold and consider the best via a philosophical approach (Fidan, 1987).

Educational philosophies can be categorized differently in terms of criteria undertaken in literature. As for a common classification, they are undertaken under four titles named "perennialism, progressivism, essentialism and reconstructivism" (Demirel, 2005; Fidan, 1987; Saylan, 2009). In "Philosophical Preferences Assessment" form which was developed by Wiles and Bondi (2007) and adapted to Turkish by Doğanay and Sari (2003), there are five educational philosophies; perennialism, idealism, realism, experimentalism and existentialism. In order to be consonant to the questionnaire, this study also examines the philosophical approaches under these five categories.

Perennialism

Perennialists emphasize on forming education according to certain universal realities. They think that the human nature, moral values, reality and the truth are universal phenomena (Demirel, 2005; Ercan, 2009; Fidan, 1987). They claim that human nature is perennial. Human beings have the ability of questioning and understanding the universal realities of nature. The purpose of education is to educate reasonable people by carefully training the mind, to uncover the universal truth and to provide the accordance with eternal truth not the reality of today (Ercan, 2009; Gutek, 2006; Ornstein, 1988; Sönmez, 2007; Wiles and Bondi, 2007). As the truth is the same everywhere, the education should be the same everywhere as well. Education is the preparation to life not a copy of the life. It is defended that the ideal one should be presented in educational settings, not the real life itself (Arslan, 2012; Demirel, 2005; Ercan, 2009; Sönmez, 2007). Perennialism indicates human sciences

are important as it clarifies the concepts of good, truth and beauty (Özdemir et al., 2008, 223).

The perennialist curriculum is subject-centered. The knowledge and the expertise of teachers cannot be questioned and they are accepted as the authorities. Moreover, the teacher should be the master of his/her subject and the instruction, and direct the discussion. Instruction is mainly based on Socratic Method. The teacher should be a role model by means of oral speech, explanation and interpretation. The student will learn by imitating the teacher (Ornstein, 1988; Sönmez, 2007; Scoot, 1994).

Idealism

It claims that reality is closely related to idea, thought and mind rather than the earthly power. According to the idealists, reality is idea, thought and soul. It does not accept the scientific method as the only way for reality; but assumes intuitional thought as important as the scientific method.

In idealist educational philosophy, which expresses a teacher centered approach, the teacher is required to reveal the embedded knowledge in students' subconscious and be a good role model both as morally and culturally. The subjects are in a hierarchical order and Socratic Method is adopted. The teacher is qualified and well-donated; order, discipline and authority is a matter of fact (Cevizci, 2011; Gutek, 2006; Ornstein, 1988; Terzi et al., 2003).

Realism

The realists perceive the world in terms of subjects/ objects and substances. People can understand the world via senses and logic. The source of everything is nature and formed by the rules of nature. According to realism, the purpose of education is to make people happy by furnishing them the best and the most perfect abilities. While it enlightens the students in fields of knowledge, it also aims to develop the mind which is the most important ability and power of human, and to encourage what they want in their choices, expressing themselves with a perfect potential and identify their own identities (Gutek, 2006).

In realism, which a teacher centered approach is adopted, a teacher is an instructor or educator rather than a scientist or researcher who is an expert in his/her field, and knows the maximum required truth about the field. The teacher is a professional instructor in terms of both expertise knowledge and instructional ability (Cevizci, 2011). He/she provides students to gain certain knowledge and proficiency. Students are supposed to be ready to learn the required things and be eager to make an effort (Özdemir et al., 2008: 216).

Experimentalism

One of the pioneers of experimentalism is John Locke. According to Locke, mind is like a white paper or blank slate that nothing is in and on before the experiment and all sources of knowledge come from observation and the data in mind as a result of the usage of senses. In short, there is no innate knowledge in human mind and the source and tool of all kind of knowledge is the experiment (Arslan, 2012: 72). Another pioneer who comes to mind first for experimentalism is John Dewey. For Dewey, thinking and action cannot be separated and thought is incomplete without realization. Basic thinking involves the problems which a person encounters and solves by scientific method. Problem solving is as well a social process as an individual phenomenon. As sharing is more, the opportunities of development are greater as well (Gutek, 2006).

Experimentalism which is based on pragmatism helps human to improve his/her environment and adaptation to environment. It accepts change as the base of reality and assumes that education is continuously improving. The child should be active in educational settings which are organized according to his/her interests. Knowledge, which is an important tool for gaining, improving and regulation of the experiences, should be obtained with interaction and is dependent on the interests of the child. The responsibility of the teacher is to guide students. School should encourage students to collaborate rather than race in democratic school environments; what is more school is the most appropriate environment for learning (Demirel, 2005; Ergün, 2003; Gutek, 2006).

Existentialism

The existentialist sees the world in terms of personal subjectivity. Goodness, truth and reality are individually defined. Reality is a world of existing, truth is subjectively chosen and goodness is a matter of freedom (Wiles and Bondi, 2007: s. 45). The basic foundation of existentialist philosophy is that a person has a freedom of choice by defining him/herself (Gutek, 2006: 133). Existentialists give importance to human. In existentialism, education is an activity which provides an individual to experience success, failure, ugliness, beauty, struggle and pain without exaggerating but honestly (Sönmez, 2007, 81). Education should enable a person to identify his/herself with his/her real characteristics. In teacher-students interaction, the responsibility of the teacher is to help students to learn and know themselves (Fidan, 1987; Wiles and Bondi, 2007).

According to Alkan (1983), a good existentialist teacher does not aim to train copy personalities. He/she tries to balance the content and student, and be sensible to students. An existentialist teacher makes an effort for three purposes: processing the content, mind's

functioning independently and creating a belief about reality for students (Arslanoğlu, 2012). Change in school environments would be embraced as both a natural and necessary phenomenon. Nonschooling and an individually determined curriculum would be a possibility (Wiles and Bondi, 2007: s. 45).

The subject matter of education and philosophy is human. The viewpoint for human can affect all the components of education. In other words, human is handled and education is organized according to this viewpoint (Sönmez, 2009). Teacher employs an educational philosophy when he/she starts to think on concepts and knowledge of human nature and society (Gutek, 2006). Educational philosophy is a discipline of philosophy which discusses education, and questions and solves the concepts and practices of education (Cevizci, 2011: 11). Educational philosophy helps the educator and the teachers to comprehend education with its all aspects. The meaning and the importance of educational practices can only be possible by a clear thinking system that the philosophy provides (Fidan, 1987). Additionally, philosophy provides a structure and a base for organizing school and classroom settings for educators. It helps to understand what the schools are for, which subjects are valuable, how the students learn and which methods and strategies are used (Demirel, 2005). Teaching styles have a key role to organize the learning and teaching process as a reflection of educational philosophy adopted by the teacher (Gencel, 2013: 644).

Grasha (1994, 2002)I who explains learning and teaching process as an interaction between students and teachers, which defines teaching styles as the continuity and consistency of teachers' behaviors and approaches in this process; and moreover a personal model that the requirements, beliefs and behaviors of the teachers construct. According to Dunn (1979), teaching styles are attitudes and behaviors of teachers towards instructional programs, methods, settings and equipment. Fisher and Fisher (1979) define teaching styles as instructional behaviors which a teacher consistently displays in teaching process. How the teacher presents knowledge in learning and teaching process, how they interact with students and their behaviors about students' socialization are all the reflections of their teaching styles (Üredi, 2007). In addition, a teaching style refers to how the teacher behaves with students while teaching, not who the teacher is. For instance, how a teacher asks questions, how he/she uses his/her voice, how he/she addresses the students, how he/she makes exams, how he/she moves inside the classroom and presents his/her ideas. These are all observable behaviors of teachers, not the personal qualifications such as IQ (Hyman and Rosoff, 1984).

In literature, teaching styles are classified differently such as; instructor, problem solver, consultant (Broudy, 1972); the behaviorist, the structualist, the functionalist,

the humanist (Bromstrom, 1975); field-dependent, field-independent (Witkin, 1979); task-oriented, cooperative planner, child centered, subject centered, learning centered, emotionally exiting (Fischer 1979); educational philosophy, student preferences, instructional planning, student groupings, room design, teaching environment, teaching characteristics, teaching methods, evaluation techniques (Dunn 1979); concrete-sequential, abstract-sequential, abstract-random, concrete-random (Butler, 1984); the command style, the practice style, the reciprocal style, the self-check style, the inclusion style, the guided discovery style, the convergent discovery style, the divergent discovery style, the learner-designed individual program style, the learner-initiated style, the self-teaching style (Mosston and Ashworth, 1986); the information processing models, the personal models, the social-interaction models, the behavior modification models (Joyce and Weil, 1986); expert, provider, facilitator, enabler (Heimlich and VanTilburg, 1990); directive, authoritative, tolerant and authoritative, tolerant, uncertain and tolerant, uncertain and aggressive, repressive, drudging (Brekelmans, Levy and Rodirguez, 1993); disseminator-transmitter, lecturer-dramatist, inducer/persuader, inquirer/catalyst, facilitator/ guide (Reinsmith, 1994); assertive, suggestive, collaborative, facilitative (Quirk, 1994); expert, formal authority, personal, facilitator, delegator (Grasha, 1996); teacher-oriented, student-oriented (Levine, 1998); planner, formal, ongoing, attractive (Evans, 2004) (Altay, 2009: 47).

As the "teaching style" instrument which was developed by Grasha (1996) was used in this research, the teaching styles are examined in five categories:

Expert: He/she has the required experience and knowledge for the students. He/she pays attention to preserve his/her status as an experienced person who develops his/her students' abilities and present his/her extended knowledge. He/she is interested in knowledge transfer and training better students.

Formal authority: In terms of his/her knowledge and role, he/she is like a college teacher for his/her students. He/she has a characteristic that has his/her own rules, expectations and purposes, reinforces students depending on the situation and does not hesitate to give negative feedback under any unwilling circumstances.

Personal: He/she believes in instruction of personal examples, constructing a basic model about how they should be thought and behave. He/she encourages students to follow their way, supervise them on what they should do, guides and manages them.

Facilitator: He/she emphasizes teacher-student relationship as a very natural personal characteristic. His/her guidance and course management is to ask questions, to develop choices, to present alternatives, to encourage students about developing the scientific criteria that they have constructed. His/her main purpose is to develop students' performance which is for initiative and responsibility in their personal activities.

Delegator: He/she is interested in improving the students' capacity by independently doing his/her responsibility. In the courses of teachers who have this style, students study independently in projects or as a part of independent teams. The teacher interferes when the students ask them as a source person. Teaching style refers to distinctive properties which is consistent in time and transferred from situation to situation (Fischer 1979). According to Heimlich and Norland (1994) teaching style includes philosophical practices in which there are attitudes, values, beliefs, teaching and all elements in students' change (Fries, 2012). Fritz (2008) quoted from Kauchak and Eggen (2011) and Elias and Merrium (1995) that educational philosophy provides a framework for teachers to think on a variety of ideas, beliefs, actions and educational matters which guide them. Heimlich and Norland (1994) expressed that teachers' beliefs about how learning and teaching should contribute to their skills. Teachers who knows their beliefs, regulate their behaviors and balance the two skills gain the experience of freedom; furthermore, explore experiences that they have never lived before, reflect these experiences, practice and improve them (Fritz, 2008).

The philosophy which is constructed by these views and beliefs guides the teacher in determining purposes, regulating learning-teaching settings and choosing an evaluation method (Ediger, 2000). Educational philosophy would affect the roles of teachers and students in the classroom, how curriculum is developed and evaluated, which methods and techniques will be used and the factor of educational beliefs of teachers in society (Fritz, 2008). The philosophy undertaken determines the view for human and educational system is organized according to this view (Sönmez, 2007).

Livingston (2001) narrated from Kagan (1995), Gutek (1995) and Burbles (1989) that every classroom teacher has different views on the framework of educational facilities provided for school and students. Therefore, every teacher has an educational philosophy because "aims, behaviors, content, learning and evaluation process should be arranged according to the criteria of the adopted philosophy" (Sönmez, 2009).

In this research, it is aimed to reveal which educational philosophy the classroom teachers adopt, which teaching style they have and is there any relationship between them. In this context, the following research questions were asked:

1. What are the educational philosophies adopted by classroom teachers?

2. Which teaching style do the classroom teachers have?
3. Is there any relationship between the educational philosophies and teaching styles of classroom teachers?

METHODOLOGY

As quantitatively designed, this research is a model of survey in terms of determining the educational philosophies and teaching styles of classroom teachers, in other words, searching and explaining the existing situation. It is a general survey model because it foretells and generalize about the universe in the light of data gathered, and a relational survey model because it examine the relationship between the educational philosophies and teaching styles of teachers.

Participants

The study group has volunteered 301 classroom teachers who teach the 1st, 2nd, 3rd and 4th classes in primary schools. Of the participants, 112 are male and 189 are female. 45 teachers have the seniority of 1-10 years, 77 of them 11-20 years, 130 of them 21-30 years and 49 of them 30 years and above.

Instruments

As a data collection tool, for philosophical views of classroom teachers "Philosophical Preferences Assessment" form which was developed by and adopted to Turkish by Doğanay and Sari (2003) was used. As a 5 likert type and 40 items questionnaire, it has an inter reliability coefficient of 0.81. The items 6, 8, 10, 13, 15, 31, 34 and 37 indicate perennializm; 9, 11, 19, 21, 24, 27, 29 and 33 indicate idealism; 4, 7, 12, 20, 22, 23, 26 and 28 indicate realism; 2, 3, 14, 17, 25, 35, 39 and 40 indicate experimentalism, and 1, 5, 16, 18, 30, 32, 36 and 38 indicate existentialism. For every philosophical view, the lowest score is 8, the highest score is 40. In research, the philosophical view which has the highest scores is accepted to determine the classroom teachers' philosophies.

The other instrument is Teaching Style Questionnaire which was developed by Gracha and Reichmann (1994) and adopted to Turkish by Saritaş and Süral (2010). As a five likert type and 40 item questionnaire, it has five dimensions every one of which has eight items. In the adaptation study, Pearson correlation coefficient of the questionnaire was found to be .80, and Cronbach alpha was .87. The items 1, 6, 11, 16, 21, 26, 31 and 36 indicate expert; 2, 7, 13, 17, 22, 27, 32 and 37 indicate formal authority; 3, 8, 13, 18, 23, 28, 33 and 38 indicate personal; 4, 9, 14, 19, 24, 29, 29, 34 and 39 indicate facilitator; and 5, 10, 15, 20, 25, 30, 35 and 40 indicate delegator teaching styles. Gracha defines teaching styles as "low", "medium" and "high".

In the process of data analysis and determination of teaching styles, a program on the web site was used (http://www.iats.com/publications/GLSI.html). The data was entered to the program and all scores belonging to five teaching styles were calculated in the levels of "low", "medium" and "high". In this research, high levels were considered to determine the teaching styles of teachers.

Data analysis

In order to determine the educational philosophies and teaching styles of classroom teachers, frequency and percentage were used, and correlation analysis was used for the relationship between educational philosophies and teaching styles.

FINDINGS

This research is aimed at revealing the educational philosophies adopted by classroom teachers, teaching styles that they have and the relationship between the two variables. The following findings were reached in terms of these purposes.

Educational philosophies adopted by classroom teachers

Educational philosophies that the classroom teachers adopt were displayed in Table 1. Of the teachers, 51.1% adopt experimentalism, 16.2% adopt idealism, 12.9% adopt existentialism, 12.6% adopt realism and 6.9% adopt perennialism. In other words, more than half of the teachers believe that education is a continuous change and because of that students should be active in educational settings which are organized according to their interests. The teacher's responsibility is to guide the students.

Teaching styles adopted by classroom teachers

Table 2 displays the teaching styles that the classroom teachers have. Majority of teachers (54.8%) have facilitator teaching style. Of the teachers, 19.6% have delegator, 17.6% have expert, 4.7% have personal and 3.3% have formal authority teaching style respectively.

Relationship between educational philosophies and teaching styles of classroom teachers

The third research question is "Is there any relationship between the educational philosophies adopted by classroom teachers and their teaching styles?" To answer this question, Kolmogorov-Smirnov test was conducted in order to determine whether the variables were normally distributed.

According to the findings, all variables have higher than .05 p values, and this indicates that they have a normal distribution.

Correlation analysis was used to examine the relationship between the variables. Correlation coefficient's being 1.00 stands for an excellent positive relation; -1.00 stands for an excellent negative relation; 0.00 shows that there is no relation. In interpretation of correlation coefficient in terms of magnitude, there are not exactly common intervals; however, it should be noted that the following limits can frequently be used in interpretation of correlation. The correlation coefficient's being between 0.70-1.00 as an absolute value can be described as high level relation; its being between 0.70-0.30 can be described as medium level relation, its being lower than 0.30 and can be described as a low-level

Table 1. Educational philosophies adopted by classroom teachers.

Philosophies	f	%
Perennialism	21	6.9
Idealism	49	16.2
Realism	38	12.6
Experimentalism	154	51.1
Existentialism	39	12.9
Total	301	100

Table 2. Teaching style adopted by classroom teachers.

Teaching style	f	%
Expert	53	17.6
Formal Authority	10	3.3
Personal	14	4.7
Facilitator	165	54.8
Delegator	59	19.6
Total	301	100

Table 3. K-S test of Teaching style and educational philosophy variables.

Parameter	Kolmogorov - Smirnov		
	Statistic	df	Sig.
Expert Teaching Style	0.165	301	0.155
Formal Authority Teaching Style	0.188	301	0.199
Personal Teaching Style	0.122	301	0.274
Facilitator Teaching Style	0.111	301	0.203
Delegator Teaching Style	0.163	301	0.185
Perennialism	0.102	301	0.166
Idealism	0.136	301	0.138
Realism	0.130	301	0.147
Experimentalism	0.137	301	0.196
Existentialism	0.114	301	0.167

relation (Büyüköztürk, 2004). Table 3 displays the relationship between educational philosophies and teaching styles of classroom teachers.

Examining Table 4, there is a significant relationship between the educational philosophies and teaching styles of teachers. Considering the teaching styles of teachers who adopt perennialist philosophy, the highest level of relationship is with authoritarian teaching style (r=0.479). Accordingly, there is a medium level of positive relationship between perennialism and authoritarian teaching style. The significant relationship between perennialism and authoritative teaching style (p= 0.000) supports this relation, as well.

The highest level of association with teaching styles of teachers who adopt idealism is the style of formal authority (r= 0.512). In this respect, there is a medium and positive relationship between the educational philosophy of idealism and authoritarian teaching style. The significant relationship between idealism and authoritative teaching style (p= 0.000) supports this relation, as well. As for the teachers who adopt realism, the highest level of relation is also with authoritative teaching style (r= 0.578). So the educational philosophy of realism is moderately and positively connected to the teaching style of formal authority. The significant relationship between realism and authoritative teaching style (p= 0.000) supports this relation, as well. Considering the teaching styles of teachers who adopt experimentalist philosophy, the highest level of relationship is with personal teaching style (r=0.571).

Table 4. The relationship between educational philosophies and teaching styles adopted by teachers.

		Expert	Authority	Personal	Facilitator	Delegator
PERENNIALISM	Pearson Correlation	.421[**]	.479[**]	.331[**]	.211[**]	.289[**]
	Sig. (2-tailed)	.000	.000	.000	.000	.000
	N	301	301	301	301	301
IDEALISM	Pearson Correlation	.437[**]	.512[**]	.405[**]	.136[**]	.196[**]
	Sig. (2-tailed)	.000	.000	.000	.000	.000
	N	301	301	301	301	301
REALISM	Pearson Correlation	.339[**]	.578[**]	.452[**]	.175[**]	.169[**]
	Sig. (2-tailed)	.000	.000	.000	.000	.000
	N	301	301	301	301	301
EXPERIMENTALISM	Pearson Correlation	.123[**]	.201[**]	.571[**]	.532[**]	.479[**]
	Sig. (2-tailed)	.000	.000	.000	.000	.000
	N	301	301	301	301	301
EXISTENTIALISM	Pearson Correlation	.101[**]	.105[**]	.432[**]	.487[**]	.579[**]
	Sig. (2-tailed)	.000	.000	.000	.000	.000
	N	301	301	301	301	301

** Correlation is significant at 0.01 level (2-tailed).

There is a medium and positive relationship between experimentalism and personal teaching style. The significant relationship between experimentalism and personal teaching style (p= 0.000) supports this relation, as well. The teachers adopting existentialism have the highest level of relation with facilitator teaching style (r= 0.579). Thereby, there is a medium and positive relationship between existentialism and facilitator teaching style. The significant relationship between existentialism and facilitator teaching style (p= 0.000) supports this relation, as well.

DISCUSSION

As for the educational philosophies of classroom teachers, they adopt experimentalism, idealism, existentialism, realism and perennialism respectively. This finding is consistent with the findings of other studies that are Doğanay and Sari (2010), Kanatli and Schreglman (2014), Duman (2008), Çoban (2002), Aslan (2014), Livingston et al. (2001). Student-centered approach is at the focus of experimentalism and existentialism. Findings indicate that teachers adopt a student-centered approach, have the perspective which gives students the opportunity of constructing their own knowledge, encourages them to search and investigate. The ongoing primary school curriculum also refers to the teacher properties as guiding the learning and teaching process and training students as individuals that search, question, wonder and be interested in their environments (Yetkin and Daşcan, 2010).

As for the teaching styles of classroom teachers, they have facilitator, delegator, expert, personal and formal authority teaching styles respectively. Grasha (1996) classified the teaching styles as teacher-centered, student-centered and both teacher and student centered. Authoritarian and expert teachers are teacher-centered; facilitator and delegator teachers are student-centered; and personal teachers are both teacher and student centered. Findings point out majority of teachers has student-centered teaching styles. This is supported by the findings of many other research such as Maden (2012), Üredi (2011), Bilgin and Bahar (2008), Efilti and Çoklar (2013), Şentürk and İkikardeş (2011), Saracalioğlu et al. (2010), Süral (2013), Lucas (2005), Labillois (2015), Lester Short (2001), Larenas et al. (2011). Findings suggested that most of the teachers have convenient teaching styles indicated in the primary school curriculum. On the other hand findings also reveal that they have expert and formal authority teaching styles meaning that 21% of the teachers have teacher-centered teaching styles. Mendoza (2004), Faruji (2012) and Saracaloğlu et al. (2010) also found that teachers prefer teacher-centered styles more. Constructivist approach was adopted in curricula during the reform process in 2004-2005 academic years, and the reflection of this approach is observed in the research results. According to the constructivist approach, teacher guides the learning and teaching process, organizes the learning environment and plans the evaluation activities (Postlethwaite, 1993). The constructivist teacher is not the authority but an observer in the classroom (Şaşan, 2002). Majority of teachers adopts students-centered

approach. Being in the transition and improvement process, the 21% of the teachers still adopt a teacher-centered perspective. Their teaching styles are thought to change in time.

For the third research question, the relationship between the educational philosophies and teaching styles of classroom teachers was analyzed. Findings indicate a significant relationship between the educational philosophies that the teachers adopt and teaching styles of them. Teachers who adopt "perennialism, idealism and realism" have a medium and positive relationship with the authoritarian teaching style. Moreover, these three educational philosophies are associated to "expert and personal" teaching styles. In perennialist, idealist and realist philosophies, a teacher is well-trained, expert in his/her field, an authority and a professional instructor. Therefore, he/she is at the centre of learning and teaching environments. Teachers are also masters of the subject in authoritarian and expert teaching styles, and they prefer a teacher-centered perspective in learning and teaching environments.

Findings also suggest that teachers adopting "experimentalism" are related to the teaching styles of "personal" and "facilitator and delegator" in a moderate level. In experimentalism, the responsibility of the teacher is to guide the students. Students are supposed to be active participants and interact in learning and teaching environments. In this respect, the teacher is required to conduct strategies, methods and techniques which focus on student. Similarly, teachers having personal, facilitator and delegator teaching styles guide students according to their interests, encourage them to take responsibilities and take part in projects individually or in group, and consult teacher when they need. Under these circumstances, students should be encouraged to be active and at the centre of the learning and teaching process.

Teachers who adopt the educational philosophy of "existentialism" have a medium level of relationship with "delegator, facilitator and personal" teaching styles. In experimentalism, human is valued and teacher cares about not training monotype students. Instructional activities should give the opportunity of finding the truth and choosing the realities by presenting various choices to the students (Fidan, 1987). Students are at the centre. Likewise, teachers having facilitator, delegator and personal teaching styles arrange learning and teaching environments and guide the students from a student-centered perspective. There is a medium and low level of relationship between the educational philosophies and teaching styles according to the findings. Grasha (1996, 2002a) observed the classroom experiences of teachers and found that teachers may have more than one teaching styles. According to the research of Grasha (1994, 1996, 2002, and 2003), he categorized the teaching style groups of teachers into four: expert/formal authority; personal/expert/formal authority; facilitator/personal/expert; delegator/facilitator/expert. According to

these categories, the expert teaching style appears in all groups. Although, the teachers locate the students at the centre and encourage them to be active, there may be some cases that they should transfer something. At least, they present their own knowledge and then guide the students.

Findings of the existing research are also supported by the research of Fritz (2008) and Fries (2012). Fritz (2008) found that teachers prefer behaviorist approach in their teaching styles. In the study conducted by Fries (2012), participants adopt progressivism most and have the collaborative and student-centered teaching styles. Snyder (2006) studied with two teachers and found that while one of the teachers adopt student-centered philosophy and teaching style, the other one adopt student-centered philosophy but teacher-centered teaching style. Classroom teachers adopt experimentalist philosophy in general and have the facilitator teaching style. That means they have a student-centered perspective in learning and teaching environments. The positive reflections of constructivist approach which has been implemented in primary schools can be observed in this respect. Nevertheless, there are still teachers who have teacher-centered teaching styles and are authoritarian since the implementation of this program for 11 years. In-service trainings can focus on the awareness of this issue. After primary schools, constructivist approach has been reflected to elementary and high school curricula as well. Future research might be conducted in these levels of education.

Conflict of Interests

The author has not declared any conflict of interests.

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Full Length Research Paper

Content analysis of memory and memory-related research studies on children with hearing loss

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Memory plays a profound role in explaining language development, academic learning, and learning disabilities. Even though there is a large body of research on language development, literacy skills, other academic skills, and intellectual characteristics of children with hearing loss, there is no holistic study on their memory processes. Accordingly, the aim of this study is to examine memory-related research on children with hearing loss (CHL). In order to distill methodological and topical trends of those studies so as to unfold relevant research needs. In this research, content analysis method was used to analyze 25 quantitative-empirical studies on memory of children below 18 years. Majority of the research studies grouped normal-hearing children as the norm group. Participants with hearing loss were quite heterogeneous in nature. Causal-comparative and correlational designs were jointly used most frequently as the research model, and assessment was based on multi-measure paradigms. Noteworthy popular topical trends include memory of children using verbal language and cochlear implants; the relation of memory to language development and literacy skills, temporary memory processes, and memory of children attending inclusive classes. A significant conclusion of the current study is that topical trends filtered from the international literature indicate the research need of our country. Furthermore, results of the analysis revealed that taking memory processes into account, especially during the assessment of hard-of-hearing children may contribute drastically to the holistic nature of assessment.

Key words: Hearing loss, children with hearing loss, deaf children, cognition, memory, memory-associated processes, content analysis.

INTRODUCTION

The nature, development and functions of memory, its relations with other cognitive processes, including academic or non-academic skills have been assessed and tested in typically developing children to enhance the capacity of their memory (Spencer-Smith and Klinghberg, 2015). On the contrary, memory studies conducted with individuals with special needs other than autism spectrum disorders are too scarce to predict a pattern or make

generalizations (Alloway and Gathercole, 2006).

Regarding research on disability groups, those conducted with individuals having visual and hearing impairment generally follow a rather different path than others. Having sensory bases, both visual and hearing losses are not the same as other disabilities. Overall perception of the relation between memory and either visual or hearing loss accepts that there are some kind of sensory compensation mechanism for these individuals. In other words, it is generally believed that individuals with visual impairment happen to hone better auditory skills and those with hearing loss are considered to have more developed visual skills than normally developing peers in order to compensate for the relevant loss. Although there are some studies supporting this view for visually impaired individuals (Melzer et al., 2011), there is no evidence to generalize this perception for people who are hard of hearing. Therefore, one of the reasons for designing memory studies of individuals with hearing loss is the endeavor to identify trends in the validity of sensory compensation approaches (Parasnis et al., 1996).

Memory studies of children with hearing loss (CHL)

Memory studies of individuals with hearing loss are multi-faceted and transcend sensory compensation. The question, "How does auditory withdrawal influence an individual's cognitive processes?" still remains to be answered. As Braden (1994) contended, at this point, the deaf turn out to be natural participants of a natural experiment. Parallel with this opinion, some studies moved from the basic scientific axis and focused on the relation between the problems of hearing sense and capacity and function of memory (Parasnis et al., 1996).

A larger group of studies that are more practical than the first group examined the relation between memory capacity and language skills, academic skills, and other cognitive processes in CHL. Accordingly, academic skills investigated include reading, writing, and math skills. Language skills involve speech perception and production, learning of new words, and development of vocabulary and grammar. While, intelligence, comprehension, reasoning, metacognition, visual and auditory discrimination and phonological awareness comprise cognitive processes (Marschark and Hauser, 2008). Obviously, the main purpose of these research projects is not to understand the nature of CHL memory, but to determine the role of memory in the development of their academic and language skills.

Although hearing loss presents a natural experimental setting for researchers, working with this group still has some crucial difficulties. The first to note is that this group of individuals is more heterogeneous in nature than both normally developing peers and those with other special needs. A series of demographic, audiological, and educational characteristics with potential influence on both the capacity and functionality of memory in children lead to profound individual differences among members of this group (Marschark, 2006). For instance, the following issues vary across children: demographic features such as age at onset, diagnosis, instrumentation, and cochlear implantation; audiological characteristics such as level of hearing, type of auditory technology used, and type and severity of hearing loss; and educational qualities such as the setting, primary communication mode, receiving of early special education services, and pre-schooling. All of these sources of individual differences mandate strict control during memory studies, which is not easy, as in other research endeavors. Thus, the participants in such studies must be well defined (Marschark, 2006).

The above difficulties also bring out another problem regarding measurement tools. Due to the heterogeneous nature of CHL, there are several controversial measurement approaches such as following general or specific norms, employing standard or non-standard tools, and administering the procedure in sign or verbal language (Braden, 2001).

Problem

Diagnosis and treatment of individuals with hearing loss have been developing rapidly due to technological advances (Marschark and Spencer, 2006; Miller, 2015). Moreover, debates still continue about cognitive development and sensory withdrawal of children (Khan et al., 2005; Mayberry, 2002). Literacy skills of hard-of-hearing children are the most frequently studied topics, followed by intelligence and memory research (Marschark et al., 2009). Although the existing literature hosts a vast amount of comprehensive assessment research, such as meta-analysis and content analysis of empirical studies focusing on literacy skills (Marschark et al., 2009) and intellectual characteristics (Vernon, 1968/2005) of CHL, no holistic research evaluating other studies on memory processes had been detected. Furthermore, the fact that children are heterogeneous population leads to the employment of different scientific methods generally and the use of other measurement tools specifically. This research is considered important since it will help to determine future research needs and methodological requirements via scrutinizing the measurement tools, the processes associated with memory, memory types under focus, and the properties of the samples studied thus far in the literature. In Turkey, very few studies have examined the features of memory and the relation between memory and academic and language skills in CHL (Doğan et al., 2013). Therefore, this study is a valuable effort to enrich the number of limited studies and to provide a framework of the topic for

researchers in our country. Moreover, this research has the potential to integrate memory processes into cognitive assessment procedures already in use. Finally, it is hoped that this study will find a key place in the literature since it will help researchers and practitioners to clearly see the general research trends by depicting different phases that relevant research efforts have gone through over time.

Purpose

The purpose of this study is to analyze international studies associated with memory in CHL to determine topical and methodological properties and to identify research trends and relevant research needs.

Accordingly, the following research questions were answered:

1. What are the demographic, audiological, and educational characteristics of children who participated in these studies?
2. What are the research models employed in these studies?
3. What are the memory types examined in these studies? What are the measurement tools utilized to determine the memory types examined in these studies?
4. What are the processes and skills associated with the memory types examined in these studies? What are the measurement tools utilized to determine the processes associated with the memory examined?
5. What are the aims of these studies?
6. What are the major findings of these studies?

METHODS

Research design

Adopting a descriptive model to analyze studies focusing on memory and related processes in CHL, this research employed content analysis method for classifying similar data by organizing them clearly to make relevant interpretations (Yıldırım and Şimşek, 2014). Not based solely on one paradigm, content analysis involves both quantitative and qualitative elements; the former involves the use of digital descriptions while the latter involves giving a detailed investigation and discussion of the topic at hand (Merriam, 2001). In accordance with Merriam's statement, our study has both quantitative and qualitative dimensions. Based on this research design, studies focusing on memory and related processes in children have been filtered in accordance with a set of specific criteria. Findings of the study were identified via analysis of data within specific categories, and these findings were examined and discussed in detail.

Selection of research studies

A purposive sampling method, criterion sampling, was utilized in order to determine the research span (Yıldırım and Şimşek, 2014). Accordingly, the criteria adopted during the selection of documents

in the present study are as follows: (a) The study must be empirical, containing quantitative data; (b) The study must have been conducted between 2000 and 2015; (c) The study's focus must be either memory or memory-related processes in children; and (d) The participants must be children below 18 years.

Based on these preliminary criteria, electronic bulk databases were scanned online. During this scan, studies in which the following keywords co-existed were filtered: Hearing loss, hearing impairment, hearing disability, deafness, cochlear implant, children, adolescents, teenagers, and memory.

Databases used in this study are Academic Search Complete, Catalogue of Anadolu University, Cambridge Journals Onli-ne, Dissertation Abstracts International, EBSCOhost, Elsevier, ERIC, Oxford Journals Online, PsycINFO, PubMed, SocINDEX with Full Text, Springer LINK Contemporary, Taylor and Francis Journals, Wiley Black, and Wilson Select Plus. The Proquest Dissertations and Theses database were also scanned to examine the references of related theses through a footnote-chasing technique. Both researchers compiled the studies they identified in accordance with preliminary criteria. The scan revealed 75 research studies conducted on children's memory since 2000. The researchers independently carried out a further filter analysis of these studies to identify those conducted with participants aged 18 or below and those designed empirically. These results were compared, and a final 25 studies meeting all the criteria were selected for analysis. Table 1 depicts the distribution of these studies across years.

In Table 1, the median year for all the research is 2007. Nine studies (36%) were published before 2007, and the remaining 16 (64%) were published after 2007. In other words, two-thirds of the research on memory of CHL were conducted recently.

Data analysis

All the documents within the scope of this research were analyzed via content analysis. In content analysis, the researcher develops categories related to the research topic, and counts the words, sentences, or pictures that fall into these categories from the research data set (Silverman, 2001). In this study, two tables were created one for participants' characteristics and the other for the categories in order to see the data analysis procedure fully. Subsequently, separate tables and figures were developed based on each category.

The following six categories were identified during the data analysis phase:

1. Demographic characteristics of the participants (the number, gender, mean age, and age range; mean age and age range at diagnosis; mean age and age range of implant insertion/mean age and age range of implant use for all participants with and without hearing loss), audiological characteristics (average hearing level/severity of hearing loss, hearing aid technology), and educational characteristics (primary communication mode, educational setting).
2. Research models
3. Memory type under focus and measurement tools
4. Processes and skills associated with memory and measurement tools
5. Main research aim(s)
6. Main research finding(s).

An evaluation form, called Article Description Form, consisting of two main parts, was developed in order to analyze the findings comprehensively. The first part of this form is allocated to demographic, audiological, and educational characteristics. The second part is developed to examine research models, memory

Table 1. Distribution of accessed studies across years.

Year	Frequency (n)	Percentage
2000	2	8
2001	1	4
2002	1	4
2003	2	8
2004	3	12
2007	2	8
2008	1	4
2010	1	4
2011	3	12
2012	1	4
2013	4	16
2014	2	8
2015	2	8
Total	**25**	**100**

types under focus, measurement tools for memory and processes and skills associated with memory, measurement tools for processes and skills associated with memory, study aims, and major research findings. The category, "aim of the study" was included at the end of the form because the authors wanted to clearly show the relation between aim and findings. All of these parts comprising a meaningful whole were named (that is, coded) by the researchers (Neuman, 2012). Each researcher did this coding for each document separately based on these categories.

Interrater reliability concerning the coding by two researchers was calculated via agreement rate formula, which is "P (agreement rate) = [Na (amount of agreement)] / [Na (amount of agreement) + Nd (amount of disagreement)] $\times$ 100." Interrater reliability was found to be 92%, which is quite high for qualitative studies (Miles and Huberman, 1994). Where there was no interrater agreement, the researchers re-assessed the coding to establish agreement.

FINDINGS

The findings of this study aimed at analyzing memory-based studies of CHL are presented parallel to the research questions. Within this scope, the participants' characteristics are analyzed first, and then the other research questions are addressed.

Analysis of participants' characteristics

CHL are extremely heterogeneous. Therefore, it is crucial to classify their characteristics properly (Marschark et al., 2009). Hence, the characteristics of the CHL who participated in the selected studies were analyzed under three sub-categories: Demographic, audiological, and educational. The number of all participants and children, gender, age, age of diagnosis, and age of implantation/duration of implant use of the participants with hearing loss were examined under demographic features, whereas level of hearing/severity of hearing loss

and hearing technology were addressed under audiological features. Lastly, primary communication mode and educational setting were investigated under educational features (Doğan, 2011). Within this classification system, details regarding the participants' characteristics are shown in Table 2.

Demographic characteristics

As shown in Table 2, 1195 of all the participants ($N = 1643$), including the comparison groups built in 25 studies, were CHL. The minimum and maximum numbers of participants in these studies were 6 and 176, respectively. The average number of participants in each study was 48. In many of the studies, the children were paired with their peers having the same gender and age, but normal hearing. Accordingly, it can be said that the distribution of CHL and normally hearing children was balanced. When the participants with hearing loss are examined in terms of gender, the rate is similar. Although no information about gender is reported in six of these studies, it was indicated that 359 and 351 of the participants were females and males in the other studies, respectively.

One of the criteria employed for the selection of the documents analyzed in this study is participants must be 18 years and below. In five studies, the mean age of the participants with a 20% hearing loss was not specified, while it was 9 years and 7 months for those with 80% hearing loss in the other 20 studies. It is understood that the youngest participant was 4 years old and the eldest was 18 years and 6 months old. In terms of memory and language development in CHL, age at diagnosis is another significant variable. In approximately half of the studies (44%), there is no information about age at

Table 2. Characteristics of participants with hearing loss.

S/N	Reference	Demographic characteristics					Audiological Characteristics		Educational characteristics	
		Total N [HL Participant N]	Gender of HL Participant	Age of HL Participants [Range]	Age at diagnosis [Range]	Mean age at CI/ Duration of CI Use	Degree of HL	Hearing technology	Primary communication mode	Educational Setting
1	Cleary et al. (2000)	[49]	-	9;2 [5;3-16;5]	0;4 [0-3]	4;4/4;8	Profound	CI	27 OC, 22 TC	-
2	Pisoni and Geers (2000)	[43]	-	[8-9;11]	-	-/5;5	-	CI	½ OC, ½ TC	-
3	Cleary et al. (2001)	125 [81]	19 F, 25 M	8;10 [7;11-9;11]	0;3 [0-3]	-/5;6	-	CI	OC	Inclusion
4	Dawson et al. (2002)	48 [24]	12 F, 12 M	[5-11]	0;4 [0-2;3]	3;6/4;6	-	CI	17 OC, 7 TC	Inclusion
5	Burkholder and Pisoni (2003)	73 [37]	12 F, 25 M	8;7 [8-9]	0;2	3;04/5;66	Profound	CI	22 OC, 15 TC	Inclusion
6	Pisoni and Cleary (2003)	221 [176]	-	[8-9]	-	- /3;6	Severe, profound	CI	OC or TC	Inclusion
7	Hansson et al. (2004)	83 [18]	10 F, 8 M	10;10 [9;1-13;3]	4;2 [1;3-7;5]	-	Mild, moderate	HA	OC	Inclusion, SCHL
8	Harris and Moreno (2004)	179 [62]	-	[8-14]	-	-	Severe, profound	-	OC and TC	-
9	Willstedt et al. (2004)	[15]	9 F, 6 M	7;7 [5;4-11;5]	Newborn	3;1/4;1	-	CI	SL	Inclusion
10	Alamargot et al. (2007)	30 [15]	-	13;8 [11;6-17]	Prelingual	-	Profound	-	SL	Inclusion
11	Asker-Arnason et al. (2007)	32 [16]	10 F, 6 M	10 [7;2-13;4]	< 3	3;8/6;6	Severe, profound	CI	OC	Inclusion
12	Wass et al. (2008)	75 [19]	11 F, 8 M	9 [5;7-13;4]	1;6	3;4 /5;5	-	CI	OC	Inclusion, SCHL, SD
13	Cockcroft et al. (2010)	39 [24]	15 F, 9 M	8 [4-11]	-	-	-	-	SL	Inclusion
14	Engel-Yeger et al. (2011)	40 [20]	6 F, 14 M	8;8 [8-10]	-	4;3-6;9/-	-	CI	OC and TC	ICHL
15	Kronenberger et al. (2011)	[9]	6 F, 3 M	10;2 [7-15]	Newborn	1;8/8;6	Profound	CI	OC	Inclusion
16	Stiles et al. (2011)	40 [16]	10 F, 6 M	7;8 [6-9]	-	-	Moderate, severe	HA	OC	Inclusion
17	Lopez-Crespo et al. (2012)	50 [30]	-	11;3	-	-	-	12 CI	10 OC, 9 SL, 11 Bilingual	Inclusion
18	Doğan et al. (2013)	223 [120]	70 F, 50 M	10;10 [7-15]	2;5	5;6/5;4	profound	77 HA, 43 CI	OC	Inclusion, SCHL, URC
19	Geers et al. (2013)	158 [112]	59 F, 53 M	16;8 [15-18;6]	-	-/13;4	Severe, profound	CI	-	Inclusion
20	Harris et al. (2013)	[66]	32 F, 34 M	7;6 [6;0-11;6]	0;3 [0-3]	3;8/3;7	Profound	CI	43 OC, 23 TC	Inclusion
21	Nittrouer et al. (2013)	172 [50]	26 F, 24 M	7;6 [6-8;5]	%80<1, %20< 2	1;10/6;9	-	CI	OC	Inclusion
22	Nunes et al. (2014)	[150]	33 F, 44 M	8;5 [5-11]	-	-	-	48 CI, 102 HA	SL and OC	-
23	Willis et al. (2014)	[6]	2 F, 4 M	10;5 [8-15]	-	< 2;6/-	Severe, profound	3 CI, 3 HA	OC	Inclusion, SCHL
24	Bharadwaj et al. (2015)	[10]	6 F, 4 M	[7-11]	-	3-4;6/-	Severe, profound	CI	OC	Inclusion
25	Marshall et al. (2015)	55 [27]	11 F, 16 M	9;2 [6-11]	Newborn	-	Severe, profound	9 CI, 16 HA	18SL, 3OC 6 SL + OC	-
	Total	1643 [1195]	359 F, 351 M	9;7 [4-18;6]	1;2 [0-7;5]	3;3/6;2		94 [30-120.1]	842 CI, 232 HA	OC>TC>SL> Bilingual	%70 Inclusion, %10 SD + ICHL+SCHL+URC

CI, Cochlear implant; dBHL, decibel hearing level; F, female; HA, Hearing Device; ICHL, Institute for Children with Hearing Loss; M, Male; N, Number of Participants; OC, Oral Communication; SCHL, School for Children with Hearing Loss; SD, School for the Deaf; SL, Sign Language; TC, Total Communication; URC, University Research Center.

diagnosis. On the other hand, in eight studies (32%), mean age at diagnosis was 1 year and 2 months. There are seven studies (27%) indicating that the age at diagnosis was at least 0 or unborn. The age at diagnosis range is from 0 to 13 years and 3 months.

Implant age is as important as age and age at diagnosis in terms of memory and language development in children. To be implanted, the participant's age should be 3 years and 3 months on average. It is determined that the implant age was at least 1 year and 4 months and mostly 10 across all the studies. In some studies, no information was reported about mean age and age range of participants (28%). The participants' duration of using implants was approximately 6 years 2 months. According to the studies, the duration of implant use was a minimum of 1 to a maximum of 11 years and 7 months.

Audiological characteristics

Regarding audiological characteristics in some of the research (32%), the level of hearing loss for the participants was specified as moderately severe or severe. The minimum hearing level was 30 dBHL, and the maximum level was 120.1 dBHL (Cleary et al., 2000). In many of the studies (40%), no information was provided about the hearing level.

Considering the hearing technology based on hearing level and hearing loss, most of the participants with hearing loss (80%) were cochlear implant users while some of them (15%) used conventional hearing aids.

Educational characteristics

The primary communication mode of the participants in 21 studies (84%) was verbal, followed by total communication, sign language, and bilingual communication modes. In Geers et al. (2013), where the relation between memory and reading skills was examined, there was no explanation of primary communication mode.

Early diagnosis, hearing technology, and primary communication mode determine the educational setting for children. In these studies, the educational setting was inclusive classes for most of the participants (70%). It was stated that the educational settings of some participants in these studies (20%) were schools for the deaf, schools for the hard of hearing, institutes for the hearing impaired, and university research centers for the deaf. However, there was no information about the educational settings of the participants in other studies (20%). All findings apart from the features of the participants are based on the data shown in Table 3.

Research models

The first category in Table 3 includes the models of the studies examined. Figure 1 shows the distribution of these studies across the research models.

One of the criteria for the selection of studies was that target studies must be quantitative-empirical. As shown in Figure 1, 10 (40%) studies were causal-comparative and correlational, five (20%) were experimental, four (16%) were only correlational, three (12%) were only causal-comparative, and the other three studies were descriptive (4%), quasi-experimental (4%), and longitudinal (4%), respectively. So, most of the studies used causal-comparative and correlational models, followed by experimental, correlational, and causal-comparative models.

Memory type and measurement tools

It was observed that most of the studies (80%) focused on one memory type while some of them (20%) focused on more than one memory type. Figure 2 shows the distribution of memory types under focus.

As indicated in Figure 2, most studies focused on working memory. Following working memory are visual working memory (13%), short term memory (STM, 13%), verbal (13%), auditory WM/STM (6%), and meta-memory (3%) types based on stimulus modalities. The measurement tools used to assess memory types are displayed in Table 4 in terms of their psychometric features.

In order to assess the memory types on which these studies focused, one or more tests or tasks were used. Both the same and different measurement tools were employed in these studies. The measurement tools used to assess the performance of memory are classified as standard and non-standard measurement tools. As shown in Table 4, 22 (58%) different types of standard measurement tools and 16 (42%) different types of non-standard measurement tools were used (Table 3).

Processes and skills associated with memory and measurement tools

In eight (32%) of the studies examined, memory was not associated with any skill. On the other hand, in the other 17 (68%) studies, memory was associated with speaking (that is, speech perception, speech production, and articulation rate), language, literacy, grammar, vocabulary (that is, word recognition, receptive vocabulary, learning new words, vocabulary access), and phonological skills.

As can be seen in Figure 3, skills related to word is the skill most frequently associated with memory (28%), followed by speaking (24%), language (21%), reading (18%), writing (3%), grammar (3%), and phonological skills (3%). Measurement tools employed to assess skills associated with memory are depicted in Table 5, as

Table 3. Summary ıdentities of the analyzed research in terms of the determined categories.

No.	Reference	Research method	Memory type [measurement tool]	Memory-Related skills [measurement tool]	Aim	Major finding(s)
1	Cleary et al. (2000)	Correlational	WM [WISC-III Auditory Digit Span-Backward and Forward, Memory Span Game]	Spoken Word Recognition [PBK and LNT], Receptive Vocabulary [PPVT-3]	The role of WM in explaining the variation in word recognition and receptive vocabulary skills of children with CI.	Word recognition, WM and receptive vocabulary are related only when WM tasks were presented in auditory modality.
2	Pisoni and Geers (2000)	Correlational	WM[WISC-III Auditory Digit Span-Backward and Forward]	Speech Perception [WIPI, LNT, BKB, CHIVE], Speech Production [McGarr Sentences], Language [WISC-III Similarities Subtest, TACL], Reading [WWA, PIAT, Rhyme]	The role of WM on speech perception, word recognition, speech production, language and reading tasks.	(1) WM and processing of spoken language are closely related. (2) WM uses speech perception, speech production, language comprehension and reading, and sharing common processing sources with reading.
3	Cleary et al. (2001)	Experimental	WM[WISC-III Digit Span-Backward and Forward, Memory Span Game]	-	Comparing the WM characteristics of children using CI for at least 4 years to normally hearing children.	WM task scores of children using CI are lower than their normally hearing peers. When visual-spatial clues are available, CI users do not use auditory stimuli as effectively as normally hearing ones.
4	Dawson et al. (2002)	C-C and Correlational	Auditory STM [Auditory and Visual Memory Tasks, Nonverbal Intelligence Scale (K-ABC)]	Receptive Language [CELF]	Evaluating the auditory sequential STM of CI users in comparison with normally hearing and determining its relation to receptive language.	(1) No sequential recall problems observed specific to CI users. (2) Visual-spatial memory performance obtained from nonverbal intelligence test is the strongest predictor of receptive language.
5	Burkholder and Pisoni (2003)	C-C and Correlational	WM [WISC-III, Digit Span-Backward and Forward]	Speech Rate [McGarr 7-Syllable Sentences]	Determining the relationship between WM span and speech rate on children with CI using verbal and total communication.	(1) Speech rate of CI users is lower than the normally hearing ones. (2) The relationship between WM performance and speech rate is higher on children using total communication than the ones using oral communication.
6	Pisoni and Cleary (2003)	C-C and Correlational	WM[WISC-III Digit Span-Backward and Forward]	Word Recognition [WIPI, LNT, BKB], Speech Rate [McGarr Sentences]	Investigating the correlations between WM, spoken word recognition and articulation rate of CI users in comparison with the ones with normal hearing.	Strong correlation between verbal WM, spoken word recognition and articulation rate was observed. 20% of variance in spoken word recognition may result from individual differences. Normal hearing group performed better in WM tasks.

Table 3. Cont'd

7	Hansson et. al. (2004)	C-C and Correlational	WM [Phonological STM (NWR ve ND), Complex WM (CLPT)]	Novel Word Learning [Novel Word Learning Test, Phoneme Test, PPVT, TROG, TIPS]	Determining the role of phonological STM and complex WM in novel word learning of CHL and ones with normal hearing.	Complex WM is the predictor of novel word learning of CHL. However, there is no correlation between phonological STM and novel word learning.
8	Harris and Moreno (2004)	C-C and Correlational	Phonological Coding (STM) [STM Span Tasks, Orthographic Awareness Task, Spelling Test]	Reading [BAS II Single-Word Reading Test]	Comparing the STM task performances of deaf children with age-matched normal controls, and the correlation between STM and reading test scores.	(1) The STM task scores of deaf children are similar to the reading age-matched hearing group; (2) For deaf children in older age group, STM is a significant predictor for reading skills.
9	Willstedt Svensson et al. (2004)	Correlational	WM [Complex WM (Sentence Comprehension and Word Recall Task), Phonological STM (NWR and ND)]	Novel Word Learning, Grammar [The Lund Test of Grammar and TROG]	Determining the predictive power of WM on novel word learning and grammar development children with CI.	WM tasks explained 72% of the variance in novel word learning and 82% in grammar development.
10	Alamargot et al. (2007)	C-C and Correlational	WM [Production Span, Phonological and Visual-Spatial Span Tasks]	Writing [Graphomotor Task and Text Production Task]	Comparing compositional performances of deaf and hearing students; investigating the relationships between these and WM capacities of deaf students	(1) No differences found between two groups in terms of planning and graphomotor execution, deaf students made more PI errors; (2) Differences observed in writing and phonological spans, but not in the visuospatial span; (3) Central executive capacity is associated with compositional fluency in deaf students.
11	Asker-Arnason et al. (2007)	C-C and Correlational	WM [Complex WM (SCR, CLPT, CWM), Visual-Spatial WM (VMPT), Phonological STM (NWR and ND)]	Reading [SL 40, SL 60, OS 64], Lexical Skills [WS and SDM]	Comparing the reading levels of CI users and their peers with normal hearing; determining the relation between reading and demographic factors, WM and language skills.	(1) 60% of CI users have the same reading level as the ones with normal hearing do; (2) Whereas complex WM is the predictor of reading, they are not demographical factors; (3) Reading percentages are interrelated with WM.
12	Wass et al. (2008)	C-C and Correlational	WM [Phonological WM (SR and NWR), Complex WM (SCR), Visual-Spatial WM (VMPT)]	Phonological Skills [ND], Lexical Access Skills [PNT, WS, SDM]	Comparing the WM capacity, Lexical access and phonological skills of CI users with the ones with normal hearing; determining the relation between WM, Lexical access and phonological skills.	(1) When compared to the ones with normal hearing, CI users have lower phonological skills, WM and lexical access scores; (2) On CI users, there is no relation between WM and lexical access. WM and phonological skills are correlated.

Table 3. Cont'd.

13	Cockcroft et al. (2010)	C-C	WM [Visual-Spatial WM (AWMA)]	-	Comparing the scores of visual-spatial WM and STM of deaf and hearing children.	In all subtests, the children with normal hearing performed better than the deaf children.
14	Engel-Yeger et al. (2011)	C-C	Memory (CMS) and Meta-memory (CMT-CH)	-	Comparing the CI users and the ones with normal hearing according to their visual memory and meta-memory skills.	CI users had lower scores in visual memory and meta-memory tests when compared to the ones with normal hearing, and they used the context in memorizing less efficient.
15	Kronenberg et al. (2011)	Experimental	WM [WISC-IV Digit Span-Backward and Forward, BRIEF:WM]	Language Skills [WRAML 2-Sentence Repetition]	Determining the effect of WM training program on the development of memory and language skills.	At the end of training program, the development in WM regressed less within 1 month and more within 6 months whereas sentence repetition regressed within 6 months.
16	Stiles et al. (2011)	Experimental	WM [LEAF, McGarr 7-syllable Sentences, WISC-III Forward and Backward Digit Span, Corsi Span, Sequential Encoding Task]	Receptive Vocabulary [PPVT-3]	Investigating the WM problems among CHL and their relation to perceptive vocabulary.	(1) Articulation rates and receptive vocabulary performance of CHL are lower than the ones with normal hearing; (2) In both groups, there is a positive correlation between vocabulary, number series, Corsi span, and articulation.
17	Lopez-Crespo et al. (2012)	Experimental	Visual WM [DMTS]	-	Investigating whether or not CHL using different modes of communication possess superior visual memory.	Groups with HL oral or sign language completed the tasks with high accuracy when compared to the bilingual and normal hearing ones. This shows that there are some problems in visual WM.
18	Doğan et al. (2013)	C-C	WM [Counting Span, Paper Folding Span and Digit Span-Backward], STM	-	Investigating the impact of early intervention on STM and WM capacities of CHL and with normal hearing.	Whereas early intervention made no differences in both memory capacities of normally hearing children, it stimulated a considerable increase on CHL
19	Geers et al. (2013)	C-C and Correlational	WM [WISC-III Backward Digit Span and Complex Reading Span], STM [WISC-III Forward Digit Span]	Reading [TORC], Articulation Rate [McGarr Sentences], Speech Perception [LNT, BKB, CAVET], Language [PPVT]	Comparing the verbal WM and STM performances by teenagers with CI and the ones with normal hearing; determining the contribution of WM and STM to language and reading skills on children with CI.	(1) CI users had the similar/higher scores as the ones with hearing did whereas they got lower scores in phonological STM than the ones with normal hearing; (2) Speech perception, articulation rate, digit-span and reading span all explained 43% of variance in language skills; articulation rate and reading span both explained 34% of variance in reading skills.

Table 3. Cont'd.

20	Harris et al. (2013)	Longitudinal	Verbal STM [WISC-III Digit Span-Forward], Verbal WM [WISC-III Digit Span-Backward]	Speech Perception and Language [PBK, HINT-C, PPVT-3-4, CELF-3]	Comparing the WM/STMs of CI users and the ones with normal hearing. Determining the contributions of WM/STMs to speaking and language skills of CI users.	(1) The verbal STM and WM scores of CI users were one standard deviation below those of normally hearing peers; (2)Verbal STM/WM scores preliminarily obtained by CI users may explain long-term language skills.
21	Nittrouer et al. (2013)	Experimental	Verbal WM [Serial-Recall Task, Rhyming and Non-rhyming Nouns]	-	Investigating the measurability of WM dimensions by a single task and the proficiency level of CI users in these dimensions.	Storing and processing might be measured by a single task, and CI users are competent in storing but not in processing.
22	Nunes et al. (2014)	Quasi-experimental	WM [WMTB-C]	-	Investigating the effect of WM intervention program on the development of WM.	The program aimed at teaching the strategies for attentiveness and repetition is effective.
23	Willis (2014)	Descriptive	Verbal STM [WMTB-C and AWMA], Visual WM [AWMA]	-	Investigating the visual WM and verbal STM skills of CI users in comparison with hearing children.	(1) Nonword repetition scores of CHL is higher than their word recalls; (2) CHL performed better in visual WM than normally hearing children.
24	Bharadwaj et al. (2015)	Correlational	STM and Verbal Knowledge [KABC-II], Auditory WM [WJ III COG NU], Visual WM [WISC-IV]	Reading [WRMT-III]	Determining the STM and WM of CI users with their relations to reading through auditory and visual tasks.	(1) Visual STM and WM scores are on normal spaces, and STM, WM and all verbal knowledge are below the average limits; (2) Listening and text comprehension both correlate with visual STM, visual and auditory WM.
25	Marshall et al. (2015)	C-C and Correlational	Visual WM [WNSA and The Odd One Out Span Task]	Language [EOWPVT, BSL-NPT, LPP-2]	Comparing deaf children those using sign language as primary mode and those using sign language not in primary mode with hearing children in terms of visual WM and language. Determining the relation between language and WM.	(1) Although they do not use sign language as primary mode, children using sign language displayed lower performance in WM when compared to the other two groups; (2) Both vocabulary and language skills in each of three groups made meaningful contributions to visual WM.

AWMA, Automated Working Memory Assessment ; BASII, British Ability Scales; BKB, Bamford-Kowal-Bench; BRIEF,WM, Working Memory Subtest of the Behavior Rating Inventory of Executive Functioning; BSL-NPT, British Sign Language Narrative Production Test; CAVET, Children's Auditory Visual Enhancement Test; CELF, Clinical Evaluation of Language Fundamentals; CHIVE, Children's Visual Enhancement Test; CHL, Children with Hearing Loss; CI, Cochlear Implant;CLPT, Competing Language Processing Task; CMS, Children's Memory Scale; CMT-CH, Contextual Memory Test for Children; CWM, Combined Working Memory; DMTS, Delayed Matching-to-Sample Task; EOWPVT, Expressive One Word Picture Vocabulary Test; HINT-C, Hearing in Noise Test for Children; HL, Hearing Loss; K-ABC, Kaufman Assessment Battery for Children; KABC-II, Kaufman Assessment Battery for Children II; LNT, Lexical Neighborhood Test; LPP, LanguageProficiencyProfile-2; ND, Nonword discrimination; C-C, Causal-Comparative; NWR, Nonwrod Repetition; PBK, Phonetically Balanced Kindergarten; PI, Phonologically Inaccurate; PIAT, Peabody Individual Achievement Test; PNT, Passive Naming Test; PPVT-III, The Peabody Picture Vocabulary Test–Third Edition; SCR, Sentence Completion and Recall; SDM, Semantic Decision Making; SL & OS, Standardized Reading Comprehension Tests; SR, Serial Recall of Non-words; STM, Short Term Memory; TACL, Test for Auditory Comprehension of Language; TIPS, Text Information Processing System; TORC, Test of Reading Comprehension; TROG, Test for Reception Grammar; VIDSPAC, Video Speech Pattern Contrast Test; VMPT, Visual Matrix Patterns Test; WIPI, Word Intelligibility by Picture Identification; WJ 3 COG NU, Woodcock Johnson 3 Test of Cognitive Abilities; WM, Working Memory; WMTB-C, Working Memory Test Battery for Children; WNSA, Wechsler Nonverbal Scale of Ability; WRAML2, Wide Range Assessment of Memory and Learning Second Edition; WRMT-3, Word Identification subtest ; WS, Word Spotting; WWA, Woodcock Word
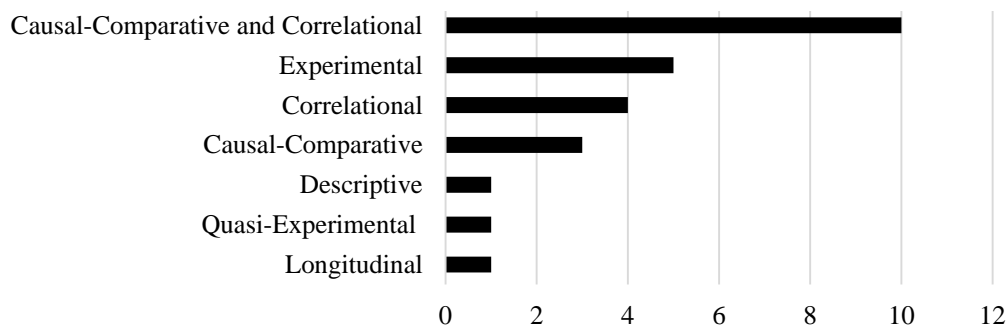
Figure 1. Research models.
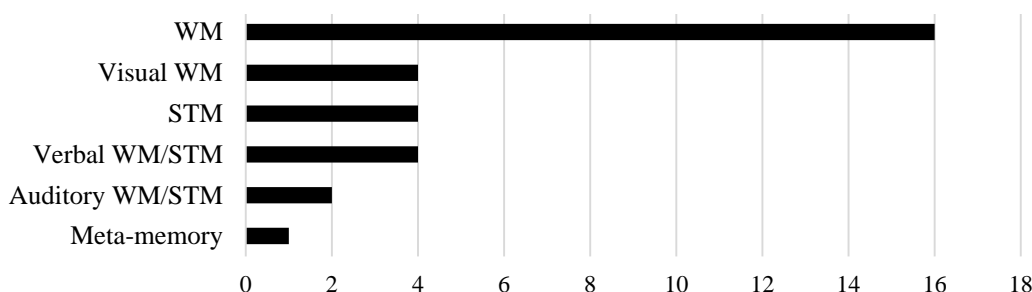
Figure 2. Memory type and measurement tools (WM: Working Memory; STM: Short Term Memory).

Table 4. Measurement tools.

Measurement tools	Frequency (*n*)	Percentage (%)
Standard measurement tools	22	58
Non-standard measurement tools	16	42

standard and non-standard tools.

As shown in Table 5, 53 different standard measurement tools and two different non-standard tools were used to assess the processes related to memory (Table 3).

Aims of the studies

The aims of the studies on memory of children are classified under four groups as follows: To compare children with hearing loss with themselves or with normally hearing children; to analyze the performances of individuals with hearing loss based on different memory types; to relate memory types to some skills, and to determine the effectiveness of intervention programs developed to improve their memory capacity (Table 6).

As clearly displayed in Table 6, 13 studies (52%) aimed

to compare groups and to relate skills with memory types. Five of them (20%) were designed to only compare groups, four (16%) were conducted to relate skills with memory types, two (8%) were conducted to determine the effectiveness of intervention programs, and the last one (4%) was designed to examine memory types.

Summary of findings

Findings obtained in accordance with the purpose of this research are organized in line with the frequencies and percentages in Table 6; relevant findings are presented in Table 7.

As shown in Table 7, statistically significant relations were found between memory types and skills in all the studies where groups were compared and skills and memory types were associated. In six (24%) of the studies where normally hearing children and CHL were
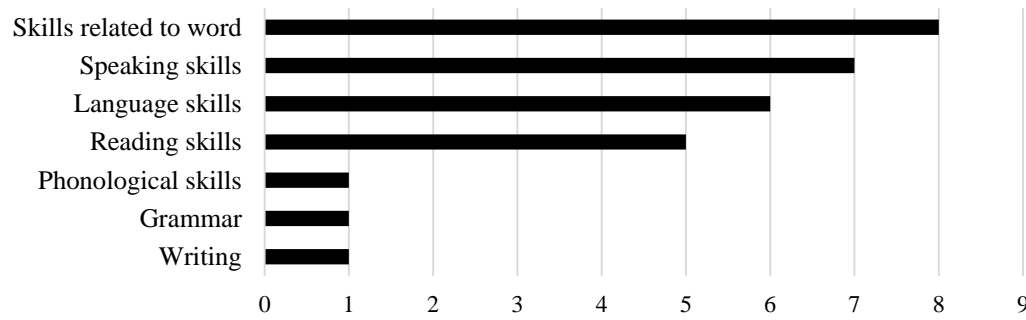
Figure 3. Processes and skills associated with memory.

Table 5. Measurement tools.

Measurement tools	Frequency (*n*)	Percentage
Standard measurement tools	53	96
Non-standard measurement tools	2	4

Table 6. The aims of the studies.

Aims	Frequency	Percentage
Comparing groups / relating skills with memory types	13	52
Comparing groups	5	20
Relating skills with memory types	4	16
Effectiveness of intervention programs	2	8
Examining memory types	1	4

Table 7. Findings of the studies.

Findings	Frequency	Percentage
Between groups comparison/ relationship between skills and memory	13	52
Favored normally hearing children; relations were found	6	24
Favored CHL; relations were found	5	20
Favored total communication users; relations were found	1	4
Favored nnormally hearing children and those whose native language was sign language relations were found	1	4
Between groups comparison	5	20
Favored CHL	1	4
Favored nnormally hearing children	4	16
Relation between skills and memory types	4	16
Related	4	16
Not related	0	0
Effectiveness of intervention programs	2	8
Effective	2	8
Non-eeffective	0	0
Investigation of memory in general	1	4
CHL are competent	0	0
CHL are not competent	1	4

compared, findings were in favor of normally hearing children, while the latter children were favored in five (20%) of them. In one (4%) study where participants using verbal communication and total communication were compared, findings indicated that those using total communication had advantage over the others. However, in another study (4%) where children with normally hearing, those whose native language was sign language, and those using sign language but not as their mother tongue were compared, the results were in favor of both normally hearing participants and those whose native language was sign language.

Findings were in favor of the participants with hearing loss in only one of the studies where the groups were compared. On the other hand, four (16%) studies revealed results favoring normally hearing individuals. Likewise, findings of four (16%) studies conducted to relate skills with memory types yielded significant relations. Furthermore, the results of all studies (8%) designed to examine the effectiveness of intervention programs showed that those programs were effective in improving memory capacities of CHL. There is only one study investigating the types of memory, and its results showed that CHL were incompetent in memory tasks.

DISCUSSION

The aims of this research are to comprehensively examine studies of memory of children in order to determine their population characteristics, topical properties and identify research trends and needs. Within this discussion section, first, findings are grouped and interpreted, and then research needs and suggestions are noted.

Characteristics of participants

The first research question aimed to identify demographic, audiological, and educational features of the participants. With respect to the first group of the findings regarding *demographic characteristics*, the total number of participants in 25 studies is 1943, the number of participants with hearing loss is 1195, and the average number of participants in each study is 48. In a majority of the studies, normally hearing children were included as control groups; and there is a balanced gender distribution among participants with hearing loss. The number of participants in each study is within acceptable limits considering the fact that hearing loss is a rather rare disability compared to others. As a result of this, it is difficult to access if the children in all the groups have to meet specific selection criteria to be included in the research. All of these studies favored normally hearing children as comparison groups. This is quite meaningful

since one of the major issues to tackle in special education research is the controversy in comparing disabled children with each other or with other normally developing peers. The dominant side of this dilemma is the idea that it is not possible to draw a plausible conclusion about disabled children without comparing them with normally developing peers in the "norm group"; otherwise, a vital methodological mistake is inevitable (Braden, 2001). Inclusion of normally hearing children as comparison groups in the 25 studies under investigation is consistent with the opinion that it is necessary to employ norm groups in studies whose primary participants are children. Lastly, gender has never been considered as a significant variable in studies conducted on CHL; however, when it comes to cognitive processes—especially visual memory, there is a high probability that performance may vary across genders (Cornoldi and Vecchi, 2003). In fact, the participants were balanced with respect to their genders in most of the 25 studies. And in some of them, they were even matched up based on their genders, and this was the right preference methodologically.

The second finding regarding demographic characteristics indicated that the age range of the children participating in these studies is between 4 years and 18 years and 6 months. Most of the studies do not include any information as to the age at diagnosis. However, some of them report that age at diagnosis ranges from 0 to 13.3 years (mean 1.2), whereas seven of them note that children were diagnosed right after birth. In addition, the age of cochlear implantation ranges from 1 year and 4 months to 10 years, and the duration of cochlear implant use is between 1 and 11 years and 7 months. Integration of these findings leads to three major points: First, one of the selection criteria adopted for this research was that the study participants had to be 18 or below. Naturally, the highest age limit meets this criterion, but none of the studies include children below 4. The reason for this is that many of the studies focused on temporary memory processes (WM and STM), and these types of memories are not available to test children below 4 years (Gathercole et al., 2004). Second, the age range is too wide for all age-related features such as age at diagnosis and age of cochlear implantation, which are included in the demographic variable. The range width indicates that relevant properties have a heterogeneous distribution in this group. This is also consistent with Marschark's (2006) opinion stating that the group of CHL is highly heterogeneous. Third, almost half of the studies at hand do not reveal any information as to the age at diagnosis, which has a crucial role in cognitive, linguistic, and academic development of CHL. A possible reason for this serious problem may be the difficulty in accessing records since majority of the 25 research studies were conducted retrospectively. On the other hand, it was observed that the age at diagnosis gets lower and lower

in recent research, as shown by those studies providing information about the age at diagnosis. A reasonable explanation for this is the fact that the Universal Newborn Hearing Screening Program, which allows diagnosis of hearing loss right after birth has become more and more common throughout the world (Yoshinaga-İtano, 2003).

Another component of the first research question targets the *audiological characteristics* of the participants with hearing loss. Accordingly, a prominent portion (80%) of the study participants used cochlear implants as hearing technology. Only four of the studies were conducted with children using hearing aids. Similarly, most of the same participants had either severe or profound hearing loss. On the other hand, 40% of the research under investigation provides no information with respect to the degree of hearing loss. A logical conclusion that can be distilled from these findings is that the participants were often cochlear implant users in the studies conducted after the year 2000 on memory of children. This is a very important finding because memory capacity has been regarded as vital along with other factors such as early diagnosis and intervention for language development of children using cochlear implant technology (Pisoni and Geers, 2000). Rather than being a methodological mistake, a probable explanation as to why more than half of the studies do not yield any information regarding the degree of hearing loss may be the fact that cochlear implant technology is only applied to individuals with either severe or profound hearing loss. The last part of the first research question aims to identify the *educational characteristics* of participants with hearing loss. As for the communication mode, 84% of the participants with hearing loss communicated through the verbal mode, followed by total communication, sign language, and bilingual users employed as comparison groups in four of the studies. This finding is literally consistent with the previous one reporting that a great majority of children used cochlear implants. Thus, it is not new to state that research efforts on memory of children mostly serve the purpose of understanding verbal language development. Analysis of the educational settings provided to children indicates that 70% of them attended inclusive learning classes. This expected finding can be explained by the fact that inclusive educational practices have become more and more common in the world, and that the participants in these studies were eligible for inclusion (Stith and Drasgow, 2005). However, a prominent inadequacy of the studies under investigation is the lack of description of the educational settings provided to the children who did not use the verbal mode or cochlear implant, and who were not in an inclusive learning environment.

Research models

With respect to the second research question, research models employed in those 25 studies were determined. Since only quantitative-empirical studies are included in the present research based on the selection criteria, qualitative research models were excluded. The most frequently used research model in the studies under investigation is the joint use of causal-comparative and correlational models (40%), followed by independent use of experimental, correlational, causal-comparative, descriptive, quasi-experimental, and longitudinal models, respectively. The nature of the CHL group may serve as an explanation as to why causal-comparative and correlational models were adopted more often than the others. Due to the fact that causal-comparative research studies, also known as ex-postfacto examine already existing phenomena, and since hearing loss is not something created by the researcher but precedes the onset of research, it is perfectly understandable to utilize this research model more frequently than other models (Gay et al., 2012). Used to test intervention programs developed to enhance memory capacity, the experimental research model is the second most frequently used in many of the recent studies, which is consistent with others conducted on normally developing children (Spencer-Smith and Klinghberg, 2015). In a sense, memory studies of CHL track the footsteps of those of normally developing children.

Memory type, skills associated with memory and measurement tools

The third and fourth research questions of the current study reflect efforts to identify the memory types, skills associated with memory, and the tools used to measure both memory and associated skills examined in the articles under investigation. Of the 25 studies, 24 focused on working memory and short-term memory. There are two possible reasons why these two types of memories were studied so vastly. First of all, although it is still debatable that the two memory types reflecting temporary memory are totally different from each other, it is widely accepted that temporary memory is the key to explaining all kinds of academic learning and learning disabilities (Alloway and Gathercole, 2006). Considering that almost all studies were conducted with children with cochlear implants, the need to reveal the individual differences leading to learning or not learning academic skills and achievement of or failure to achieve language development may have driven researchers to focus on temporary memory processes. Moreover, the detailed definition of measurement paradigms and tools utilized to determine these memory types may be given as the second reason. Assessment of these memory types is relatively more concrete than that of other types of memory in both auditory and visual modalities (Gathercole et al., 2004).

Within 32% of the articles under investigation, "memory" was not associated with any skill. Across the rest of the studies, memory was mostly associated with vocabulary, speaking, language, reading, phonological, grammar, and writing skills, respectively. A closer look at the data set showed that memory was highly associated with the groups of verbal language and literacy skills.

Pisoni (2000) emphasized that the role of audiological and educational variables such as hearing technology, early diagnosis, and early education is mostly underpinned during the explanation of language and academic development in CHL while the role of cognitive variables is generally ignored. Examination of studies conducted after the year 2000 shows that Pisoni's concern regarding the effect of memory in explaining the individual differences across language and academic skills is also shared by other researchers.

Another noteworthy point regards the measurement tools. Approximately half of the tools employed to measure memory were standard ones and the other half were non-standard ones (tasks). Yet, almost all the tools used to assess language and literacy skills associated with memory were standard ones. Again, the use of more than one tool to measure either memory or associated skills is common across the studies examined in this research. A multi-measure paradigm (that is, use of more than one tool to measure the same thing in order to improve reliability) is frequently adopted in the 25 studies (Stevens, 2009). Thus, it is plausible to state that the studies included in the current research paid due attention to measurement reliability. Despite this positive remark, it is obvious by the measurement tools used in the 25 studies that these two memory types (working memory and short-term memory) were not differentiated in practice, but in theory, which is proven by the existence of studies employing the same measurement tool for both working memory and short- term memory.

The main aims and findings of the studies

The fifth and sixth research questions relate to the main aims and findings of the studies. Of all 25 studies, 52% aimed simultaneously at comparing groups and building relations between memory types and skills. However, the rest of the studies were designed to compare groups, associate skills with memory types, determine the efficacy of intervention programs, and understand the nature of memory of CHL in isolation and respectively. As reported earlier, the most frequently employed research model among the 25 articles under investigation is a joint use of causal-comparative and correlational models, which indicates that aims and models match perfectly. Therefore, one can conclude that the studies examined in the present research are methodologically solid with respect to their research models.

Pertinent to the aims, there are two emerging groups of findings. According to the first group, there are meaningful positive relations with varying numerical values between memory capacity and skills (e.g., vocabulary, speaking, language, reading, phonology, grammar, and writing). This group of findings points out that cognitive processes, at least on the memory level, are effective over the development of aforementioned skills in CHL as well as their demographic, audiological, and educational features (Pisoni, 2000). An interesting finding has been identified regarding the aim of cross-group comparison. In 10 out of the 15 studies, it is concluded that memory capacity is in favor of normally hearing children whereas CHL were determined to have better memory capacities in five studies. In all the studies where temporary memory capacity is identified to be stronger for CHL, measurement tools are presented in visual modality. Obtaining this finding even in 33% of 15 studies means that Parasnis et al. (1996) warning as to investigating sensory compensation hypothesis in detail has been confirmed. According to the sensory compensation hypothesis, the span of visual memory in individuals with hearing loss is wider than that of normally developing individuals and it functions to compensate for the deficiency created by the relevant sensory loss. Even though the studies within the scope of the current research did not produce enough findings to make any generalizations concerning the sensory compensation hypothesis, they yielded strong enough clues to further question the hypothesis.

CONCLUSION AND SUGGESTIONS

At the end of this research, two kinds of trends have been determined: Methodological and topical. Considering that only one study bearing the selection criteria has been conducted in our country so far; each emerging trend naturally points to a research need, in other words, a suggestion.

Methodological trends and suggestions

Four basic methodological trends have been determined in this research examining 25 quantitative-empirical studies. As for the first trend, normally hearing children are included as norm groups in the studies investigating memory and related processes in CHL. Thus, the use of normally hearing children as norm groups will provide a more holistic assessment of the target group even if CHL are evaluated without comparison to the norm groups. Forming norm groups for research is not limited to memory studies; they are also used in language, reading, writing, and other academic and cognitive skill studies. Moreover, referring to normally hearing children during

research efforts will also reveal over time significant information as to the validity of the sensory compensation hypothesis.

The second methodological trend is that the individual differences among participants are quite numerous. In addition to general features such as gender and age, other variables specific to participants with hearing loss such as age at diagnosis, age of implantation, hearing level, level of hearing loss, hearing technology, primary communication mode, and educational features make this group of participants extremely heterogeneous.

Therefore, researchers planning to conduct memory studies of CHL should define the relevant variables in detail and should control them as tightly as possible. Otherwise, the findings will be difficult to generalize.

As for the third trend, most of the studies utilize a joint design of causal-comparative and correlational research models. However, an increase in the use of experimental models has been noted. Thus, it is reasonable to expect a rise in experimental studies on an international scale and to hope for a beginning in terms of causal-comparative and correlational research studies in our country before transcending to experimental models. With respect to practice, it is of crucial importance to develop experimental research on intervention programs.

According to the fourth methodological trend, measurement of both memory and related skills is based on a multi-measurement paradigm (that is, measuring the same feature by more than one tool) (Stevens, 2009) which is vital for measurement reliability. The multi-measurement paradigm deserves special interest and attention in terms of research on memory and related skills in individuals with special need, including CHL.

Topical trends and suggestions

Four basic topical trends have been identified as a result of analyzing the studies within the scope of the current research. As for the first common trend, memory research has predominantly been conducted on children with cochlear implants. Although the use of cochlear implants may be interpreted as a methodological trend because of being one of the participants' characteristics, the influence it has over the lives of CHL turns it into a single topic on its own. Similarly, the participants of the 25 studies are vastly children using verbal communication as their primary mode. As a result, one can conclude that a serious amount of research should be conducted on memory and related skills in CHL administered cochlear implant using verbal language mode. This trend indicates an important study area for researchers in our country. On the other hand, the rates of children who use hearing aids and communicate through verbal language and who make use of sign language with or without hearing technology are also

considerably high, which unravels another research need.

The second topical trend is the relation between memory and language and literacy skills in children. Statistically significant and positive relations are determined between memory and language and literacy skills in all the studies examined in this research. For future research, one can suggest that the strength of memory capacity in explaining language and literacy skills be studied. If future research efforts take demographic, audiological, and educational features into account, it may be possible to determine which of these variables is more effective on the development of the skills mentioned earlier. After clearly stating the effect of memory, the questioned if intervention programs designed to enhance memory capacity have any slight influence over language and literacy skills may arise.

Inclusive educational practice is the third topical trend. In most of the studies, the participants attend inclusive classes. Thus, inclusive practice, as an educational setting, has become a topic of research not only in terms of language, literacy, and other academic skills, but also in terms of cognitive processes such as memory. The relation inclusive education has with the cognitive processes of CHL may also be a topic of study for researchers in our country.

The last topical trend is the focus on temporary memory processes such as short-term memory and working memory in almost all the studies conducted on memory in CHL. Considering the relation it has with language, academic learning, and learning disabilities, examining temporary memory processes is perfectly understandable. All of these indicate major research topics for our country. However, the results of the current study yield that other memory types such as implicit memory, autobiographic memory, semantic memory, episodic memory, and procedural memory in CHL have been neglected in both national and international literature. Therefore, these memory types may very well serve as study topics for future research endeavors.

General suggestions

All the methodological and topical trends mentioned above prescribe research needs for researchers in Turkey. No direct suggestion has been distilled for practice based on the results of this study. Nevertheless, two indirect suggestions may be deduced. First, using a multi-measurement paradigm during the assessment of CHL may increase the reliability in practice as well as in theory no matter what the aim is. Second, taking temporary memory processes into account while investigating the causes of difficulties that children have in acquiring language, literacy, and other academic skills might improve the validity of assessment.

Finally, this research has analyzed quantitative-

empirical studies conducted during the 16-year span between 2000 and 2015. Focusing on the studies conducted earlier than 2000 may help to observe the changes especially within topical trends over time.

Conflict of Interests

The authors have not declared any conflict of interests.

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Educational Research and Reviews

Full Length Research Paper

The shifting of students' epistemological belief about mathematics in polytechnic

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The research aims to figure out students' epistemological belief shift about mathematics after having attended a lecture in a Polytechnic. In addition, it also aims to find out the relationship between their beliefs and mathematics performance. The study applied mix method with explanatory sequential design approach by conducting first study quantitatively and further study qualitatively. The sample consists of 223 participants drawn randomly by stratified random sampling method. The result showed that students' epistemological belief about mathematics either pre- college or in-college period in Polytechnic was "poorly positive". Most of them (about 95%) had their epistemological beliefs about mathematics shifted with the changes "low increasing". Also, the belief shifting was positively correlated with mathematics performance at a significance level of 1%, and the Pearson correlation coefficient was 0.204. Some factors that affects students' epistemological belief about Mathematics shifted was: student's orientation purpose, assessment system, curriculum, methods of learning, and met-before.

Key words: Belief, belief shift, epistemological belief, students' belief.

INTRODUCTION

Belief is a personal judgment and views, which constitute one's subjective knowledge, and it does not need formal justification (Kapetanas and Zachariades, 2007). For the past three last decades, "belief' has become an interesting subject for researchers of mathematics education to conduct, especially in relation to mathematics behavior, performance and problem solving. Many researchers have proven that students' believe on Mathematics has a strong effect on students' mathematics behavior and performance

(Steiner, 2007; Buehl and Alexander, 2005; Op't Eynde et al., 2002).

In the last ten years, there are many researchers who have epistemological beliefs revealed (Chen, 2010; Steiner, 2007; Buehl and Alexander, 2005). Student's epistemological beliefs about mathematics can be regarded as personal judgments and views, which is a one subjective knowledge, which does not need formal justification, which include individual beliefs about the nature, justification, resources and

knowledge, and acquisition related to the learning about mathematics. Muis (2004) states that epistemological belief about mathematics (EBaM) consists of belief on: the nature of mathematics as a discipline, the nature of knowing mathematics, the acquisition of mathematics knowledge, and the usefulness of mathematics. Muis (2004) also differentiates beliefs on mathematics to be "availing", which is the supporting belief for learning process or the positively affecting belief on learning process, and "nonavailing" belief, which is non beneficial or negatively affecting belief on learning process.

The nonavailing belief has also been studied by Steiner (2007) stating that students' EBaM consists of required time to solve mathematics problem, mathematics problem complexity, the importance of understanding mathematics, and the usefulness of mathematics. This research will apply those earlier mentioned definitions. Steiner's research showed that generally, students hold no availing beliefs about mathematics and mathematics self-concept.

Most of them commonly believe that mathematics problem must be solved quickly; and they did not believe that mathematics problems can be solved with logic and reason instead of learned mathematics rules; and over 40% of the students did not believe that it was beyond basic mathematics which was useful to everyday life.

Nonavailing belief about mathematics has been proven to negatively affect mathematics performance either directly or indirectly. For instance, students who believe that most of all mathematics problems can be solved by applying facts, rules, formulas, and procedures tend to approach mathematics task by mechanical or by memorizing method (Garofalo, 1989). Those with non-availing belief may also have lower motivation level and task performance than those with availing belief (Buehl and Alexander, 2005).

Both students' availing and nonavailing belief about mathematics learned in the university or college as a certain subject of course differs from those who learn mathematics as mathematics user. In one hand, those who learn mathematics as a subject generally showed a positive attitude toward mathematics and had a higher motivation (Selden and Selden, 2007; Sowder and Harel, 2003). In the other hand, those who attended mathematics lecture in other majors generally showed a less positive attitude (Hassi and Laursen, 2009).

Mathematics lecture in Polytechnic (especially in Politeknik Negeri Malang) has some different characteristics compared to that of non-Polytechnic students. To mention some, they are short lecture duration (2 to 3 h per week on two semesters), plentiful material, and students with various different backgrounds (General High School, Islamic High School, and Vocational High School). Apart from those earlier mentioned characteristics, educational system in Polytechnic also has some peculiarities compared to

other colleges (such as Universities, Institutes, Academies or Diploma programs). Among those peculiarities are: Polytechnic curriculum contains 45% theory and 55% practice; its lectures apply a package system; and its evaluation apply drop outs (DO) study system. Every semester, lots of students gets DO from their studies due to getting grade pointE or grade point average (GPA) which is below 2.00. Most of those DOs' students are those who acquire low mathematics grades (Dewi et al., 2007). One of the factors that affect students' achievement in mathematics was their EBaM (Buehl and Alexander, 2005; Schoenfeld, 1989; Szydlik, 2000) and their confidence in their mathematics capability (Kloosterman et al., 1996; McLeod, 1992; Schoenfeld, 1985). The belief about mathematics is formed in the context of students' individual academic experiences (Cobb, 1986; Schoenfeld, 1989). Meanwhile, academic experience is formed by personal characteristic such as gender, age and ethnicity (Wilkins, 2003; NCTM, 2000).

There are lots of studies focusing on students' belief about mathematics either in the elementary school, high school, or in college and its relation with mathematics achievement. Studying those earlier mentioned literature research; we have not found yet any study concerning mathematic with Polytechnics students as its subject research. As we have experienced for the past 23 years teaching in Polytechnics, there are lots of dropped out Polytechnic students due to their poor mathematics achievement. A study conducted by Griese et al. (2011) in German also says that there is a high number of engineering students who give up in learning mathematics before successfully passing. This indicates that technical students who fail in learning mathematics were not only found in Polytechnic. Daskalogianni and Simpson (2001) also confirmed the important role of belief about mathematics which determines students' success or failure at university. However, it is barely stated on those studies whether such belief has been related to the students since their early level education or there has been a shift on them. In regard to this problem, Steiner (2007) suggested that we had to conduct a research which explores how students' perceptions of mathematics can be challenged at the college-level and prior to college.

Considering the previously conducted research and some earlier mentioned reasons, we focus on studying shift of students' EBaM starting from pre-college up to in-college period in Polytechnic. The research aims to explore Polytechnic students' belief starting from their pre-college up to after having followed mathematics lecture at Polytechnic. The research also aims to figure out its relation with mathematic performance. The research questions explored were:

1. How did students' EBaM shift after having followed its lecture in Polytechnic?

2. How did Polytechnic students' epistemological belief relate with mathematics performance?

METHODOLOGY

The study applied mix method with explanatory sequential design approach, by conducting first study quantitatively and further study qualitatively (Creswell, 2002). Firstly, a quantitative study will be conducted and then it will be continued by little bit collecting qualitative data. Creswell gives a symbol of"QUAN-+ qual" to indicate that quantitative study has a heavier quality than qualitative study; meanwhile, arrow sign indicates that the quantitative study is prioritized, and then it will be completed by the qualitative study.

Sample

The population of this research was students of Politeknik Negeri Malang attending mathematics lectures in 2015 to 2016 academic year. Random sample was selected by stratified random sampling amount (N) 223 participants, consisting of 60 participants majoring in Electrical Engineering, 45 participants majoring in Civil Engineering, 46 participants majoring in Chemical Engineering and 72 participants majoring in Mechanical Engineering. Furthermore, randomly selected 30 of the 223 participants were able to provide qualitative feedback on the four statements about students' EBaM. Of the 30 participants, some subjects were selected to be interviewed relating to their beliefs by referring to the results of the questionnaire and mathematics test.

Instrument

Scale of students' EBaM designed by modifying Mathematics Beliefs Scale (MBS) questionnaire from Steiner (2007), consists of subscale: time, steps, understanding, and usefulness, each of which had six items; three of them were positive wording and the rest three were negative wording. MBS likert-type formula with five responses/alternative answers was modified to be six items, that is, by eliminating doubt vs unsure answer. Alternative responses for each item from MBS modification result were:

1. False/strongly disagree (not like me at all),
2. Mostly false/disagree
3. More false than true/ somewhat disagree
4. More true than false/ somewhat agree,
5. Mostly true/agree, or
6. True/strongly agree (It is very much like me).

And to figure out shift in students' belief, the questionnaire in the study was divided into two stages. The first stage was given at the beginning of the first semester, the participants were asked to provide feedback on the EBaM before studying at the Polytechnic. The second stage was given at the end of the second semester, the participants were asked to provide feedback on the epistemological belief about mathematics after college at the Polytechnic for two semesters. Also, to gain deep belief description, in the second stage questionnaire MBS added some qualitative questions that must be answered in writing.

The research instrument to be applied, apart from using MBS, would also applied mathematics test to gain data about students' mathematics performance. Furthermore, student test result was also applied to be one of the reference to figure out students'

background experience in relation to mathematics- known terminologically as "met-before" (McGowen and Tall, 2010).

Data analysis technique

Weighting

MBS likert scale contains of 6 agreeing/disagreeing levels, that is, strongly agree (6), agree (5), somewhat agree (4), somewhat disagree (3), disagree (2), and strongly disagree (1). MBS scale also makes 6 sub scales, each of which contains six items. Three of them were positive wording, and the rest three were negative wording. For weighting calculation, we scores participants response using the equivalences below:

1. The positively worded items applied weighting 6 = +3, 5 = +2, 4 = +1, 3 = -1, 2 = -2, and 1 = -3
2. The negatively worded items applied weighting 6 = -3, 5 = -2, 4 = -1, 3 = 1, 2 = 2, and 1 = 3. As the result, we had a range from "strongly agree" = 3 to "strongly disagree" = -3.

Categorization

For instance, student X encompasses 5, 6, 6, 2, 4 and 3 (first three item are positive wording, and second three items are negative wording) scoring attitude on Time Subscale. In this sense, the weight will each be translated into 2, 3, 3, 2, -1 and 1, with total quantity of 10. Due to 6 items in time subscale, we divide 10 with 6, of which we receive score 1.7 (from range score -3 to 3). To translate the score, we will categorize them not to be strongly "agree" (somewhat agree) or student X has belief in "somewhat positive" mathematics for Time subscale. So do the other subscales, and to see the whole complete, the categorization classified with criteria is presented in Table 1.

Shiftdetermination

Shifting belief is gotten from difference in the total of each subscale in students' belief pre-college (first stage) and in-college (second stage) in Polytechnic. For instance, student Y in his pre-college got belief response scores for each subscale which were: Time= 0.17; Step=-1.0; Understanding= 1.5; Usefulness= 1.83. Meanwhile, in his in-college, belief response score for each subscale were: Time= -0.5; Step=-0.83; Understanding= 1.83; and Usefulness= 2.33. So, shifting belief scores for each subscale were: Time= -0.5-0.17 = - 0.67; Sstep = -0.83- (-1.0) = 0.17; Understanding= 1.83-1.5 = 0.33; and Usefulness= 2.33-1.83 = 0.5, and total of shifting belief score (BS) was -0.67 + 0.17 + 0.33 + 0.5 = 0.33. According to the result, it was concluded that student Y belief about mathematics on his pre-college up to in college period in Polytechnic was low. We categorize belief shift into 7 groups that is, high increasing if BS is BS ≥ 8, average increasing if 4 ≤ BS <8, low increasing if 0 ≤ BS <4, stable if BS = 0, low decreasing if -4 ≤ BS <0, average decreasing if -8 ≤ BS <- 4, and high decreasing if BS <-8.

RESULTS AND DISCUSSION

Data EBaM was processed with MS Excel and statistical package for social sciences (SPSS) program. The following was presented for Polytechnic students' EBaM,

Table 1. Categorization reference of EBaM.

Category	Subscale score	EBaM score
Highly positive	2.5:'0 Score :'0 3	10:'0 Score :'0 12
Moderately positive	1.5:'0 score <2.5	6:'0 score <10
Poorly positive	0:'0 score <1.5	0 :'0 score <6
Poorly negative	-1.5 <score <0	-6< score< 0
Moderately negative	-2.5 <score:'0 1.5	-10< score :'0 6

Table 2. Summary statistics of students' EDaM in their pre-college period in Polytechnic and reliabilities (Cronbach's Alpha) for MBS.

Subscale	Mean	Std. Dev.	Category	*Cronbach's Alpha*
Time	0.72	0.8425	Poorly positive	0.609
Step	-0.29	0.8058	Poorly negative	0.640
Understanding	1.18	0.8617	Poorly positive	0.736
Usefulness	1.68	0.9914	Moderately positive	0.792
EBaM	3.28	1.7347	Poorly positive	-

Table 3. Summary statistics of students' EBaM in their in-college period in Polytechnic and reliabilities (Cronbach'sApha) for mathematics belief scale.

Subscale	Mean	Std. Dev	Category	Cronlxlch 's Alphtz
Time	1.06	0.8318	Poorly positive	0.711
Step	-0.54	0.9798	Poorly negative	0.712
Understanding	1.35	0.8758	Poorly positive	0.749
Usefulness	2.06	0.7999	Moderately positive	0.852
EBaM	3.92	1.8420	Poorly positive	-

Shifting of Polytechnic students' EBaM, Polytechnic student mathematics performance, relationships students' EBaM and mathematics performance, and qualitative response of Polytechnic students' EBaM.

Polytechnic students' epistemological belief about mathematics

Mean and standard deviation of Polytechnic students' EBaM in their pre-college period, and internal reliabilities *(Cronbach 'sAlpha)* of the total scale scores are presented in Table 2. Based on the calculation, we gained a description of students' belief on step subscale with the lowest mean score of -0.29. Such belief score was categorized as "poorly negative". The mean of other subscales respectively were: *Time* = 0.72; *Understanding*= 1.18; and *Usefulness* = 1.68. Although, *Cronbach's alphas* for MBS were lower than the *Cronbach 'salphas* reported by Steiner (2007), but reliabilities is still

quite high (greater than 0.6). Overall, the score of students' EBaM in their pre-college period in Polytechnic is 3.28 which was the sum of all belief subscales and categorized *as* "poorly positive".

Furthermore, mean and standard deviation of Polytechnic students' EBaM in their incollege period, and internal reliabilities *(Cronbach 'sAlpha)* of the total scale scores were shown in Table 3. As we had seen on students' belief in their pre-college period in Polytechnic, that of in-college period also indicates that step subscale had the lowest mean score of -0.54 and categorized as "poorly negative" The mean of other subscales respectively were: *Time*= 1.06; *Understanding*= 1.35; and *Usefulness*= 2.06. Meanwhile, students' EBaM in their in-college period was 3.92 and categorized *as* "poorly positive". It confirms the results of Hassi and Lauren (2009) that students who attended mathematics lecture in other majors generally showed a less positive attitude. Specifically, this can be concluded that "students in general believed that to solve mathematics problems may

Table 4. The frequency of students' EBaM based on the category

Category	Pre-college period		In-college period	
Highly positive	0	0%	0	0 %
Somewhat positive	11	4.93%	24	10.76%
Poorly positive	205	91.93%	193	86.55%
Poorly negative	7	3.14%	6	2.69%
Somewhat negative	0	0%	0	0%
Highly negative	0	0%	0	0%
Total	223	100%	223	100%

Table 5. The shifting of students' EBaM.

Shift of belief	Mean (BS)	Std. deviation
Time	0.34	0.7865
Step	-0.25	1.0153
Understanding	0.17	0.5816
Usefulness	0.37	0.6116
EBaM	0.64	1.3900

take a long time, understanding concepts was important in mathematics, and mathematics was useful in daily life". Students in general did not believe that mathematics problem was solved by logic and reason. This description indicated that Polytechnic students hold the non-availing belief that problem was solved by memorizing formulas or following step-by-step procedures. The study result actually confirms what Steiner has done previously (2007).

Furthermore, when all participants were classified into belief category as explained on data analysis technique, it was revealed that most Polytechnic students' belief was categorized *as* "poorly positive" with total a of 193 (86.55%). Meanwhile, the frequency of students' EBaM in their pre-college period shows a total of 205 (91.93%). It appears that there was none who has "highly positive" belief as presented in Table 4.

The shifting of polytechnic students' EBaM

The shifting of students' EBaM was BS = 0.6415 and categorised low increasing. A positive shift occurs on the belief subscales of time, understanding and usefulness, each of which were 0.3414, 0.1741 and 0.3743 (Table 5).

Meanwhile, the negative shift occurred on step subscale being -0.2484 or low decreasing. This showed that after the lecture at the Polytechnic, students generally believed that understanding in mathematics is important, not just to get the right answer. It also revealed that the Polytechnic students were more aware of the usefulness of mathematics than pre-college students. Also, learning

in Polytechnics is more on practical than theory which affected the learning condition. Students in Polytechnics are more familiar with the use of formulas or procedures in solving technical problems in mathematics. Taylor (2009) stated that curriculum and instruction designed specifically can influence students' beliefs about mathematics, it turned out to be in line with the curriculum, and learning at the Polytechnic affects students' EBaM. This specifically turned out to have a negative effect on the sub-scale step.

Further, the shift frequency of Students' EBaM is presented in Table 6. Most of the students' EBaM shifted: category of average increasing has 2 participants (0.90 %), low increasing has 147 participants (65.92 %), and low decreasing has 65 participants (29.15 %). It indicated that more than 95% participants shifted their EBaM. This also indicates that students' EBaM is not constant but shifting. A huge shift on usefulness subscales was due to Polytechnic students always relate with mathematics application on various lecture. When asked:

"why did your belief about mathematics shift from you pre-college up to in-college period?", a student S47 stated "because I am faced with many applied mathematics tasks and I also find mathematics usefulness on other lectures during my in-college period, the tasks and usefulness of which are barely found during my learning period in senior high school".

This means that mathematics lesson has given much application examples and other lectures also support

Table 6. The shift frequency of students' EBaM based on shift category.

Shift category	Frequency	Percentage
High increasing	0	0
Average increasing	2	0.90
Low increasing	147	65.92
Stable	9	4.04
Low decreasing	65	29.15
Average decreasing	0	0
High decreasing	0	0
Total	223	100

Researcher   : How many score do you think you will get?
M70   : I think around 60 Sir!
Researcher   : Why can you get 100 instead of 60?
M70   : I have not reviewed yet how to complete number2 and 1c
Researcher   : You left question number 1c empty. Why did not you write down any answer?
M70   : after I did the calculation and apparently I cannot still find the correct answer, I left it blank.

(Participant only put the answer which he firmly believe they are correct. He only completed three from five numbers so he predicts that he will get only score 60)

Figure 1. Interview quotation 1 with participant M70.

students' belief about mathematics usefulness.

Mathematics performance of Polymchnic students

Mathematics performance of Polytechnic students was measured from the final score of their second semester results. From the collected data, gained performance scores were: minimum= 38, maximum= 100, mean= 69.81 and standard deviation= 14.3427. If the scores are categorized as high (score> 80), medium (50< score::::; 80) and low (score ::::; 50), then gained scores are as follows: high category is 54 participants, medium category is 144 participants, and low category is 25 participants.

The researcher tried to find relationship between mathematics performance achieved by students and their EbaM. Researcher had conducted an interview with two participants based on test answer and shifting their belief. The interview below is quotation with participant's code M70 and M52. M52 is a participant with belief shift of "low decreasing" category and M70 is a participant with belief shift of "low increasing" category (Figure 1). Based on the interview in Figure 1, it indicates that students would not complete their answers whenever they feel doubtful about it. So that they answer the only three questions they feels sure of. Further, we asked a question to the M70 for his answer of question number lb.

The participant strongly was sure that his answer is correct, and he barely knows that its structure is incorrect (Figure 2). He gave an excuse that this was the way he was used to answer during his high school period, and it was considered correct by his teacher. This case is actually in line with what McGowen and Tall (2010) stated that the particular mental structures is built from previous experience (known as met-before). Moreover, assessment system factor also affects the participant's perception. It makes him think that what matters is the correct answer although the structure is incorrect (please refer to example ofM70's answer on Figure 3). This clearly indicates that students' understanding about mathematics is strongly affected by "met-before".

Furthermore, when he was asked about mathematics achievement in his pre-college period, M70 answers that he had good achievement in his Elementary school, Junior high school and tenth grade of his High school (Figure 4). He even mentioned that he was appointed to be the representative of mathematics Olympia during his elementary school. He also mentioned that his achievement was decreased during XI and XII grade of his high school due to his mathematics teacher's unclear explanation. When we compared between M70's interview answer and the questionnaire score of MBS, we knew that they fit each other, that is, low decreasing. He also mentions that his achievement was decreased during XI and XII grade of his high school due to his mathematics teacher's unclear explanation.

Researcher   : Why do you not complete question 1b?
M70   : This is what I am used to doing this, sir. I have never completed it as long as I give the correct
                answer. I am used to have multiple-choice questions during my high school period, sir, so this
                (as pointing to the answer) means x1 and x2. We know the answer has been correct this way if
                it is a multiple choice question. And I think it was also justified as correct when high school.
                What matters is the answer is correct because there will be a separated calculation.

(Participant is affected by his habit of answering model of multiple choice questions during his high school
period. He thinks what matters is the correct answer even though it has a mathematically incorrect answer.
This is one of multiple-choice method weaknesses in that it may fatally affect on students' future mental
structure. This also indicates that met-before strongly affect on students' belief about mathematics, especially
in mathematics understanding.)

Figure 2. Interview quotation 2 with participant M70.

- Participant does not put x and sign "=" in his calculation. This indicates there is misconception in the form of ignoring sign x and "=".
- Multiple-choice question habit actually affects on students' understanding in mathematics. It makes them think what matters is the correct answer.
- Blue mark indicates the required sign to be put by the participants.

Figure 3. Work result of participant code code M70.

Researcher : Has your achievement always been like this from your elementary to Junior or high school?
M70   : I had achieved a good one when I was in elementary, junior high and grade 1 (X) of senior high
             school. However it had been decreased when I was in grade XI and XII of my senior high
             school,Sir.
Researcher : Why?
M70   : I think it was the teachers Sir. They gave us unclear explanation, and described the material too
             fast and made the student confused.
Researcher : had you ever asked to your friends, parents or others when you were in difficult situation?
M70   : I had Sir, Yes, My dad is actually a mathematics teacher. He had always taught me when I was in
             elementary or junior high school. However, I had never learned together with my dad since I
             was in senior high school because he had always been busy to give additional lesson to his own
             students every night. So it made me lazy then. .
Researcher : who gave you help ever since?
M70   : I was used to discuss with my friends Sir (while mentioning several of his friend names).

(At first, participant did like mathematics and he had a good achievement indeed. However, since he was in
grade XI he did not like it any more. There is two factors causing this condition. First is unclear explanation
from his teacher and second is guider unavailability in time of facing difficulty.)

Figure 4. Interview quotation 3 with participant code M70.

The condition experienced by M70 has also justified the previous study that students' negative behavior in mathematics generally occurs after grade 10 or after 15 years old (Hakim et al., 2014; Steffens et al., 2010). The qualitative questionnaire response showed the same indicators result, in his pre-college period, he believed that mathematics has no use for daily life. However, in his in-college period, he now believed that mathematics is useful in our daily life. M70 gave an excuse:

"I perceive that mathematics is helpful to do something in relation with my major study".

Second participant, M52 is a student whose belief

Researcher : how many score do you think you can earn from test 1
M52 : 80 sir!
Researcher : Why 80, why would it not be 100?
M52 : I think I had the last question wrong answer.
Researcher : Why?
M52 : I did it not seriously and only use my common sense.
Researcher : So do you think that using common sense for answering mathematics is unserious?
M52 : Not really sir!

(Participant believed that to solve mathematics questions, must use step-by-step procedure instead of logic or reason).

Figure 5. Interview quotation1 with participant code M52.

Question:
Two cars A and B have an average speed of 40 km/hour. The distance between them is 490 Km. they start to move in opposite direction by 19.15 West Indonesian Time. At what time and what distance will they meet?
Answer:

Figure 6. M52 question and answer.

questionnaire score in mathematics is categorized "low increasing". He believed that the answer he gave is incorrect, and it is actually correct. Below is the quotation interview with this participant (Figure 5).

In the beginning, participant was not sure that his answer on the last question is correct because he only uses logic instead of procedural formula (Figure 6). It indicated that the participant believed that to solve mathematics problems, a step-by-step procedure is required. M52's answer actually fits his MBS scores, especially on the Step subscale, that is, 0.83 categorized as "poorly negative". The following are question (linear equations) and M52 answers which he believed incorrect because it only uses logic and reasoning.

M52's response about belief shift related with Step subscale indicated a negative shift. At pre-college, he believed that there were mathematics problems that were solved with logic and reason instead of learned rules and procedures, but in his in-college period, he now believes

that there has always been a rule to learn to be complied with to solve mathematics problems. His opinion actually fits with MBS questionnaire results which indicate "low decreasing" on Step subscale. However overall, his belief shift categorized as "low increasing". M52 also tells that in the beginning he didn't like mathematics, however, since 9 grade of his junior high school, he starts to show interest in mathematics due his teacher who explained the mathematics material clearly, and help him whenever he had difficulties.

Moreover, there were some participants whose belief does not shift such as S8, S11 and S17. In addition, the quantitative response actually also indicates the same consistency. There are lots of participants whose belief is shifting (increase and decrease); generally, they would be interested in mathematics whenever they able to understand and solve the mathematics problems well and whenever their teachers were friendly. On the contrary, they would not be interested with mathematics whenever

Table 7. Correlation between students' EBaM, internal correlation each subscale, epistemological belief shift, and mathematics performance.

		T	s	Un	Us	EBaM	EBaMS	MatPer
T	**Pearson Correlation**		**-0.188****	**0.395***	0.031	**0.553****	**0.272****	**0.214****
	Sig. (2-tailed)		0.005	0.000	0.641	0.000	0.000	0.001
s	Pearson Correlation		1	-0.284*	-0.045	0.292*	0.274*	0.159*
	Sig. (2-tailed)			0.000	0.503	0.000	0.000	0.017
Un	Pearson Correlation			1	0.415*	0.683*	0.231*	0.313"
	Sig. (2-tailed)				0.000	0.000	0.001	0.000
Us	Pearson Correlation				1	0.622*	0.170*	0.215*
	Sig. (2-tailed)					0.000	0.011	0.001
EBaM	Pearson Correlation					1	0.452*	0.424*
	Sig. (2-tailed)						0.000	0.000
EBaMS	Pearson Correl						1	**0.204****
	Sig. (2-tailed)							0.002

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed). Description: T: Time subscale, S: Step subscale, Un: Understanding subscale, Us: Usefulneas Subscale, EBaMS: EBaM Shift, MatPer: Mathematics performance.

they think the material is hard to understand and the teacher is not quite friendly (unclear in delivering the material, too fast, or easily angered).

The relationship of students' EBaM and mathematics performance

Referring to observation and interview result with some participants, we knew that students' belief about mathematics is closely related with their mathematics performance. Below the statistical summary of relationship between students' EBaM and mathematics performance is presented in Table 7. The results of correlation analysis between students' EBaM and mathematics performance showed a positive association on significance level of 1%, with a Pearson correlation coefficient of 0.424. Each subscale epistemological belief has a positive correlation with mathematics performance at a significance level of I%: subscale understanding with correlation coefficient of 0.313; subscale usefulness with correlation coefficient of 0.215; subscale time with a correlation coefficient of 0.214; and the shifting students' EBaM with a correlation coefficient of 0.204. While subscale step showed a positive association at a significance level of 5%, with a correlation coefficient of 0.159.

Students' EBaM positively correlated with mathematics performance. This means that the high belief score obeyed the high mathematics performance. Surprisingly, students' EBaM shift positively correlated with the performance of mathematics, it is different from the previous year results of the study conducted by the researchers. Students who experienced positive shift of EBaM (or the increase in EBaM) will be followed by the increase in mathematics performance. One interesting result was step subscale which was negatively correlated with other subscales (Time, Understanding, and Usefulness). It was indicated that in general, students who believed in solving mathematics problems may take a long time understanding of mathematics concepts, and mathematics will be useful if only the students believes that mathematics problems must be solved by memorizing formula or follow a step by-step procedures.

Based on analysis and interview resulted as described earlier, we may recommend some types of belief shift as following: first increasing monotone, this is an always increasing belief such as the case of M52; second is decreasing monotone, this is an always decreasing belief as found in the case of M70; third is stable, this is a stable/unchanged, or less changed belief as shown in the case of S8; fourth is unstable, this is a dynamical belief (up and down) which often changes all the time.

Qualitative response

30 participants were randomly selected to the qualitative

Table 8. Summary of qualitative response of students' EBaM.

Subscale	EBaM	Number of participants
	Since pre-college I believe that to solve a mathematics problem to be in quick time	5
	In pre-college I believe that to solve a mathematics problem to be in quick time, but in-college I believe that to solve mathematics problems may take a long time	9
Time	Since pre-college I believe that solve mathematics problems may take a long time.	7
	In pre-college I believe that solve mathematics problems may take a long time, but in-college I believe that to solve mathematics problems to be in quick time	9
	Since pre-college I believe that there are mathematics problems that be solved with logic and reason instead of learned rules and procedures	4
	In pre-college I believe that there are mathematics problems that be solved with logic and reason instead of learned rules and procedures, but in-college I believe that there is always a learned rule to follow in mathematics.	7
Step	Since pre-college I believe that there are a rule that must be followed to solve mathematics problems	13
	In pre-college I believe that there are a rule that must be followed to solve mathematics problems, but in-college I believe that there are mathematics problems that be solved with logic and reason instead of learned rules and procedures	6
	Since pre-college I believe that understanding concepts is important in mathematics	19
	In pre-college I believe that understanding concepts is important in mathematics, but in-college I believe that in mathematics that important was about getting the right answer	0
Understanding	Since pre-college I believe that in mathematics that important was about getting the right answer	2
	In pre-college I believe that in mathematics that important was about getting the right answer, but in-college I believe that understanding concepts is important in mathematics	9
	Since pre-college I believe that mathematics is useful in daily life	22
	In pre-college I believe that mathematics is useful in daily life, but in-college I believe that mathematics is not useful in daily life	1
Usefulness	Since pre-college I believe that mathematics is not useful in daily life	1
	In pre-college I believe that mathematics is not useful in daily life, but in-college I believe that mathematics is useful in daily life	6

response from participants. Researchers have filed four statements about students' EBaM in the questionnaire to be given response and the reasons. The statement called on the students to give themselves an assessment of the associated changes in beliefs about mathematics (Table 8).

Based on qualitative response to the students' EBaM, the results were parallel with quantitative response of participants. The majority of students have availing belief in Time, Understanding and Usefulness subscales, whereas in Step subscale majority of students have non availing belief.

1. Time subscale: This consists of 16 (53.33%) participants who had availing belief "Solve mathematics problems may take a long time", and 14 (46.67%)

participants have non availing belief "Solving mathematics problems should be in quick time." This condition was in accordance with the quantitative results that the Time subscales had "low positive" belief.

2. Understanding subscale: There were 28 (93.33 %) participants who had *availing* belief "understanding concepts is important in mathematics", and 2 (6.67 %) participants had *nonavailing* belief "in mathematics that it is important to get the right answer".

3. In usefulness subscale there were 28 (93.33 %) participants who had *availing* belief "mathematics is useful in daily life" and 2 (6.67 %) participants have *nonavailing* belief "mathematics is not useful in daily life".

4. In step subscale there were 20 (66.67%) participants having *nonavailing* belief "there is always a learned rule to follow in mathematics", and 10 (33,33 %) participants have *availing* belief "there are mathematics problems that be solved with logic and reason instead of learned rules and procedures".

Some of the reasons that many participants expressed related to their belief shift can be stated as follows.

1.The reasons for shifting of belief in the Time subscale, were: he/she is weak in mathematics that requires sufficient understanding which takes time; while in-college they learn more mathematics during High school and also increases the level of difficulty; while in-college mathematics problems become more difficult so it takes longer to complete; in-college variations matter become more complicated, solving it took a longer time; in college mathematics problem is more developed; in college all the materials tested in the essay that require students to answer coherently, different from at senior high school model of multiple choice questions; Senior high school mathematics problems were not too complicated as in-college, in-college mathematics takes long time because the matters are more complicated; solving mathematics problems should be gradual order, so it may take a long time.

2. The reasons for shifting of belief in the Step subscale, were: the higher the education level of the problems encountered, the more complicated it is which cannot be solved easily; actually there are some problems that cannot be solved easily; not all mathematics problem can solved easily but a specified procedure most be followed; rules are made to get answers from the problems that have been created; in-college, many questions requires us to reason before we can follow the steps in the formula.

3. The reasons for shifting of belief in the Understanding subscale, were: better understand the concept of getting a good value but do not understand the concept; in pre-college his final destination is only by value, but in-college he/she should also think about the application; in Senior high school they are informed about the formulas

without knowing where it came from and assessed only answer, if the answer was wrong but the concept was true then it has not be completed, while in-college understanding of the concept was important; if he/she did not understand the concept then it is possible to solve the problem with a different method; honest, in pre-college he/she pursued grades, but in-college the process of working was more important in order for he/she to understand all the problems of mathematics problems; when at Senior high school he/she have always focused on National Exam with mathematics problem having multiple choice, it was important to get the correct answer, but in-college the concept is more important; in-college he/she must solve a problem by describing the process of obtaining the answers, whereas in pre-college it is not so; in Senior high school to get the correct answer was a good thing in getting value.

4. The reasons for shifting of belief in the Usefulness subscale, were: in-college, mathematics is associated with other academic subjects so that mathematics becomes useful; in pre-college, a complex mathematical seem useless in daily life, but in-college it turned out to have everything that has to do with mathematics along with other subjects that also deals with the majors that he/she take; in-college my firmament thinking increases, making his/her belief that mathematics is important in daily life; if there is no mathematics he/she will be blind to calculate and solve problems related to numbers; everywhere mathematics is always needed in all areas, mathematics is important and useful; in-college he/she feel the benefit of mathematics in doing something related to his/her majors.

Based on the reasons stated earlier, the researchers classify the reasons of participants into the following groups:

1. Student's orientation purpose, which is to get good grades
2. Assessment system by teachers/lecturers during school/college
3. Curriculum
4. Methods of learning
5. Meth-before.

Conclusion

Based on result and discussion as described earlier, we may conclude some points as follows:

1. In pre-college period, the average score of students' EBaM sows is 3.28 (range -12 to 12), and can be classified in "poorly positive" category. The average score of students' epistemological belief in their in-college period shows 3.92 and be classified in "poorly positive".

Students' EBaM mostly shifts with details as following: 2 participants (0.90%) are average increasing; 147 participants (65.92 %) are low increasing; 65 (29.15%) participants are low decreasing. Meanwhile, those whose belief does not shift are 9 students (4.04%). This means that more than 95% participants have their EBaM shifted.

2. Step subscale shifts by -0.25 or can be said to be "decreasing". Meanwhile, *Time, Understanding* and *Usefulness* subscale positively shift by representatively 0.34, 0.17 and 0.37.

3. Some factors to affect students' EbaM shifted in were: student's orientation purpose, which is to get good grades; assessment system by teachers/lecturers during school/college; curriculum; methods of learning; meth-before.

4. There are four types of students' belief shift in mathematics that is, increasing monotone decreasing monotone, stable and unstable.

5. Students' EBaM and shifting Students' EbaM with mathematic performance were positively correlated on the significant level of 1%, with Person correlation coefficient respectively 0.424 and 0.204.

RECOMMENDATION FOR FUTHER RESEARCH

To gain the good result in the education department, especially for mathematics education in Polytechnic, we recommend for further studies to focus on qualitative research rather than quantitative research in order to gain a comprehensive description about students' belief shift in mathematics.

Conflict of Interests

The authors have not declared any conflict of interests.

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Educational Research and Reviews

Full Length Research Paper

Enhancing argumentative writing skill through contextual teaching and learning

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This study aims to describe the influence of contextual learning model and critical thinking ability toward argumentative writing skill on university students. The population of the research was 147 university students, and 52 university students were used as sample with multi stage sampling. The results of the research indicate that; group of contextual learning model has more significant influence than group of non-contextual learning model, there is an interaction between learning model and critical thinking ability, there is a significant difference of argumentative writing skill between group of contextual learning and non-contextual learning for the group with high critical thinking ability, and there is also significantly different argumentative writing skill between contextual learning and non-contextual for the group of low critical thinking ability. Based on this finding, the researcher concludes that critical thinking ability and contextual learning model have significant influence toward argumentative writing skill.

Key words: Contextual, non-contextual learning model, argumentative writing skill, critical thinking ability.

INTRODUCTION

Language is a human communication instrument. Almost every day humans use language, receptively or productively. By using language, humans present their feelings, ideas, inspirations, imaginations, and convey everything to everyone else. Beside, language is not only a medium of communication, but also a means of representing human intelligence. This is why language is often considered an indicator of intellectuality.

Campbell et al. (2002) states that language is an example of primary intelligence of human being. They also maintained the rhetoric aspect of language, as an ability to convince someone, a potential tool to remember a list or process, the capacity to explain concepts, metaphors' values, and it is used to analyze language in terms of "metalinguistic". These language abilities need to be taught in order to engender human's language skills. There are several aspects of these skills (Adejimola and Ojuolape, 2013), and these are:

1. Listening and comprehending
2. Speaking
3. Reading, and

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4. Writing.

Of these skills, writing is the most complex ability compared to others. When writing, one must have indirect communication ability, language structure, writing techniques, and the ability to extract ideas form text.

The complexity of writing activity requires systematic and well-ordered thinking that must be mastered by students and which finally will be the way of their behavior (Gonye et al., 2012). The behavior of thinking orderly will lead students to deliver messages, ideas and feelings systematically, and foreseeable in writing activity then. Rather than to teach writing theory, writing instruction should be focused on writing activity. Teaching only focused on writing theory will cause passivity and unproductivity, even though students have retained knowledge of various techniques of writing. Many scholars in linguistics and literature programs are not productive in writing (Alwasilah and Alwasilah, 2005). It means that mastery of writing theory is not sufficient condition for someone to be active and productive in writing.

Writing skills are not gifted skills or not categorized as cultural knowledge, nonetheless they can be achieved by learning and training processes. In the study of Paas and Sweller (2011), this kind of knowledge was classified in secondary biological knowledge, which cannot be achieved by "naturally" process. In other word, to attain this skill, someone has to train continually and be guided by expert (Magogwe, 2013). This kind of learning, principally is of learning that borrows knowledge and skill from others (Paas and Sweller, 2011; Sweller and Sweller, 2006). With this method, students can learn other ideas through sentences which are expressed in the form of writing. Furthermore, by this method students attempt to explain to themselves the ideas, opinions, thoughts, feelings, desires, or expressions which are written in other writings (Chi et al., 1989; Chi et al., 1994; Johnson and Mayer, 2010). By this method also, students drive to express the sentence connections and finally are able to generate the meaning of others thinking thoroughly. Learning this way, students can develop critical thinking in writing by learning from others.

One important type of writing to be learned in school and in the university is argumentative writing (Alarcon and Morales, 2011; Nippold, 2000; Preiss et al., 2013). It has an effect on the success of learning (Preiss et al., 2013). At university, students usually write argumentative writing when they create a paper for daily routine tasks or thesis. They use these argumentative writings because a paper deals with new and original ideas, and it must be written with strong and convincing argumentation. Faraway, argumentative skill is very important when students engaged in professional working environment, they have to convince and persuade colleagues related to their professions in well-behaved argumentation.

Certainly, argumentative writing skill is not at ease to get (Chanie, 2013; Deane and Song, 2014), and the most difficult kind of writing among others (Ferretti et al., 2007; Neff-van Aertselaer and Dafouz-Milne, 2008). Students frequently generate incomplete argumentation; they do not assert elements of argumentation; they do not write down clearly; there is insufficient evidence to support argumentation, and students might not comprehend or respond to other possibility of viewpoints (Ferretti et al., 2000). Amogne (2013) states that many students cannot criticize well statements and give convincing support. The most emerging problem is students' inability to conduct well-mannered declarative statements, because they are not used to work with this type of writing and also they have insufficient knowledge to support their argumentation considerably and clearly. Likewise, some research show that students' difficulties come from grammar and lexis (Chanie, 2013).

The main obstacle in argumentative writing is the indicator to measure the success. The success of argumentative writing is when reader can be persuaded, brought, and conveyed to the paradigm that is stated and believed by the writer (Pranowo, 2000). In other word, good argumentative writing should contain several aspects which are:

1. Data
2. Claim
3. Warrant
4. Backing
5. Modal qualifiers
6. Rebuttal (Shehab and Nussbaum, 2015; Toulmin, 2003, 2009) or at least contain the first three aspects (Karbach, 1987).

Ka-kan-dee and Kaur (2015), Lertpreedakorn (2009), Panahandeh and Esfandiari (2014), Promwinai (2010), and Schworm and Renkl (2007) are some of the researchers who attempted to overcome the difficulties in argumentative writing. Lertpreedakorn (2009) and Promwinai (2010) show that the ability for writing argumentation might be increased by choosing an effective strategy in order to stimulate students' writing ability. Research conducted by Schworm & Renkl (2007) employed *self-explaining* as a method to improve argumentative writing skill focused on ill-structured problems. Through this method and using the instruction about declarative knowledge and connected with argumentation could bring to light students' argumentative production. On the other hand, research by Panahandeh and Esfandiari (2014) revealed that a classroom which used metacognitive instruction strategy could perform influence better in writing ability for students with moderate writing ability compared with control classroom.

Another research from Ka-kan-dee and Kaur (2015)

states that there are some issues to decide on choosing the appropriate strategy to enhance argumentative writing ability. These according to Ka-kan-dee and Kaur (2015) are:

1. Employing different topics and various activities in the classroom in order to motivate student to be an active learner.
2. Analyzing textual examples and presenting students' understanding based on those texts in front of the class.
3. Understanding students' learning styles and affording necessitates to develop their writing ability.

Related to those strategies, teachers need to take into account an effective students' social interaction and provide effective scaffolding. In view of those strategies also, the researcher needs to consider instructional as an approach that can conceal all issues pointed out before.

Contextual teaching and learning (CTL) theoretically encompass all of the recommendations listed earlier. CTL principles can facilitate students to comprehend instructional subjects and develop creative ideas in the form of writing and make a link between academic subject and real world context. Context in this manner is related to existing experience, personal life spans, societal problems, and their milieu. There are seven principles which are contained in contextual teaching; constructivism, inquiry, questioning, learning community, modeling, reflecting, and authentic assessment (Nurhadi, 2002).

Another aspect that closely relates to argumentative writing ability is critical thinking. Keraf (2000) states that the foundation of argumentative writing skill is critical thinking ability. Without this ability, according to him, the product of argumentative writing only contains sequences of meaningless sentences or paragraphs. This claim is supported by Pranowo (2000), who confirms that there is a strong connection between critical thinking ability and argumentative writing.

Research questions

In general, these research questions are meant to compare students with argumentation writing skills with those with contextual and non-contextual instructions. Specifically, this research sought to address the following:

1. Are there significant differences between students with argumentative writing skills and those who learn by contextual and non-contextual teaching and learning?
2. Is there an interaction between instructional model and critical thinking ability to students' argumentative writing skill?
3. For lower level students' argumentative writing, is there significant difference between students who learn by

contextual and non-contextual teaching and learning?

METHODOLOGY

Design

A quasi-experimental design, with post-test measurements and two groups (experimental and control) was employed (Creswell, 2014). The independent variables of this study consisted of treatment and attribute variables. The treatment was contextual teaching and attribute was critical thinking ability. Classrooms are randomly assigned as treatment and control group. Only students in the treatment group received contextual learning. Students in the control group continued their normal lessons but they also solved the problems studied in treatment group.

Participant

The participants of the study consist of second year students studying in one of the Universities in Banten, Indonesia. The universities were selected conveniently. Fifty two students took part in this study. Of this number, 26 were experimental group and 26 were control group. Each group consisted of low and high level critical thinking ability.

Instrument

Instruments used in this research were questionnaires and tests. Questionnaires were employed to collect data regarding teaching method, while test instruments were used to collect data on the critical thinking and argumentative writing skill abilities. These instruments have been developed by the researcher. There were four stages:

1. Developed variables instrument
2. Developed instrument content
3. Limited field test
4. Validity and reliability test instruments

Argumentative writing instrument

Essay test was an instrument to assess students' argumentative writing skill. Students were required to write an argumentation on some topics. There were several assessments regarding argumentative writing;

1. Argumentation language, consisting of comparison and contention.
2. Argumentation contents, consisting of considering author credibility, empirical data, logic or reason, value, emotion, and attitude
3. Argumentation techniques, consisting of paragraph development and coherence.

Before argumentative writing instrument was used, this instrument was tested to other 20 students. They had to write argumentative essay at least 350 words, with certain topic. Students chose one topic from five topics provided. They were to choose either handwriting or type it in word processing software. The method to determine instrument reliability is interrater reliability (ratings). Ratings were calculated by two lecturers. As a result, the reliability score was 0.76. This score was categorized high as it showed that

Table 1. Mean of score of argumentative writing skill in the experiment and control.

Critical thinking ability	Statistics	Groups		Sum
		Contextual	Non-contextual	
High	N	13	13	26
	Mean	82.15	74.54	78.35
	Standard deviation	7.85	11.39	10.34
Low	N	13	13	26
	Mean	66.77	70.46	65.62
	Standard deviation	8.11	6.54	7.31
Total	N	26	26	52
	Mean	74.46	72.50	73.48
	Standard deviation	11.08	9.33	10.19

Table 2. Summary of Tukey post hoc two way ANOVA.

Compare groups	Absolute mean difference value	Free Degree	Q_{val}	Q_{tab}	Note
A1B1 and A2B1	7.62	4.48	14.14	2.798	Sig
A1B2 and A2B2	3.69	4.48	6.85	2.798	Sig

A1B1: Sample of High Critical Thinking Ability with Contextual Model; A2B1: Sample of High Critical Thinking Ability with Non-Contextual Model; A1B2: Sample of Low Critical Thinking Ability with Contextual Model; A2B2: Sample of Low Critical Thinking Ability with Non-Contextual Model.

this instrument could be used in this research.

Critical thinking ability instrument

Critical thinking ability data were attained by testing several aspects, which:

1. Ability to contrast knowledge. This aspect consists of arrangement and identification.
2. Ability of students to express their thinking openness. This consists of an ability to acquire similar and dissimilar author ideas.
3. Ability to understand author perspectives. This consists of explaining, resuming, and stating
4. Ability to analyze. This consists of comparing and contrasting
5. Ability to synthesize
6. Ability to evaluate argumentation.

Similar with argumentative writing instrument, critical thinking ability instrument also tested 20 students to determine validity and reliability. Validity instrument employs Pearson product moment, the item is valid if r score > r table at $\alpha = 0.05$. There were 30 items, 26 items were accepted (valid), but 4 items were invalid. Besides, reliability instrument employs alpha Cronbach, the reliability criteria is shown by alpha coefficient. As a result, from 26 items the alpha coefficient was 0.91 which was categorized as very high reliability.

RESULTS

Descriptively, the mean score of students' argumentative

writing skills in contextual teaching classroom is higher than the control group (Table 1). This condition holds for students who critical thinking ability is low and high. Further, according to statistical test (Tukey Post-Hoc), there is a significant difference between experiment and control groups at $\alpha = 0.05$. This condition lets the researcher to determine that contextual teaching model instruction has an effect on argumentative writing skills than non-contextual instruction model (Table 2).

This condition holds because contextual teaching affords the chance for students to actively learn and improve their previous knowledge base on information they got when studying in the classroom. Previous and new knowledge can be connected with students' daily life. Students act naturally and properly with brain function, human base psychology, and also three principles of humanity, which are dependency, differentiation, and self-regulated, all of these conditions lead to students' success when they write argumentations. Different conditions occur in control group classroom: instruction control by lecturers, students act as objects, and one directional instruction, which of course make students become passive.

The findings also suggest that there is an interaction between instructional model and critical thinking ability; the F value (4.61) > F table (4.030) (Table 3). In other words, argumentative writing skill ability is affected by

Table 3. Summary of measurement analysis with two between subject factor (group and critical thinking ability) and a within subjects factor (test).

Change sources	Free degree	Sum square	Sum square average	F value	F table 0.05	F table 0.01
Between groups	3	2.429.77	809.92	10.80*	2.683	3.955
Within groups	48	3.598.46	74.97	-		-
Groups	1	723.77	723.77	9.65		
Critical thinking	1	1.360.69	1.360.69	18.15**	4.030	7.159
Interaction	1	345.31	345.31	4.61*		
Total	51	6.028.23	-	-	-	

** : Significance at α = 0.01; * : Significance at α = 0.05.

critical thinking ability and instructional model. This finding suggests that the lecturer has to consider critical thinking aspect when teaching argumentation writing. Critical thinking ability can be accessed from students' ability when they identify problems, arrange table, express their mind, contrast, summarize, analyze, and conclude. These conditions are supported by contextual teaching model, because this model has questioning principle that lead students to know, reveal and get appropriate information while they are writing argumentation assignment.

The findings show that students with high critical thinking ability in contextual model get better scores than those in non-contextual teaching. The mean argumentative writing score between experiment and control group respectively (82.15 and 74.54) (Table 1) and statistically significant at $\alpha = 0.05$ (Table 2). This occurs because students with high critical thinking ability have "assets" or "resources" to support the condition which is generated by contextual model. Contextual model requires students to find for themselves information and knowledge through activities such as:

1. Observing
2. Questioning
3. Explaining
4. Designing
5. Conjecturing
6. Proving
7. Analyzing, and
8. Concluding.

Contextual model also generates learning community which supports students to learn and improve upon their ideas in their community. Unlike in high students' critical thinking ability, it seems that contextual model is "unsuccessful" to facilitate students with low critical thinking ability. The mean score of argumentative writing ability with contextual and non-contextual in low critical thinking ability is 66.77 and 70.46, respectively (Table 1) and statistically significant at $\alpha = 0.05$ (Table 2). Inquiry

process cannot function well in contextual classroom because of students' inability to get information and knowledge by themselves through inquiry process. This is different with non-contextual teaching where students with this ability get advantage from lecturers who guide them in writing argumentative assignment.

DISCUSSION AND CONCLUSION

This study shows that overall, students' argumentative writing skills in contextual model are better than those in non-contextual model. But, particularly, students with low critical thinking ability failed to improve their writing ability in contextual than those in non-contextual classroom.

Based on these findings, it can be concluded that students' argumentative writing skills are not only affected by instructional model but also supported by students' critical thinking abilities. Students with high critical thinking ability will be better if we put into practice contextual model, as it follows students with low critical thinking ability may use non-contextual instructions.

Also the finding indicated that all students with difficulties require special attention. These students have special educational needs. Under their guidance, lecturers have to ask students to construct their own knowledge. These students need explicit instruction and fade it up toward contextual instruction. For further research, we need to construct and improve upon teaching strategies which takes care of student with difficulties, especially students who have low critical thinking ability.

Conflict of interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Variance difference between maximum likelihood estimation method and expected A posteriori estimation method viewed from number of test items

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The aim of this study is to determine variance difference between maximum likelihood and expected A posteriori estimation methods viewed from number of test items of aptitude test. The variance presents an accuracy generated by both maximum likelihood and Bayes estimation methods. The test consists of three subtests, each with 40 multiple-choice items of 5 alternatives. The total items are 102 and 3159 respondents which were drawn using random matrix sampling technique, thus 73 items were generated which were qualified based on classical theory and IRT. The study examines 5 hypotheses. The results are variance of the estimation method using MLE is higher than the estimation method using EAP on the test consisting of 25 items with F= 1.602, variance of the estimation method using MLE is higher than the estimation method using EAP on the test consisting of 50 items with F= 1.332, variance of estimation with the test of 50 items is higher than the test of 25 items, and variance of estimation with the test of 50 items is higher than the test of 25 items on EAP method with F=1.329. All observed F values ≥ 1.00. 5 RMSE in items 10, 15, 20, and 25 are different in both MLE and EAP, with t = 3.060, $\alpha = 0,011$, thereby meaning that statistical null hypothesis are rejected. The study concludes that variance of MLE method is higher than EAP, and the test with 50 items has higher variance than that with 25 items, the accuracy of EAP estimate higher than that of MLE in item 10, 15, 20, and 25.

Key words: Variance, RMS of estimation, maximum likelihood, expected A posteriori.

INTRODUCTION

There are two types of psychological and educational measurement theories; classical and modern. Such a modern measurement theory is also known as item response theory which is developed in response to the weakness of the classical measurement theory, mainly in its dependence among groups of test-takers and items. Dependence means that result of measurement depends on groups of those who do the test. If such a test is

provided to groups of its takers who have high proficiency, level of difficulty of items assessed in the test is getting lower. On contrary, if it is given to those with low capabilities, level of difficulty of the test items becomes higher (Hambleton, 1991). It was found that the classical test theory (CTT) had some limitations, however, Item Response Theory (IRT) showed a variety of benefits such as:

1. Estimating item difficulty
2. More stable in terms of difficulty indeces
3. More stable of internal consistency, and
4. Markedly reducing in error's measurement (Magno, 2009).

IRT, as a model- and item-basedapproach, is obviously considered succesful in its use in terms of research and practice applications. The main role of IRT model is to estimate someone's position on a latent dimension (Reise and Revicki, 2014). In addition, estimation quality depends on accuracy criteria consisting mean square error (MSE), bias and estimation variance. The results showed that parameter estimation is much more better by implementing priory, particularly for two and three parameter models (Baker, 2004).

The aim of educational measurement is to know level of test takers' ability that could be used in selections for decision-makings. Results of such selections are used to identify whether or not candidates can be accepted in a particular program. A decision to accept the candidates or not is often wrong which may bring negative implications to further individuals' developments. An inappropriate decision is often caused by the use of invalid and unreliable instruments or tests, results of measurements which are very different from the actual conditions so that it contains high uncertainty. In contrast, a measurement is believed containing high accuracy if its result has small RMS and variance.

Perspective proposed by DeMars reveals assumptions on item response theory relating to unidimensional, local independency and model specification accuracy (DeMars, 2010). Firstly, unidimensional is a test measuring only a character or a particular test takers' ability. Items in a test, for example, just measure participants' ability to count, not to assess their proficiency in a language either. Statistically, unidimensional can be calculated its Eigen score using factor analysis, indicated by a dominant one. Secondly, local independency is meant that the influence of test takers' ability and test items is supposed to be constant; test takers' responses on the items are not statistically connected. "This assumption can be accepted if test takers' answer in a certain item do not influence answers in other items. Test takers' answers in some test items are expected to be unrelated" (Hambleton et al., 1991). Implication of such assumption causes is that the test can be analyzed item per item. For the test takers, an

analysis is also done on individual basis.

Correct answer probability, item parameter and test takers' characteristics are correlated in a logistic formula model. As a result, item curve characteristic is reflected by logistic model used as a basis of calculation (Naga, 1992). Model description of a parameter in a curve of item characteristic is level of difficulty of item itself (b_i). The higher level of difficulty a certain item has, the higher ability the test takers need to answer such item correctly. Thus, as shown in the location, the higher level of difficulty the test item has, the righter position it will be.

In a two-parameter logistic model, it shows that such a model calculates item level of difficulty (b_i) and item discrimination index (a_i). The picturing in item arch curve (ICC), item discrimination index is shown in the curve of item with slope or curve precipitousness. An item with high precipitousness shows high discrimination index or value of a_i is high. In contrast, slope item curve shows low discrimination index or value of a_i is low. Here is a formula for two-parameter logistic model:

$$P_i(\theta) = \frac{e^{Da_i(\theta-b_i)}}{1+e^{Da_i(\theta-b_i)}} \quad i=1,2,3, \tag{1}$$

Pi (θ) = probability of test takers having ability θ chosen randomly that could answer item i correctly.
θ = subject's level of ability
bi = parameter of item level of difficulty for i
ai = discrimination index for item i
n = number of items in a test
e = numeral valuing 2.718
D = scaling factor made in order that logistic function closes to function of normal ogive (Hambleton et al., 1991)

Estimation is means fathoming or apprising. Estimation contains the findings of appropriate values for parameters of equality using certain ways or methods (Makridakis et al.,1999). Some differences, however, may be found between them. Such differences are:

1. Regression model is often applied in variables that have linear correlation; while in parameter logistic model, there is a correlation between test item and nonlinear test takers' ability.
2. Independent variable in regression model is observable. On contrary, independent variable of test takers' ability (θ)is unobservable in item response theory (Hambleton et al., 1991). Since actual scores of test item parameters and ability of test takers are unidentified, an analysis and estimation for parameters of test takers' ability and item scores is required to do. The identification of scores of parameters is known as parameter estimation.

A study by Borgatto and Pinheiro (2015) aims to determine the impact of ability estimation on IRT with respect to the difficulty level of the test and to evaluate

whether the error of estimation can be influenced by method of estimation used. There are 2 estimation methods used, which are weighted likelihood estimator (WLE) and MLE. EAP method is divided according to its prior θ uniform and normal distribution, and this uniform distribution is compared with WLE. The standard measurement to determine the accuracy of estimation method is Mean Squared Error (MSE). Simulation uses 4 tests based on the number of items which are 15, 30, 45 and 60 items. The result of study showed that uniformed EAP has better MSE than WLE with 45 items, and from this result it was suggested to use more items in estimating ability parameter.

Accuracy is meant as the most criteria used to evaluate the works of models of estimating methods. Accuracy shows level of correctness of estimating result. It can be measured using average dimension of square error which is referred to as *Mean Square Error* (Makridakis et al., 1999). A standard error of estimate is commonly composed of two components, including bias in the estimate and MSE (de Ayala, 2009).

Uncertainty of measurement contains measurement estimation error. In a regression method, correlations of two variables stated in simple regression lines in forms of justifiable and unjustifiable errors. An estimation of student's scores in a particular test is done using logistic analysis which is basically in line with what Hambleton (1991) stated that logistic model is nonlinear correlation and measuring invisible matter. Although logistic model is nonlinear correlation, the interpretation of fault or *error* is equal to deviation. Total deviation $(Y_i - \bar{Y})$ consists of unjustifiable deviation $(Y_i - \hat{Y})$ and justifiable deviation $(\hat{Y}_i - \bar{Y})$ (Makridakis et al., 1999).

Justifiable deviation shows differences between result of ability estimation and its mean score $(\hat{Y}_i - \bar{Y})$, and this was used as a basis for calculating estimation variance in this research analysis discussion. As previously discussed, the estimation accuracy is indicated by *Mean Square Error*, bias, and variance. Such variance is seen as a part of concept of measurement uncertainty. Variance (σ^2), in which the high one shows high uncertainty in its parameter measurement. Variance also shows score distribution. The bigger score range distribution it has, the higher variance it will be. This means that the accuracy of estimation measurement is low or vice versa. Score of parameter obtained through such estimation contain big variance. Thus it is not very accurate. In contrast, if score of parameter obtained through estimation contain small variance, it $\sum s^2$ means that the score of parameter is sharp and accurate (Naga, 1992).

Estimation accuracy with *residual error* score is also referred to as *mean squared error* (MSE), while variance is indicated by a distinction between estimation score and

average score $(Y_i - \bar{Y})$ as a justifiable deviation. Hambleton et al. (1991) explains that score of *residual error* of *maximum likelihood estimation* method is higher than that of *expected a posteriori* method. Hambleton et al. (1991) clearly states that scores of *residual error* of MLE is higher than EAP. This indicates that the accuracy of EAP estimation is better than MLE (Hambleton et al., 1991). Swaminathan et al. (2003) argues that "*Bayes* procedure generally can result to smaller variance compared to that generated from *maximum likelihood*. Baker et al. (2004) points out an estimation bias resulted from both of the estimation methods; "*there was little difference between the MLE/EM estimates and those obtained via the Bayesian procedures*". This means that accuracy of both estimation methods is equal or at least it has a little difference so it is possibly ignored. There are many items in a set of test in *item response theory*, and test length estimation variance influence accuracy of ability estimation.

In a classical testing theory, longer tests are more trustful than those of the shorter ones, yet in an item response theory, shorter test may be more reliable than those of the longer ones. This can be seen in a *computer adaptive test* in which level of difficulty is adjusted with test takers' ability and will bear small measurement error (Embretson and Reise, 2000).

The accuracy of ability estimation is not visible when using a few numbers of items because it requires many of those in order to be able to judge it. A test with 30 items indicates fixed error much lower than that with 20 items (Embretson and Reise, 2000). Referring to experts' points of view (Embretson and Reise, 2000):

1. 30 items indicate fixed error smaller in number than that with 20 items. This is in line with classical theory in which it believes that the more items in a package of test, the more trustful it will be
2. In item-response theory, there is no guarantee for the greater number of items in a test package to have little number of errors when comparing to that with small number of items.

Referring to the theoretical discussion, some hypotheses can be addressed as follows:

1. Variance of ability estimation method (θ) of MLE is higher than that of ability estimation (θ) of EAP in a test with 25 items.
2. Variance of ability estimation method (θ) of MLE is higher than that of ability estimation (θ) of EAP in a test with 50 items.
3. Variance of ability estimation (θ) of a test consisting 50 items is higher than that of a test with 25 items in MLE method.
4. Variance of ability estimation (θ) of a test consisting 50 items is higher than that of a test with 25 items in EAP

method.
5. Accuracy of RMS in EAP method is higher than that of MLE method particularly in item 10, 15, 20 and 25.

METHODOLOGY

Procedure of ability estimation can be done using method of *Maximum Likelihood (ML), MAP and EAP* (Embretson and Reise, 2000). The word *"likelihood"* interpreted as possibility or probability' while *"maximum"* means big opportunity. "Maximum likelihood", therefore, may be interpreted as probability that has biggest opportunity. "*Maximum likelihood"* is a model of "*total likelihood*" (Du Toit, 2003). This biggest opportunity will depend on probability of correct and wrong answer made by test takers when doing a particular test as well as logistic model used in it. To indicate maximum score, calculation of iteration is done (Baker and Kim, 2004). Ability estimation of *maximum likelihood* method determines score of maximum ability belongs to each test taker, calculating process of formula 1 up to 5 (Du Toit, 2003). Score of $P_j(\theta)$ acquired from formula 1, $L_i(\theta)$ from formula 2 in term of multiplication, notated in *quadrature* $P_j(\theta) = P(X_k)$ as follows:

$$\log L_i(\theta) = \sum_{j=1}^{n}\{x_{ij}\log_e P_j(\theta) + (1 - x_{ij})\log_e[1 - P_j(\theta)]\} \tag{2}$$

$L_i(\theta)$ = Score of maximum ability for each test taker.

$P_j(\theta)$= Probability of ability in an item as shown in formula 1.

x_{ij} =Number of correct item.

1-x_{ij}= Number of wrong item.

Maximum score of ability of each test taker $L_i(\theta)$ derived in logarithm which is equal to null using the following formula:

$$\frac{\partial \log L_i(\theta)}{\partial \theta} = \sum_{j=1}^{n}\frac{x_{ij}-P_j(\theta)}{P_j(\theta)[1-P_j(\theta)]}\frac{\partial \log(\theta)}{\partial \theta} = 0 \tag{3}$$

The estimation of ML, θ is calculated using Fisher scoring which is commonly known as "*Fisher information*". Formula used for two-parameter model is as follows:

$$I(\theta) = \sum_{j=1}^{n} a_i^2 P_j(\theta)\left[1 - P_j(\theta)\right] \tag{4}$$

$I(\theta)$ = information function of respondent's ability.
θ = respondent's level of ability.
a_i = discrimination index of item i.

After obtaining score of ability information function from a two-parameter logistic model, an iteration is done using the following formula:

$$\theta_{t+1} = \theta_t + I^{-1}(\theta)\left(\frac{\partial \log L_i(\theta)}{\partial \theta}\right) \tag{5}$$

θ_{t+1} = estimation score of ability in existing round.

θ_t = estimation score of ability in previous round.

$I(\theta)$= ability information function.

$\left(\frac{\partial \log L_i(\theta)}{\partial \theta}\right)$ = a respondent's estimation score of *maximum likelihood*.

Calculation is done until no changes may appear in the previous and last rounds or convergence. Criteria of such convergence is 0.05 or 0.01, even can be lower to 0.001. By having convergent calculation, estimation score of ability (θ) can be found or determined.

Method of ability estimation of EAP

Lord (1986) described probability of using Bayes estimation because of a tradition in education to assess similar groups of test takers using parallel or same tests from year to year. In this case we can make good description about ability frequency distribution for further groups of test takers. We can also do ability estimation of using Bayes approach through estimating procedure of Bayesian hierarchy. Such procedure, however, is difficult to implement because of lack of computer program available for it. "Researchers have adopted more pragmatic approaches in which the Bayes approach is seen as a tool to improve parameter estimation" (Baker and Kim, 2004).

In line with the latest improvement of computing system which is simpler but more sophisticated, an estimation does not use integral any longer but is based on discrete distribution. Even estimation done using EAP method could predict level of ability for all correct or wrong responses. EAP is a method applied through average calculation of *posterior* distribution. EAP calculation is done through *"Mislevy Histogram"*; its description does not show area width in a curve (Baker and Kim, 2004).

1. Determine score θ which is specifically called as *quadrature nodes* as shown in abscissa.
2. In ordinate it shows density. Usually such density and quality is taken from fixed normal distribution.
3. In "Mislevy histogram" it is assumed as normal distribution so that score or value X_k can be identified, value $A(X_k)$ shows distance between X_k and another X_{k+1}. If X_k determines same distance, value or score of $A(X_k)$ can be identified by: one divided by number of nodes. However, if the distance of X_k is not the same as $A(X_k)$, the value of $A(X_k)$ is the deviation between X_k and X_{k+1}.
4. Calculating score of L (X_k)

X_k is the same as θ_k, L is *likelihood* function of participants' ability, formula in for of multiplication as shown in formula 2.

$$L(X_k) = \prod_{i=1}^{n} P_i(X_k)^{u_{ij}} Q_i(X_k)^{1-u_{ij}} \tag{6}$$

$L(X_k)$=each participant's score of maximum ability.

$X_k = \theta_k$= level of ability gained from formula 1
P_i = probability of correct answer
Q_i = probability of wrong answer
(v) Calculating score of ability estimation

$$E(\theta_j|U_j,\xi) = \theta_j = \frac{\sum_{k=1}^{q} X_k L(X_k)A(X_k)}{\sum_{k=1}^{q} L(X_k)A(X_k)} \tag{7}$$

$E(\theta_j|U_j,\xi) = \theta_j$ is the average level of ability with identified requirement that the test takers' responses in the scoring is 0 or 1.

$E(\theta_j)$ = score of ability expected

ξ = score of item parameter

q = number of node (quadrature point).

Method of maximum likelihood estimation and method of expected A posteriori

The difference with both methods lays on the ability to estimate test takers' ability. *Maximum Likelihood Estimation* is not able to analyze test takers' ability if all answers they make are correct or wrong and estimating process is done with *iteration*. In contrast, *Expected A Posteriori* is able to calculate test takers' ability although they have all wrong or correct answers in such a test. In addition, the calculating process is done without *iteration* which is based on average scores of answers made by each test taker after answering certain number of items. Baker and Kim (2004) explain that *Expected A Posteriori* method uses prior data made by a particular program as "artificial data" using formula:

$$\hat{f}_{ik} = \sum_{j=1}^{N} \left[\frac{L(X_k)A(X_k)}{\sum_{k=1}^{\xi} L(X_k)A(X_k)} \right] \tag{8}$$

$\hat{f}_{ik}$= artificial data "*artificial examinee*" for each participant's ability (X_k)

X_k = θ_k= level of ability
$A(X_k)$ = quality, distance X_k with X_{k+1}
q = number of nodes (quadrature point) referred to level of ability.

$$\hat{r}_{ik} = \sum_{j=1}^{N} \left[\frac{u_{ij}L(X_k)A(X_k)}{\sum_{k=1}^{\xi} L(X_k)A(X_k)} \right] \tag{9}$$

$\hat{r}_{ik}$= artificial data "*artificial item*" correct answer in item -i in participant's level of ability (X_k)

X_k = θ_k= level of ability
$A(X_k)$ = quality, distance X_k with X_{k+1}
q = number of nodes (quadrature point), referred to level of ability.

To achieve research objectives, a numerical thinking test for students of Senior High School in Lombok-NTB was standardized applying item-response theory of two-parameter logistic model. Research was done at twenty one state senior high schools in Lombok, West Nusa Tenggara (NTB) Province with tenth year students taken as samples. The schools were situated in four regencies/cities; Mataram City, West Lombok Regency, Central Lombok Regency and East Lombok Regency. Data of this research were collected in 2008. This was an experimental research by analyzing data with BILOG MG software ver 3.0.

Independent variables were used in this research, employing ability estimation methods; *Maximum Likelihood Estimation* (MLE) and *Expected A Posteriori* (EAP). Both of them are different in method of calculating ability estimation.

Moderator variable can strengthen or weaken independent variable, referred to as second independent variable. In this research, moderator variable had many items in test packages, grouped into two test packages consisting 25 and 50 items each. Dependent variable in this research was the accuracy of estimation, limited on ability estimation variance with a unit of measurement of ability estimation result (θ).

Variable independent was grouped into two; method of ability estimation (θ) of MLE and method of ability estimation (θ) of EAP. Moderator variable; number of items in a test package was divided into the one with 25 items and the other with 50 items. Number of item which is less than 25 may bear an inaccurate result of item analysis program.

Populations of this research were respondents and test item population. Respondent populations were students, who gained data about their numerical thinking talent and test item population. Student populations consisted of 21 ninth year students of senior high schools in Lombok-NTB, situated at four regencies/cities. Test item populations had 120 items and grouped into three packages; A, B and C covered 40 items each. Each of the three packages had equal number of anchor items as many as nine. Thus, number of item populations were (3 x 40) − (2 x 9) = 102 items. Number of minimum samples required in a particular analysis also depends on sort of program analysis used. There is such a program requiring at least 25 items with 500 respondents. Another one may need not less than 1000 respondents (DeMars, 2010; Naga, 1992). Furtherly, quality of test used in a research data gathering was elaborated:

Test reliability

In the phase of trial I Alpha reliability coefficient of test packages A = 0.865, B = 0.906 and C = 0.933 and in trial II = 0.657. Sugiyono elaborates criteria of correlation interpretation as 0.60-0.799 (strong) and 0.80-1.00 (very strong). Calculation results gained by either modern or classical theory have high correlation coefficient, bigger than minimum requirements in a test standardizing oriented to cognitive, namely 0.85 (Sugiyono, 2010).

Test validity

Examining quality of numerical thinking talent test by internal and external validity calculation

External validity in this research used criteria variable of Differential Aptitude Tests (DAT) test result, subtest of numerical thinking talent. In subtest of numerical DAT, all items consisted of application of arithmetic operation; while standardized test consisted of that covering arithmetic operation and deliberation. Therefore, external validity examination was done prior to item separation based on two dimensions revealed by the test. Because of this, each respondent had two score dimensions; score dimensions 1 and 2. Each of this dimension correlated with scores obtained from subtest DAT through calculation of *Pearson* Correlation. Results of tests package A, B and C consecutively show as 0.415, 0.578 and 0.421 at the same dimension. At different dimension, obtaining correlation coefficient was 0.351, 515, and 0.286. Referring to this condition, tests used in data gathering of this research had good validity. Result of test examining or calibrating according to item response theory obtained from the three test packages shows:

1. In the test package A there were dominant factors based on eigen value of 7.767 with variance of 19.181%. At the next second factor was 2.001 with variance 5.004% and third factor was 1.411 with variance 3.528%.
2. Test package B has the biggest Eigen value of 7.261 with variance 19.152%, the next second factor was 2.157 with variance 5.392% and the third one was 1.535 with variance 3.839%.
3. The biggest eigen value of test package C was 7.707 with total variance 19.268%. The next second factor was 2.021 with variance 5.054% and the third one was 1.329 with variance 3.323%.

Local independency examination was aimed at recognizing whether or not an item and another in a subpopulation of certain participants' ability characters had independency statistically. Local independency indicated by score of covariance null. In this research local independency examination was done through;

1. Examining covariance score in its matrix between theta score from 10 of theta score interval and criteria reference of small covariance score or nearly reaching null. From the result of examination through covariance calculation, upper subsample (10th interval) and lower subsample (1st interval) were obtained. It had covariance score which was high enough or not nearly reaching null: test packages A = 0.23019, B= 0.2176 and C=0.2610. Because of this, an examining process can be continued to correlation examination among items; and
2. Examining correlation matrix among items using statistical package for social sciences (SPSS), gaining result of pairs of items were correlated in the three test packages. In test package A, there were three pairs of items correlated, four pairs of items for test package B and a fair of items for test package C.

Compatibility examination was conducted to know whether or not empirical data of each test item of numerical thinking talent was compatible with two-parameter logistic model. In the second phase of calculation or calibrating process, results of test item estimation were achieved covering level of difficulty (b), test item discrimination index (a) and calculation result of *chi-Square* (χ^2) together with probability index for each item. Level of significance applied in the examination was 0.01, meaning that the test items were compatible to two-parameter logistic model with index of probability ≥ 0.01, thus interpreting that test items which are good quality are 73 items. All 73 items then were considered as "pool item", and this study ultimately applied matrix sampling. Results of model compatibility examination and local independency analysis were suitably done by Jumailiyah (2015).

In line with the objective of this study, the study aims to know the distinction based on estimating methods and estimation variance referring to moderator variable consisting of 50 and 25 items. Seventy three qualified items were taken as populations as references to having research samples. Research samples were chosen randomly in two phases; the first phase was for choosing 50 items and the second one was for the rest of 25 items.

RESULTS AND DISCUSSION

Data descriptions of test and theta (θ) score of numerical thinking talent

This research employed three packages of tests. Thus three matrixes of respondents' scores were obtained. The three packages of tests consisted of multiple choice tests containing 40 items which were scored dichotomy. The highest variance gained from test package C could reach 63.769, while central tendency used calculation average. The highest calculation average reached 21.32 from test package A and the lowest was 18.76 coming from test package C.

In this section, data about result of ability estimation (θ) prior to requirement examination of items-response theory will be delivered. Data were analyzed using estimation calculation through ability estimation method

of *maximum likelihood* of two-parameter logistic model. Result of ability estimation (θ) shows that the lowest minimum score was -3.6129 gaining from test package A, while test package C could only reach -3.1351. The highest theta was 3.8667 coming from test package C; whereas, the lowest one was 3.4994 obtaining from test package B.

The highest variance was found in test package C reaching 1.230 with deviation standard 1.109, while the highest calculation average of test package C was 0.0647. Data calculation of test package C reached the lowest one but had the highest variance. Distribution of *skewness* indicated positive index in the three test packages. The three types of data tended to distribute sticking outward to the right showing that the ability of most respondents were under that belonged to average. Either the raw score distribution or the theta data gained from estimation indicated same distribution in the three test packages; more data were under calculation average.

Curtosis score was found positive, indicating that it has acute distribution vertically. Result of estimation shows that data would be pulled out or moved to center of distribution. This also happened to the above of it. Result of ability estimation calculated using *maximum likelihood* method indicated that the extremely high score would have high frequency. Theoretically, when the score was further from center of distribution, it would be getting smaller or lower, yet empirical data of this research indicate that there was a tendency of getting frequency declined.

Data descriptions of ability estimation results

Data about ability estimation results refer to estimation method of *maximum likelihood* and method of *expected a posteriori,* and data based on number of items of 50 and 25 were analyzed to see estimation variance differences. Descriptions of such data are shown in the following Table 1.

An important point can be extracted from Table 1 that there were significant differences on variable magnification data which resulted from estimation in four groups using *maximum likelihood* and *expected a posteriori.* This happened either in tests with 25 or 50 items as shown in Figures 1 and 2.

Figure 1 shows results of MLE with 50 test items on the top left indicated higher ability was bigger having higher frequency than that on the top right of distribution or estimation score was getting low as seen from -2.00 up to -3.00 which had very little frequency. On the top left +2.00 up to +3.00, it indicates high frequency. If it is compared to Figure 2, releasing estimation result of EAP method, it shows that abscissa to the left and right was unbalanced. An abscissa to the left could reach up to

Table 1. Descriptions of MLE and EAP data viewed from number of item of 50 and 25.

Statistics	Estimation methods and number of items			
	MLE 50	EAP 50	MLE 25	EAP 25
N Respondent	3159	3159	3159	3159
Range	7.9239	3.6701	7.4947	4.0719
Minimum	-4.0107	-1.0804	-3.7882	-1.4087
Maximum	3.9132	2.5897	3.7065	2.6632
SD	0.9858	0.7788	1.0771	0.9246
Variance	0.972	0.606	1.160	0.855
Skew	0.600	1.039	0.678	0.779
Curtosis	2.827	1.293	1.190	0.095
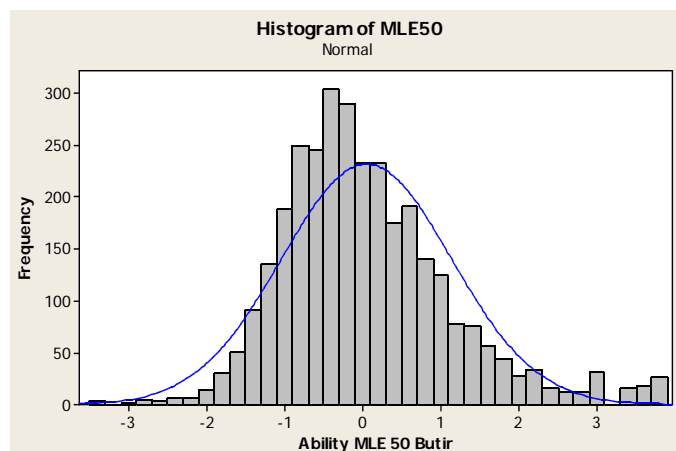
Figure 1. Ability estimation result of MLE 50 items.

Figure 2. Ability estimation result of EAP 50 items.

+2.8, while to the right was just reaching up to -2.1. Figure 1 and 2 shows different data range of which further analysis will confirm that both MLE methods differ with EAP in variances, data range in EAP is narrower than that of MLE leading to differences in their variance. Figures 3 and 4 describes 25 test items. Result of ability
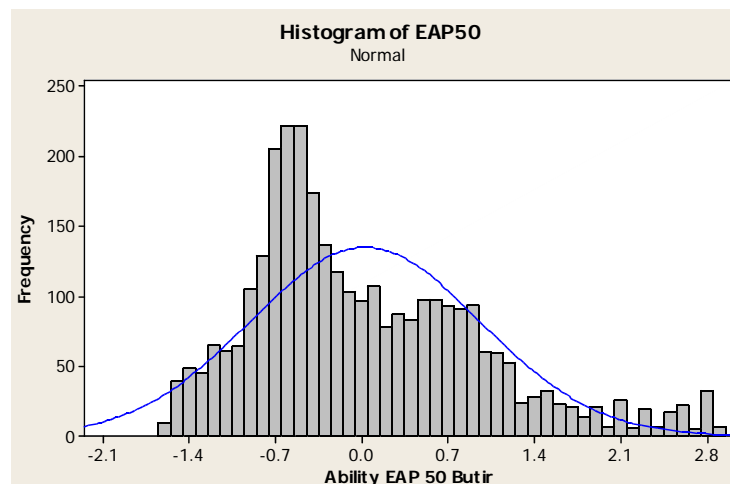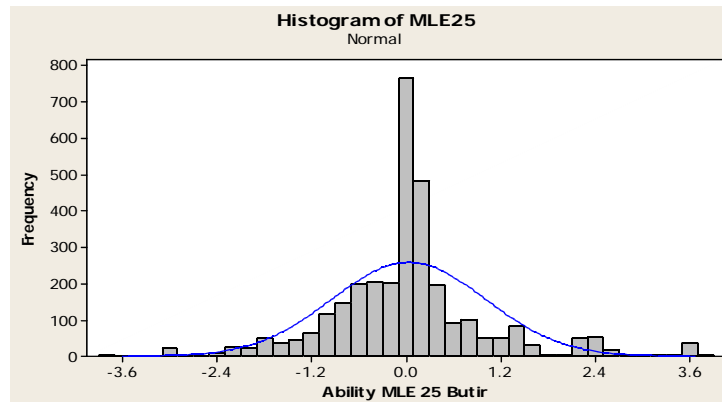
Figure 3. Ability estimation result of MLE 25 items.
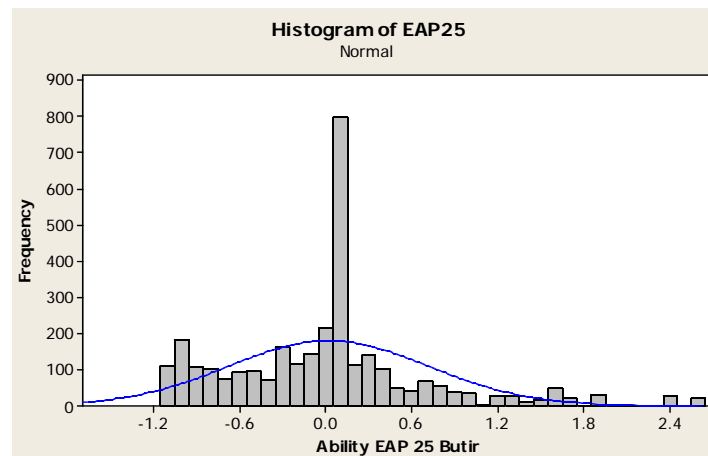
Figure 4. Ability estimation result of EAP 25 items.

estimation applying MLE as shown in Figure 3 justify that both top left and top right had high enough frequency with level of ability (θ) +3.6 and -3.6. Symmetrical index of range of estimation result indicated that it was equal either to the left or to the right. Figure 4, moreover, displays estimation result obtained through ability estimation method (θ) of *expected a posteriori* ranging from -1.2 to + 2.4 which shows different range in the graphs resulted from both methods in which MLE range is wider that EAP. Such differences will result in variance differences of both methods as it will be proven in hypothesis test. Further data exposure after estimation calculation through Bilog MG and Excel programs is presented in Table 2.

This research examined variance difference in two groups. The first group was constructed based on independent variable with methods of *Maximum Likelihood Estimation* and *Expected A Posteriori*; whereas, the second one was made up based on moderator variable consisting of 50 and 25 test items (Table 3).

Ability estimation variance ($\hat{\theta}$) of MLE method was bigger than that of ($\hat{\theta}$) gained through EAP method in each test consisting of 25 items. The value of = 0.606 and the value of = 0.972. The value of F_{hit} = 1.6023 while F_0 = 1.000. Smaller test items of 25 items each show small variances in both methods with different EAP. Then with bigger test items of 50 items, the value of = 0.806 and the value of = 1.073. The value of F_{hit} = 1.332 while F_0 = 1.000. Bigger test items of 50 items each show variances in both different methods with smaller variances in EAP method. Thus, variance differences of EAP method is smaller than MLE method in bigger or smaller items. High variance indicated measurement uncertainty. Variance can also be indicated by score distribution. The bigger score range distribution the test

Table 2. Summary of Ability estimation score ($\hat{\theta}$) variance of MLE and EAP methods viewed from number of items.

Number of items	Methods of ability estimation ($\hat{\theta}$)					
	Maximum likelihood estimation			Expected A posteriori		
	N	$\sum_{i=1}^{N}(\theta_i - \hat{\theta})^2$	Variance	N	$\sum_{i=1}^{N}(\theta_i - \hat{\theta})^2$	Variance
50 items	3159	3390.33	1.0732	3159	2545.47	0.8058
25 items	3159	3069.06	0.9715	3159	1915.29	0.6063

Table 1. Summary of statistic-based hypothesis examination result.

Variance	N	Scores of variance	Formula F	Score F	Decisions
σ^2_{MLE25}	3159	0.9715	$F = \dfrac{\sigma^2_{MLE25}}{\sigma^2_{EAP25}}$	1.6023	Rejected H_0
σ^2_{EAP25}	3159	0.6063			
σ^2_{MLE50}	3159	1.0732	$F = \dfrac{\sigma^2_{MLE50}}{\sigma^2_{EAP50}}$	1.3318	Rejected H_0
σ^2_{EAP50}	3159	0.8058			
-	-	-	-	1.1047	Rejected H_0
			-	1.3290	Rejected H_0

had, the more variances it might bear from it, yet this means that the measurement accuracy was low. This might also occur vice versa. When small variance occurs, the accuracy of estimation gets higher.

Ability estimation variance ($\hat{\theta}$) consisting of 50 test items had more variances than that ($\hat{\theta}$) consisting of 25 items obtained through *Maximum Likelihood Estimation* (MLE) method. The value of = 0.606 and the value of = 0.972 The of F $_{hit}$ = 1.6023 while F$_0$ = 1.000. Smaller test items of 25 items each show small variance in both different EAP methods. Then the bigger test items or test with 50 items come with the value of 0 = 0.806 and the value of = 1.073 The value of F $_{hit}$ = 1.332 while F$_0$ = 1.000. The bigger test items of 50 items each show small variance in both different EAP methods. Consequently, the test consisting less number of items may have high level of accuracy when estimation is done through MLE.

Furthermore, determining the estimation of RMS or RMSE (Root Mean Squared Error) (du Toit, 2003), there are 73 items identified as good items based on classical and modern test, randomly taken from the tests of 10, 15, 20 and 25 items in each sets (A, B, and C). These 73 items were, therefore, analyzed in both MLE and EAP.

According to Table 4, RMS or RMSE resulting from MLE and EAP implemented paired T-test. The pair of

RMSE correlates 0.837 in 0.001 significance. Hypothetical test of RMSE differences between both MLE and EAP was analyzed by SPSS ver.18. The result was T = 3.060 (0.011 significance), meaning that RMS of EAP is lower than that of MLE. Other view in this study includes the number of test items to analyze, test with 50 items and test with 25 items. Both of these item groups are differentiated by MLE and EAP methods. Therefore, both methods do not show differences since both methods come with bigger variance on bigger items compared to that of test with smaller test items. A measurement appears to be good if it results in small variance. In classic theory, the more the test items the better their reliability and accuracy, thus while this study is in contrary with classical approach, it supports item response theory saying "smaller items do not mean it will result in accurate test (Embretson & Reise, 2000). Moreover, based on the accuracy of estimate of RMS, this study resulted that RMS of EAP is lower than that of MLE, and EAP resulted the estimate more accurate than that of MLE.

DISCUSSION

The study was preceded with development of numerical

Table 4. RMS estimate in both MLE and EAP, based on the number of items.

Set	Number of items	RMS	
		MLE	EAP
A	10	0.7941	0.6374
	15	0.5579	0.5373
	20	0.5057	0.4927
	25	0.4505	0.4357
B	10	0.7950	0.6125
	15	0.6429	0.5901
	20	0.5126	0.5775
	25	0.4577	0.4268
C	10	0.7418	0.5601
	15	0.6257	0.4972
	20	0.5367	0.4415
	25	0.4285	0.4071
Mean		0.5874	0.5180

reasoning talent test to show student's capability in arithmetic operation, arithmetic reasoning, basic of mathematics and its implementation in daily life. In the test development, 3159 samples and 102 items were divided into three sets of test. The quality test on the test items was based on classical test and parameter IRT 2 yielding in 73 test items that serve as "test bank".

The items were then selected into 25 items group and 50 items group provided that they did not show "mutual exclusive" overlapping and were randomly based on the test construction. The two test item groups were tested with two methods that is, MLE of Maximum Likelihood group and EAP of Bayes group. The measurement used to show the accuracy estimation is variance from which the variance differences were tested in F significance differences while other researches presented such estimation in picture.

In some literature and studies, the two MLE estimation methods were performed through iteration that they failed to obtain maximum final value or were not convergent. The second group of Bayes employed prior distribution for their working principle. De Ayala (2009: 71) is presented in histogram, in which the range will show continuum variable such as from -4 to 4 when the number of the bar increases. This can be equalized with normal curve concept. Thus prior distribution will be the same with normal distribution.

This study uses BILOG MG ver. 3 software with its manual to guide the user, and theoretically both estimation methods were explained by Kim and Baker (2004). The parameter estimation is presented in GIBBS sample. Software that is developed to suit computer

technology development will facilitate researchers in the analysis. For parameter estimation, older programs failed to show the result but newer software has been developed and improved to meet researcher's need.

This also apples to other studies using data generated by computer programs or simulation data. This study employs real sample that is, data collected from samples set forth in the study design. Study reports and journals presented data simulation obtained from SAS, and R program. Thus, software will continue to develop and facilitate researchers to obtain accurate parameter estimation.

Previous study (Borgatto et al., 2015) conducted on associating estimation method accuracy with items difficulty level found that the test item resulted in high accuracy estimation in line with classical method that is, the more the items the more accurate the result is. On the contrary, estimation in smaller items shows lower level of variance that it can be said that this study supports Embretson (2000) opinion. Study by Chen et al. (1998) concentrated on the accuracy of MLE and EAP estimation method in the implementation of Computer Adaptive Test. EAP of Bayes estimation group by varying many quadrature points came with 10, 20, 40 and 80 in prior distribution. The findings show that RMSE in MLE is smaller than the quadrature point of 10, while prior with quadrature point of 20, 40, and 80 shows relatively the same RMSE. In other word, RMSE will stay stable in quadrature point of 20. Bayes estimation made its way to a discussion that during its early implementation from Lord (1986) was considered a difficult method to understand by social science researchers. Smithson

explained the development of Bayes analysis with Markov Chain Monte Carlo (NCMC), yet it developed well particularly in social science, rare social studies employing Bayes method yet currently there are six (6) books in the phase of introduction. These books are considered containing certain type of statistics and mathematics (Smithson, 2010).

Conclusion

The following was made:

1. Variance of ability estimation () of *maximum likelihood* method is higher than that () of *expected a posteriori* one obtained from a test package consisting 25 items.
2. Variance of ability estimation () of *maximum likelihood* method is higher than that () of *expected a posteriori* one gained from a test package consisting 50 items.
3. Variance of ability estimation () of a test package consisting 50 items is higher than that of a test package having 25 items when it was done through MLE method.
4. Variance of ability estimation () of a test package consisting 50 items is higher than that of a test package having 25 items when it was done through EAP method.
5. RMS of EAP method is lower than that of MLE method in test item 10, 15, 20, and 25. Findings of this research correlate to important aspects of education mainly to those numerical thinking talent researchers and test developers who apply items-response theory of two-parameter logistic model. Accuracy of estimation result which specifically focuses on estimation variance resulted from applying methods of ability estimations of *maximum likelihood* and *expected a posteriori* is supposed to furtherly concern.

The conclusion of this research is not restricted to sample collection venue or talent test used as data collecting instrument, yet it may be generally applicable to learning materials. Consequently, such findings can be used by any teachers in constructing or making their own tests. They can construct such tests with ideal quality- assured or calibrated items. For multiple choice test with five alternative choices, they can construct it in 25 items.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Analyzing the dissertations about differentiated instruction in terms of their contents in Turkey

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This study aims to analyze the dissertations about differentiated instruction in terms of their contents in Turkey. The data of the study was collected from Council of Higher Education National Thesis Center database. The dissertations were searched without any year limitation. As a result of searching, 19 dissertations were found. The data obtained from the thesis was analyzed with content analysis. The dissertations were analyzed in terms of the year they published and type of the dissertation, the field on which the studies were conducted, the purpose of the studies, the methods of the studies, data collection tools and research staff in the direction of the purpose of the researcher. The obtained data are indicated in tables considering their percentage and frequency values. As a result of the study, it was seen that the studies mostly focused on the individuals with superior intelligence. It was seen that the researchers used quantitative methods and focused on the academic success of the students. Moreover, it was determined that the studies about the subject were inadequate and there was no interest about the subject.

Key words: Differentiated instruction, dissertations, content analysis.

INTRODUCTION

Each individual is unique and different from others. They have different learning, perceiving and understanding capacity. They are different from each other in terms of both their physical characteristics and cognitive, affective, psychomotor and moral characteristics. Some of them are good at sport, some of them at art, some of them at using words, and some good at making other happy. Each student has different interests and learning style as a result of her/his habits and brain functions. The students who watch the same movie can make different

deductions. Some of us see the glass half empty while some of us see the glass half full. We should accept the world in which each individual is different from each other (Kurt and Ekici, 2013; Özden, 2014; Tomlinson, 2014).

Several factors like the multiculturalism's becoming prevelant, student differences, new studies conducted on learning and rapid social changes makes it necessary that teaching strategies should be changed (Gregory and Chapman, 2007). Even though everyone accepts that all students are different from each other, this assumption is

not included in the school system. The problem of not including the individual learning styles and differences in the curriculum is left to the discretion of the teachers. Hence, the teachers are to reorganize the curriculum according to the capacities, interests and learning pace of the students by differentiating them from each other (Kapusnick and Hauslein, 2001). Therefore, it is quite important that while designing teaching and learning environments, individual characteristics of the students should be considered for an effective teaching. These differences should not be ignored and they should be transformed into advantages for an effective teaching (Tomlinson, 2005).

Interests, attitudes, learning styles, readiness in terms of individual differences and the intelligence, abilities and creativeness of the students should be considered while preparing curriculums. It is seen that many prepared curriculums are intended for the individuals who have normal-level intelligence (Gökdere, 2004). They should be neither very hard nor very easy and not be for an average student same as before but they should be prepared according to the individual differences of the students (Çalıkoğlu, 2014). Expecting a curriculum which is prepared for the middle-level students can appeal that all the students should not be right. In today's education environments, the teachers should know how to respond to the students with these individual differences (Subban, 2006).

The pedagogues have been arguing about a curriculum which can meet all the needs of the students with individual differences. The conducted studies revealed that the most effective curriculum about this subject is differentiated instruction (Bailey and Williams-Black, 2008). A differentiated classroom should answer all the special needs of all the students. Differentiated instruction presents various options to the students who aim success. It presents appropriate options to the students for active success. The teachers differentiate the content, evaluation tools, performance assignments and teaching strategies considering the needs of the students (Gregory and Chapman, 2007).

Differentiated instruction is an approach which responds to differences of the students in the same classroom like their needs, readiness, former learnings and learning styles. It is a process through which each student reaches the highest standards they can (Hall, 2002; Anderson, 2007). Differentiated instruction includes educational practices and strategies that provide the students including the disabled ones to be successful in the general educational environments and it provides the best educational presciption for all the students (Santamaria and Thousand, 2004).

Organizing an educational environment that is appropriate to the needs and levels of the students is in the responsibility of the school, and the students cannot be expected to adapt a school environment which does not respond to their own needs (Tomlinson, 2005). If an individual is not educated according to his/her needs, these individuals may lose their abilities or their abilities can be directed to other areas (Yaman, 2014). Thus, the teachers should vary the education according to the characteristics of the students and the content, process, products, emotions and educational environment should be designed as they can respond to the individual needs of different students (Avcı and Yüksel, 2014).

A differentiated classroom provides different activities which help the students learn the content, process their ideas and legitimate them and develop products which ensure effective learning (Tomlinson, 2015). In differentiated instruction, the teachers consider the readiness levels of the students rather than the curriculum. The teachers present the students different learning models by considering their individual differences. To do so, they diversify the teaching by considering the interests, talents, learning style and learning pace of the students (Tomlinson, 2014).

An important group of students who are neglected with the idea that "they already know" is the individuals with superior intelligence. Even though they have perfectionist standards from their early ages, they always need help for these needs (Dağlıoğlu, 2004). As the normal educational environments would have a restraining effect on the education of the individual with superior intelligence, they cannot be sufficient for these students. It is as important to give correct education in correct places as discovering the individuals with superior intelligence on time. The individuals with superior intelligence need unique curriculum, software and program to strengthen their abilities. The studies which have been conducted for years show that different curriculums are needed in the education of the individuals who have special talents. If the individuals with special talents are not educated in the direction of their needs, these individuals can lose their special talents or direct them to different fields (Yaman, 2014). The conducted studies show that the classrooms which include differentiated curriculums are the effective educational environments for the individuals with special talents (Yaman, 2014; Çalıkoğlu, 2014; Chen, 2011; Karaduman, 2012; Kök, 2012). With its focus on individual differences and effective methods, differentiated instruction has considerably changed the success, attitudes of not only the individuals with special talents but also the students in the normal classes in a positive way (Yabaş, 2008; Karadağ, 2010; Demir, 2013).

The dissertations constitute another dimension of the conducted studies related to differentiated instruction. On analyzing the literature, it is seen that the interpretations related to the subject are inadequate. This study will provide an evaluation of the dissertations about differentiated instructions from various aspects by developing a holistic perspective. With this respect, it is

thought that it will be a source for the future studies to be conducted about differentiated instruction.

The purpose of the study

The purpose of this study is to analyze the dissertations about differentiated instruction in terms of their contents with content analysis. Answers to the questions below are sought in the direction of this purpose.

1. How are the dissertations about the differentiated instruction in Turkey distributed in terms of year and type?
2. Which fields are the dissertations about the differentiated instruction in Turkey conducted on?
3. What are the themes of the dissertations about the differentiated instruction in Turkey?
4. What are the research models of the dissertations about the differentiated instruction in Turkey?
5. What are the data collection tools of the dissertations about the differentiated instruction in Turkey?
6. Who are the research staffs of the dissertations about the differentiated instruction in Turkey?

METHODOLOGY

In this section, information about the research model, data collection, data analysis and the limitedness of the study is presented.

The research model

This study is a qualitative research. Qualitative research is a method in which qualitative data collection tools like interview, observation and document analysis are used, and the facts and perceptions are presented in their natural environment (Yıldırım and Şimşek, 2013). It provides to present complication in a rich and holistic content (Miles and Huberman, 2015). Document review that is commonly used in the qualitative research was used as a data collection tool. Document review is analysing of the materials that is related with the research topic. These documents can be journals book, pictures, pictures, movie and also daily (Cansız, 2014). In this sense, it is aimed in this study to evaluate the dissertations about differentiated instruction with a holistic perspective using document analysis in this study. The dissertations are analyzed in terms of method, theme, interests, research staff, distributions by years and data collection tools.

Data collection

This study aims to analyze the dissertations about differentiated instruction in Tukey. In this direction, the dissertations collected from Council of Higher Education National Thesis Center database constitute the scope of this study. The manuscripts of the dissertations have been reached by using the key words "differentiated instruction." On analyzing the database of Council of Higher Education without year limitation, 19 dissertations about differentiated instruction have been found. Three of these

dissertations are limited to access. On analyzing the abstracts of the dissertations limited to access, it has been seen that if these dissertations were not included in the study, there would be no data loss and it is decided not to include them in the study. So, the study has been conducted with 19 dissertations about differentiated instruction.

Data analysis

The data obtained from the dissertations were analyzed with descriptive analysis. The data that gathered in the descriptive analysis is summarized and explained. Data is organized according to the research questions (Yıldırım and Şimşek, 2013). In this direction, the year, purposes, methods, research models, data collection tools, data analysis methods, research staff or populations and samples of the dissertations are presented as coded in and categories. The obtained data is presented in tables, and interpretations are done about the frequency and percentage values, and a general evaluation has been done about the dissertations about the differentiated instruction in Turkey.

Data analysis and finding

In this section, findings about the dissertation about differentiated instruction are presented respectively in tables in the direction of the purpose of the study, and interpretations are done according to frequency and percentage values. The first sub-goal of the study is "How are the dissertations about the differentiated instruction in Turkey distributed in terms of year and type?" The findings and interpretations related to this sub-goal are presented in Table 1.

On analyzing Table 1, it is seen that most of the 19 dissertations about differentiated instruction conducted between 2001 to 2015 are doctoral dissertations. It is remarkable that most of the dissertations are doctoral dissertations. Considering the publication years of the dissertations, it is seen that there had been no publication about the subject between 2002 to 2008 and in 2009 and 2011. Even though there had been an increase in the number of the dissertations in 2013 and 2014, there was only one dissertation about the subject in 2015; and it cannot be said that there is an interest about the subject. That only 19 studies conducted about this subject within 14 years-2001 to 2015-shows that there is not a deep interest for the subject and it indicates the gap in this field. Considering the publication years, there were few dissertations related to the differentiated instruction earlier but there has been an increasing interest to the subject.

The second sub-goal of the study is "2. Which fields are the dissertations about the differentiated instruction in Turkey conducted on?" The findings and interpretations related to this sub-goal are presented in Table 2. On analyzing Table 2, it is seen that the 57.8% of the dissertations were conducted on science, mathematics and physical science. However, a very small ratio (5.2 %) of the dissertations were conducted on Turkish, social studies, preschool, classroom teaching and English. With this result, it is also seen that there has been no study conducted on visual arts, sport and music and there is a gap in these fields. The third sub-goal of the study is "3. What are the themes of the dissertations about the differentiated instruction in Turkey?" The findings and interpretations related to this sub-goal are presented in Table 3.

On analyzing Table 3, it is seen that 34.6% of the purposes of the studies are about increasing the academic success of the students. It is seen that the studies are also about the creativeness (%18.3) and attitudes (%16.3) of the students towards the class. Moreover, the effect of differentiated instruction on the critical thinking skills, scientific process skills, learning approaches, academic self-

Table 1. The distribution of the dissertations according to years and themes.

Year	Master's degree		PhD		
	Frequency	Percentage (%)	Frequency	Percentage (%)	Total
2001	1	5.2	-	-	1
2008	1	5.2	-	-	1
2009	-	-	-	-	0
2010	1	5.2	1	5.2	2
2011		-	-	-	0
2012	1	5.2	1	5.2	2
2013	2	10.5	4	21	6
2014	-	-	6	31.5	6
2015	-	-	1	5.2	1
Total	6	31.5	13	68.5	19

Table 2. The distribution of the dissertations according to the field.

Field	Frequency	Percentage
Turkish	2	10.5
Mathematics	7	36.8
Science	3	15.7
Physics	1	5.2
English	1	5.2
Social Studies	1	5.2
Preschool	1	5.2
Classroom Teaching	2	5.2
General	1	5.2
Total	**19**	**68.5**

Table 3. The distribution of the dissertations according to their purposes.

The purposes of the thesis	Frequency	Percentage (%)
The effect on academic success	17	34.6
The effect on creativeness	9	18.3
The effect on attitudes	8	16.3
The effect on critical thinking skills	3	6.1
The effect on scientific process skills	1	2
The effect on learning approach	1	2
The effect on academic self-concept	1	2
The effect on self-efficacy perception	1	2
The effect on metacognition skills	2	4
The effect on the adequacy levels of the teachers	1	2
Views of the teachers	4	8.1
The effect on classroom management	1	2
Total	49	100

concept, self-efficacy perceptions, metacognition skills of the students is among the skills which are desired to be gained by the students. The views of the teachers related to the differentiated instruction are the subject of a few studies (8.1%). This study shows

Table 4. The distribution of the dissertations according to their research models.

Research model	Design/Technique	Frequency (f)	Percentage	Total f	%
Quantitative	Experimental	1	5.2		
	Quasi-experimental	13	68.5	15	79
	Correlational	1	5.2		
Qualitative	Interview + Observation	1	5.2	2	10.4
	Interview + Observation + video	1	5.2		
Mixed	Interview + quasi-experimental	1	5.2	2	10.4
	Interview + Observation + weak experimental	1	5.2		
Total		**19**	**100**	1	5.2

Table 5. The distribution of the dissertations according to their data collection tools.

Instruments			Frequency (f)	Percentage	Total f	%
Traditional	Test	Achievement test	16	30.7		
		Creativeness test	8	15.3		
		Critical thinking test	3	5.7		
	Scale	Attitude scale	7	13.4	43	82.6
		Self-efficacy scale	1	2		
		Cognitive skill test	2	3.8		
		Academic self-concept scale	1	2		
	Questionnaire		5	9.6		
Descriptive		Interview	4	7.6		
		Observation	3	5.7	9	17.4
		Portfolio	1	2		
		Multimedia	1	2		
Total			52	100	52	100

that the number of the studies related to the differentiated instruction is quite inadequate even though differentiated instruction has a positive effect on the academic success of the students. The fourth sub-goal of the study is "4.   What are the research models of the dissertations about the differentiated instruction in Turkey?" The findings and interpretations related to this sub-goal are presented in Table 4.

On analyzing Table 4, it is seen that the researchers conducted their studies mostly on quantitative data (79 %). It is seen that control grouped and pre-test post-test quasi-experimental design was used in more than half of the studies (68.5 %). It is also seen that qualitative studies are at a very low percentage as 10.4% and mixed studies are also at a very low percentage as 10.4%. The fifth sub-goal of the study is "What are the data collection tools of the dissertations about the differentiated instruction in Turkey?" The findings and interpretations related to this sub-goal are presented in Table 5.

On analyzing Table 5, it is seen that most of the assessment instruments (82.6%) used in the dissertations are traditional assessment instruments which can be found in every levels of

education and are known by most of the teachers (Bahar et al., 2012). It is seen that among these assessment instruments, achievement test (30.7%) and creativeness test (15.3%) were used in the dissertations. It is also seen that scales which are used to evaluate cognitive, affective or behavioral performance were used in the dissertations. Among these scales, attitude scale (13.4 %) was used the most. Critical thinking scale, self-efficacy scale, cognitive skill scale and academic self-concept scale are also among the traditional assessment instruments used in the dissertations. It is also seen that questionnaires (9.6 %) which are used to determine the preferences in the face of a situation (Metin, 2014) were used in the dissertations. As it can be seen in the table, supplementary assessment tools through which both the output and the process are evaluated and which is more related to the real life than the traditional assessment tools (Bahar et al., 2012) were used at a lower percentage as 17.4%.The sixth sub-goal of the study is "Who are the research staff of the dissertations about the differentiated instruction in Turkey?" The findings and interpretations related to this sub-goal are presented in Table 6.

On analyzing the distribution of the dissertations according to

Table 6. The distribution of the dissertations according to their research staff.

Research staff	Preschool		Primary school		Elementary school		High school		Total	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Students with superior intelligence	-	-	2	10.5	7	36.8	2	10.5	11	57.8
Students with normal intelligence	-	-	2	10.5	4	21	-	-	6	31.5
Teachers	1	5.2			1	5.2	-	-	2	10.5
Total	1	5.2	4	21	12	63.1	2	10.5	19	100

their research staff, it is seen that the dissertations were mainly focused on the individual with superior intelligence. It is appealing that 57.8% of the dissertations focused on the individuals with superior intelligence as research staff. 31.5% of them were conducted on the individuals with normal intelligence and 5.2% of them were conducted on the teachers as research sample. In terms of schools, 63.1% of the dissertations were conducted on elementary school students. It is seen that primary school students were chosen at a ratio of 21% and high school students were chosen at a ratio of 10.5% as research staff. These results also show that the views of the teachers, parents and school managers were not considered about this subject in preschools.

DISCUSSION AND RESULTS

This study aims to analyze the dissertations about the differentiated instruction from various aspects. In the direction of this general purpose, the information about the publication years and themes, purposes, fields, research staff and data collection tools of the dissertations are presented in tables with frequency and percentage values. A broader perspective which would provide a general evaluation opportunity for the subject was created with the obtained data. Here under, the similarities and differences of the analyzed dissertations and general interest and drawbacks related to the subject was tried to be determined.

On analyzing the related literature, it can be seen that the number of the content analysis, descriptive analysis and meta-analysis studies about differentiated instruction is limited. There is only one study in which Karadağ (2014) analyzed the doctoral dissertations. In his study, Karadağ (2014) analyzed the doctoral dissertations which were about differentiated instruction and which were done in Turkey and other countries between 2010 to 2013.

Considering Karadağ (2014) study, it is seen that the dissertations in Turkey have some similarities and differences in terms of field of study, purpose, method and research staff when compared to those conducted abroad. It is seen that the dissertation conducted abroad focused more on the academic success of the students just like the one conducted in Turkey. On looking at the distribution of the dissertations done abroad by years, it can be seen that it is parallel with this study and there is not an increasing tendency towards the dissertations related to differentiated instruction abroad. These result show similarities with those of Karaduman (2010) about the importance and the necessity of differentiated instruction.

Another result which supports the study of Karadağ (2014) shows that the dissertations conducted abroad focus more on the academic success of the students just like the ones conducted in Turkey. However, it is revealed that not enough studies are conducted in Turkey including the perceptions, interests and attitudes of the school managers, teachers and parents about the differentiated instruction except its effect on academic success. This result is parallel with results of the study of Bailey & Williams-Black (2008) which investigates the views of the teachers about the subject. On analyzing the dissertations conducted abroad in terms of research model, it is appealing that the number of the qualitative studies conducted in Turkey is lower and the number of the qualitative studies conducted abroad is higher. It is seen that there is no difference in terms of research staff. Although the studies in Turkey were conducted more on the individuals with superior intelligence, it is seen that different groups like teachers, school managers and parents were also used in the studies conducted abroad.

In the light of the related literature and findings obtained through this study, the results of the study can be summarized as follows:

The number of the studies about differentiated

instruction is inadequate and there is not an increasing tendency towards this subject in Turkey. Quantitative studies are generally conducted and these studies aim to increase the academic success of the students. It was found that different from the ones conducted abroad, the studies generally focus on the gifted individuals, and different samples are neglected. More studies are needed to be conducted. Studies which evaluate not only the results of the dissertations but also the results of all other studies about differentiated instruction.

RECOMMENDATIONS

The studies related to differentiated instruction are quite inadequate even though differentiated instruction has a considerable effect on the academic success, creativeness and attitudes of the students. Moreoever, considering the working fields, it is seen that physical sciences are mainly dealt with. Studies can be conducted on different fields like visual arts, music and physical education. Qualitative and mixed research models should be used in the dissertations and the studies about differentiated instruction.

Another result of the study shows that most of the conducted studies focused on the elementary school students. Considering these results, it can be said that different studies about differentiated instruction should be done in preschools, primary schools and high schools. In addition, it can be said that the studies should be conducted with pre-service teachers, teachers and school managers.

The research staff should be diversified, the pre-service teachers, teachers, school managers and parents can also be chosen as research staff. It is thought that research models like ethnographic research, action research, phenomenological method, social theorizing, in which not only the result but also the process is included in the evaluation, should also be used in the studies.

Conflict of Interests

The author has not declared any conflict of interests.

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Full Length Research Paper

An analysis of social, literary and technological sources used by classroom teachers in social studies courses

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In this study, social, literary and technological sources used by classroom teachers in social studies courses are analyzed in terms of frequency. The study employs mixed methods research and is designed following the convergent parallel design. In the qualitative part of the study, phenomenological method was used and in the quantitative dimension, scanning model was used. The participants of the study were 305 classroom teachers who work at public schools in Turkey. Qualitative data were collected from nine classroom teachers. The data of the study were collected using the following two tools: "scale for social, literary and technological sources used in social studies courses" and interview form with six open items. The use of the social, literary and technological sources in social studies courses was found in terms of arithmetical mean and standard deviation. In order to see whether or not the data had a normal distribution, the Shapiro-Wilk tests were employed. It was found that the data did not have a normal distribution. Therefore, the Mann Whitney U and Kruskal Wallis-H Tests were used to analyze the data. Content analysis was also used in examining the data. The findings showed that the participants mostly used media, technological sources and literary work in the courses. Outside school and source people were found to be less used by the participants.

Key words: Social studies, classroom teacher, social, cultural and technological sources, mixed methods, exploratory factor analysis.

INTRODUCTION

In terms of goals and content, social studies courses are the courses which are learnt through teaching and extracurricular activities. Given that social studies courses have an interdisciplinary nature using monotonous activities is not proper. Also, the social studies program requires that teachers must use various sources and have interaction with immediate environment Therefore, teachers must employ various sources including field

specialists, institutions, NGOs, field visits, cultural and social courses as well as technology to produce informed and active citizens (Brad et al., 2015; Akengin ve Ersoy, 2015; Demir and Akengin 2014; Çengelci, 2013; Crawford and Kibry, 2008; Martorella, 1998; Foran, 2008; Smith, 2008; Yaşar and Gültekin, 2007; MEB, 2005; Öztürk ve Otluoğlu, 2002).

In social studies courses, only traditional teaching materials should not be used, but also literary work should be employed, because it is necessary to produce citizens with proper attitudes, values and knowledge (Öztürk and Otluoğlu, 2002). Literary worksare is significant for social studies courses. All types of literary work provide an opportunity to teach any dimension of social life (Şimşek, 2009). For instance, stories, novels, poems, puzzles, tales, myths, idioms etc. can be used in the courses (Demir and Akengin, 2014). The social studies program also puts an emphasy on the use of literary work (Kaymakçı, 2013).The reasons for using literary work in social studies courses include the following: helps in the teaching of topics, makes abstract topics concrete, improves students' achievement and motivation as well as several skills such as critical thinking, empathy, communication, and makes various values such as respect, hard-work, etc. more precious. In the courses, students should read other books rather than textbooks. Comenius suggested that historical events should be introduced through storybooks and these books should be used in courses. If the topics and life of others in books are given in an exciting way, children receive information in an entertaining way (Bölücek, 2014).

Social studies courses have a rich content, which may be used to teach various spaces. Through visits and social activities, students can be taught about spaces (Akengin and Ersoy, 2015). Field visits that can be carried out in social studies courses include museums, municipalities, historical sites, natural sites, NGOs, public institutions, factories, theatres, cinemas, and universities. Field trips provide various advantages to students. Well-planned extra- curricular activities improve students' personal, social and affective development, achievement, self-confidence, communicative skills, make learning long lasting, joy and quality, make it possible for students to know society, nature and the relationship between nature and society better (Hund and Bueno, 2015; Kennedy, 2014). Dewey (1938), argued that the importance of practical experience in learning, because, every experience should prepare a person for later experiences of a deeper and more expansive quality. The belief that all genuine education comes about through experience does not mean that all experiences are genuinely or equally educative. Experience and education cannot be directly equated to each other. For some experiences are miseducative. Any experience is miseducative when it has the effect of arresting or distorting the growth of

further experience.

In basic education programs, which are based on constructivism and activity, the use of materials is very significant. In material development newspapers and journals can be employed. Such materials can be used in the learning process in social studies courses. Newspaper articles, maps, graphics, notifications, pictures, cartoons can be used in discussions, and news bulletins can be developed in the class (Ünlüer and Yaşar, 2012). Today, children heavily make use of technology, Internet for the purposes of education. In social studies courses technology can be employed due to its multidisciplinary nature. Teachers may employ educational technology to raise children's awareness. However, in order to achieve it, teachers should have technology literacy in addition to field and professional knowledge (Crawford and Kibry, 2008). If they do not have enough information about how to use educational technologies, they cannot achieve this goal. There is a close relationship between the use of educational technologies and teachers' skills to use technology and be efficient in it (Friedman and Heafnee, 2010). Brad et al. (2015) deal with a course outline in which video games are used. They concluded that teaching through video games made several improvements in children's problem-solving skills, motivation, interest and planning related skills. In addition, it was found that students better understood abstract concepts and theories.

It is significant for social studies courses to have primary information sources such as field specialists. Several field specialists can be invited to the class such as professionals (lawyers, artists, farmers), experienced people. It is possible to visit them or they can be invited to the class (Yaşar and Gültekin, 2007). In teaching and learning process, source people can be used in various ways. One of the teaching methods in which source people involve in this process is project-based teaching. For instance, in project-based teaching source persons may be invited to the class and they answer students' questions (Taşkaya and Taşkaya, 2011).

The aim of the study

Research on the sources used in social studies education (Brad, Jet al., 2015; Akengin and Ersoy, 2015; Çengelci, 2013; Demir and Akengin 2014; Crawford and Kibry, 2008; Martorella, 1998; Foran, 2008; Smith, 2008; Öztürk and Otluoğlu, 2002) mostly focuses on one of the sources such as social, cultural and technological or deals with the effects of these sources on student achievement. However, specific social, cultural and technological sources used by classroom teachers in social studies courses and the frequency of their use of them has not been examined in detail. On the other hand, these topics should be analysed to provide an efficient
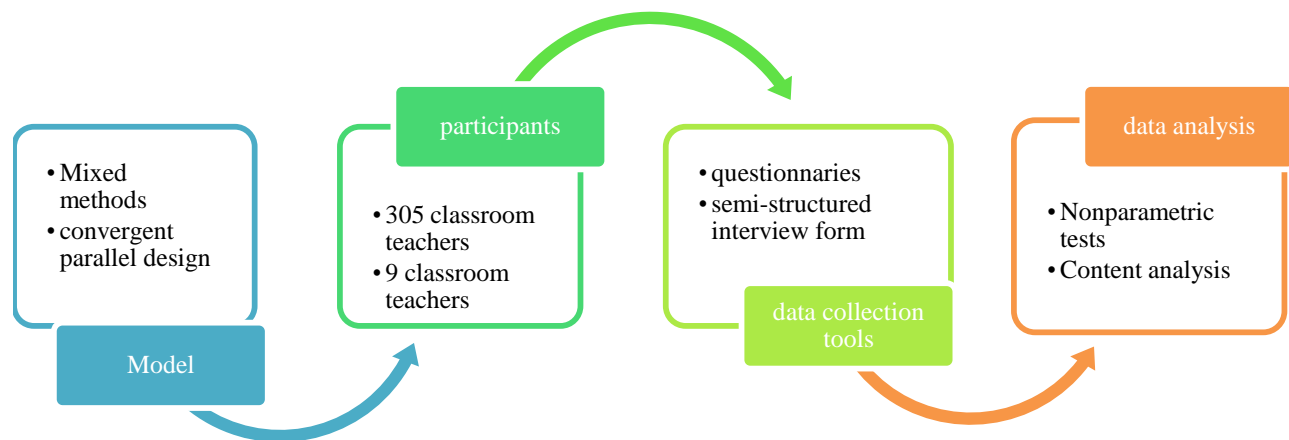
Figure 1. Research process.

social studies education. It is thought that this study will contribute to make it clear the current use of these sources in social studies courses and to uncover insufficient dimensions in the use of them. In addition, the results of the study may support the use of sources in social studies education in-service training activities by the ministry of national education and also, in teacher training programs. Therefore, the aim of the study is to analyze the social, literary and technological sources used by classroom teachers in social studies courses in terms of frequency of use. Based on this aim, the study tries to answer the following research questions:

1. Do classroom teachers make use of source people, extra- curricular activities, outside school spaces, mass communication devices and literary work in social studies courses?
2. At which level do classroom teachers use these sources?
3. Is there a significant relationship between social, cultural and technological sources used and teachers' demographical characteristics (gender, experience, educational background)?
4. Which type of the sources below is used by the classroom teachers in social studies courses?
a. Source people.
b. Mass communication and technology.
c. Literary work.
d. Outside school spaces.

METHODS

This study was designed as a mixed research. In mixed research quantitative and qualitative research methods are combined. It is based on the assumption that quantitative and qualitative research methods are not rivals, but complement each other and can be used simultaneously in a single study (Christensen et al., 2015).

In the current study, convergent parallel design was employed. This design is defined as follows: "research make use of the steps of quantitative and qualitative research methods simultaneously. It attaches equal importance to both methods, but in analysis each research method is used separately and the discussion of the findings is combined" (Creswell and Plano Clark, 2014). In the quantitative dimension, scanning model was adopted and the data were collected using questionnaires. Scanning models attempt to describe a past or present situation (Karasar, 2005). In the qualitative dimension phenomenological method was employed. The phenomenological method attempts to reveal individuals' experience, perception and sense that they are attached to a fact (Yıldırım and Şimşek, 2013) (Figure 1).

Participants

Two different participants groups were used in the study, one for qualitative dimension and the other for quantitative dimension. For the quantitative dimension the participants of the study were 305 classroom teachers who work at basic education school in Turkey during the fall semester of the school year of 2015 to 2016. Table 1 presents the demographical characteristics of these participants. For the qualitative part nine classroom teachers from the quantitative dimension were chosen. They took part in the interviews voluntarily. They were chosen using criterion-based sampling method, part of purposive sampling. The goal of purposive sampling is to choose those persons who can provide significant explanations about the topic at hand (Christensen et al., 2015). The criteria used in choosing the participants were as follows: they should teach fourth grade and have teaching experience of more than five years. Among the participants three teachers with these criteria each from three different SES status schools (higher-medium-lower) were selected. Table 2 presents information about participants. Table 2 shows that five participants are males and four are females. Three of them had a teaching experience of 1 to 10 years, 3 11 to 20 years and 3 21 years or more.

Data collection tools

Two data collection tools were used in the study. For the

Table 1. Demographical characteristics of the participants (n = 305).

Variables		F	%
Gender	Female	156	51.1
	Male	149	48.9
	Total	**305**	100.0
Teaching experience	1–5 years	24	7.9
	6-10 years	45	14.8
	11–15 years	50	16.4
	16- 20 years	67	22.0
	21 years or more	119	39.0
	Total	**305**	**100.0**
Grade level	1. grade	61	20.0
	2. grade	66	21.6
	3. grade	75	24.6
	4. grade	103	33,8
	Total	**305**	**100.0**
Educational background	Two-year education	36	11.8
	Undergraduate	252	82.6
	Graduate	17	5.6
	Total	**305**	**100.0**
Work placement unit	City	260	85.2
	Town	33	10.8
	Village	12	3.9
	Total	**305**	**100.0**

Table 2. Personal information of the participants.

participants		Gender	Experience	Educational background	Grade level
Higher SES school teachers	İrem	Female	27	Faculty of ed. sciences	4
	Fatih	Male	25	Faculty of ed. sciences	4
	İlkay	Female	16	Faculty of ed. sciences	4
Medium SES level school teachers	Bahadır	Male	36	Institute of ed. Sciences	4
	Funda	Female	18	Faculty of ed. sciences	4
	Şahin	Male	17	Faculty of ed. sciences	4
Lower SES school teachers	Sinan	Male	7	Faculty of ed. sciences	4
	Umut	Male	9	Faculty of ed. sciences	4
	İnci	Female	5	Faculty of ed. sciences	4

quantitative data by Çengelci (2013) was employed and by the authors was revised. For the qualitative data a semi-structured interview form developed by the authors was used.

The scale for social, literary and technology sources used in social studies courses

The scale has two parts. The first one is personal information part. It includes items on gender, teaching experience, educational background. The other part is made up of four dimensions and the total number of the items is 23. The dimensions are "source person", "outside school", "mass communication and technology" and "literary work". The items which are all positive statements are answered using five-point Likert scale: "everytime (5), frequently (4), sometimes (3), rarely (2) and never (1)". The scale was revised based on literature review. The items developed by Çengelci (2013) and the goals of social studies program were combined to produce

Table 3. Results of the explanatory factor analysis.

Item no	Item	Rotated Factor loading values**			
		Fac. 1*	Fac. 2*	Fac. 3*	Fac. 4*
20	I make it possible for students to read poetry books about topics in social studies courses.	0.775			
29	I encourage students to make search about folk songs and artists.	0.731			
21	I encourage students to read memories and travel writing about topics in social studies courses.	0.722			
27	I use folk stories in social studies courses.	0.714			
19	I encourage students to read stories and novels about topics in social studies courses.	0.708			
25	I use proverbs and idioms in social studies courses.	0.702			
28	I encourage students to read biography of significant figures about topics in social studies courses.	0.688			
23	I read informative articles about topics in social studies courses to students.	0.658			
30	I encourage students to gather information about culture through verbal history.	0.629			
12	I develop relationships between social studies topics and television movies.		0.833		
11	I use actual news for social studies courses.		0.827		
13	I encourage students to watch documentaries about topics in social studies courses.		0.757		
14	I use newspapers for social studies courses.		0.743		
15	I use animation movies for social studies courses.		0.679		
18	I encourage students to make internet research about topics in social studies courses.		0.610		
9	I bring students to factories about topics in social studies courses.			0.833	
10	I bring students to meteorological institute about topics in social studies courses.			0.819	
4	I bring students to museums about topics in social studies courses.			0.795	
5	I organize visits to review the natural environment.			0.782	
6	I organize visits to review historical places.			0.781	
2	I encourage students to meet with various professionals.				0.790
3	I encourage students to meet with local administrators.				0.656
1	I invite field specialists to the class.				0.629
Total variance accounted for = % 67.053; KMO values= 0.92; Bartlett's Test= ($\chi2$ = 4560.414 p <0.001).					

* Factor 1 "literary work"; Factor 2 "mass communication and technology"; Factor 3 "outside school" and Factor 4 "source person".
** Those values under 0.45 are not given.

40 items. The items were reviewed by four field specialists in terms of content validity. Based on the reviews by the specialists the resulting scale included 34 items. It was administered to classroom teachers in a pilot study. Explanatory factor analysis was done on 305 scales using SPSS 20.0. In order to see whether or not the data set was suitable for factor analysis the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests were used. In the study the KMO value was found to be 0.92. The result of the Bartlett's test was found to be significant ($\chi2$ = 4560.414, p <0.001). The inclusion criterion was set at 0.45 or more. The results of the explanatory factor analysis showed that one of eleven items was under 0.45 and two appeared in two different factors and eight items had no sufficient loading values. Therefore, these items were excluded, and the explanatory factor analysis was repeated on 23 items. Table 3 presents the results of the explanatory factor analysis loading values.

As shown in Table 3, 23 items are grouped under four dimensions which accounted for the total variance at 67%. The first factor is made up of nine items. Load values of the factor range between 0.77 and 0.62. It was called "literary work". The second factor covers six items. Load values of the factor range between 0.83 and 0.61. It was called "mass communication and technology". The third factor is consisted of five items. Load values of the factor range between 0.83 and 0.78. This factor was called "outside school". The fourth factor includes three items and was called "source person". Load values of the factor range between 0.79 and 0.62. Regarding reliability of the scale the Cronbach alpha coefficient was calculated. The alpha coefficient for the "literary work" is 0.91; for "mass communication and technology" it is 0.89; for "outside school" it is 0.90 and for "source person "it is 0.76.The overall Cronbach Alpha coefficient of the scale was found to be 0.93.

Semi-structured interview form

The qualitative data were collected through "semi-structured interview form" which included open-ended items. The form was developed by the authors. In qualitative research semi-structured

Table 4. Means and standard deviations for sub-dimensions.

Sub-dimensions	N	Means	Sd
Literary work	305	3.5	0.7
Mass communication and technology	305	4.0	0.7
Outside school spaces	305	2.8	0.9
Source person	305	2.9	0.8
Total	305	3.3	0.7

interviews are used to have detailed information about a topic (Harrell and Bradley, 2009). A draft interview form with eight items was developed and the form was reviewed by four field specialists. Based on the reviews two items were excluded and the final form included six items. The form was used in a pilot study on two classroom teachers.

Data analysis

Quantitative data were analyzed using SPSS 20. More specifically, the frequency (f) and percentage (%) were determined. In addition, both arithmetical mean ($\overline{X}$) and standard deviations (sd) were calculated. Range values used in the interpretation are as follows: never: 1.00 to 1.79; rarely: 1.80 to 2.59; sometimes: 2.60 to 3.39; frequently: 3.40 to 4.19; everytime: 4.20 to 5.00. The Shapiro-Wilk test was used to determine which statistical method should be used. The significance level was set at 0.05. The results of the Shapiro-Wilk test showed that the data did not have normal distribution. Therefore, for two-group comparisons the Mann-Whitney U test and for comparisons of three or more group the Kruskall-Wallis test were employed. The standardized values were used in the Mann Whitney U Test. In the Kruskal Wallis-H Test, the Tukey test was employed when significant differences were found among the groups. The significance level was set at 0.05.

The qualitative data were analyzed using content analysis. In content analysis, the data are analyzed in depth to reveal concepts and themes. The process of content analysis is made up of the following steps: coding the data, determining themes, categorization of the data based on codes and themes, describing the data and interpretation (Yıldırım and Şimşek, 2013). The interviews were recorded and then transcribed by the authors. The written text was coded by the authors. Similar and different codes were classified. Consistency between the codes created by two researchers was calculated using the formulation: [Agreement/ (Agreement + Disagreement) x 100] (Miles and Huberman, 1994). Accordingly, the reliability of the study was found out to be 0.94. It indicates that the scoring was reliable (Miles and Huberman, 1994).

FINDINGS

Table 4 presents mean scores of the participants in the scale as well as arithmetical means and standard deviation. Table 4 indicates that the mean score is $\overline{X} =$ 3.3. For the literary work sub dimension it is $\overline{X} = 3.5$ and for the sub dimension of mass communication and technology, it is $\overline{X} = 4.0$. The mean score for the sub dimension of outside school spaces is $\overline{X} = 2.8$ and that for the sub dimension of source person is $\overline{X} = 2.9$.

Therefore, the participants are found to use more frequently mass communication and technology in social studies courses. It is followed by literary work, outside school spaces and source person. In order to see whether gender has a significant effect on the use of these sources the Mann Whitney U test was employed. Table 5 shows the results of this analysis.

As shown in Table 5, the mean scores of the female participants are much higher than those of the male participants (p = 0.013; p = 0.038 p <0.05). More specifically, female participants much more commonly use mass communication and educational technology as well as source persons in social studies courses than male participants. However, there is no significant effect on the use of literary work as teaching materials in social studies courses (p >0.05, Mann-Whitney U Test). The results of the Kruskall-Wallis H test are given in Table 6. Table 6 indicates that there occurs a significant difference in using literary work based on their teaching experience (χ^2 (4) = 11.04, p < 0.05). This difference exists between those with 21 years or more teaching experience and those with 1 to 5 years of teaching experience; in other words, more teaching experience means more frequent use of literary work in social studies courses. It is also seen that there occurs a significant difference in using field visits based on their teaching experience (χ^2 (4) = 44.7, p <0.05). This difference is between those with 6-10 years teaching experience, those with 11-15 years teaching experience those with 21 years or more teaching experience. Again, more teaching experience means more frequent use of outside school spaces in social studies courses.

In addition, there occurs a significant difference in using source persons based on their teaching experience (χ^2 (4) = 16.01, p< 0.05). This difference exists between those with 21 years or more teaching experience and those with 1 to 5 years of teaching experience. Total score of the participants also differs based on their teaching experience (χ^2 (4) = 28.8, p < 0.05). It was found that the scores of those with 21 years or more teaching experience were higher than those with 6 to 10 years of teaching experience and 1 to 5 years of teaching experience. Table 7 shows the results of the Kruskall-Wallis H test regarding the effects of the educational background of the participants on their use of various

Table 5. Comparison of the participants based on gender.

Sub-dimension	Gender			Mann Whitney U Test	
		N	Mean rank	U	p
Literary work	Female	156	156.80	11028.5	0.440
	Male	149	149.02		
Mass communication and technology	Female	156	165.19	9720.5	0.013
	Male	149	140.24		
Outside school	Female	156	148.37	10899.0	0.34
	Male	149	157.85		
Source person	Female	156	142.83	10035.0	0.38
	Male	149	163.65		
Total	Female	156	152.05	11474.5	0.84
	Male	149	153.99		

*p <0.05.

Table 6. Comparison based on teaching experience (the results of Kruskall-Wallis H Test).

Sub-dimension	Experience	N	Sıra Ort.	sd	χ^2	p	Significance
Literary work	1–5 years	24	123.98	4	11.4	0.02	21 years or more and 1-5 years
	6-10 years	45	127.72				
	11–15 years	50	146.98				
	16- 20 years	67	152.95				
	21 years or more	119	170.97				
Mass communication and technology	1–5 years	24	127.42	4	3.4	0.49	No
	6-10 years	45	152.49				
	11–15 years	50	144.29				
	16- 20 years	67	160.99				
	21 years or more	119	157.52				
Outside school	1–5 years	24	81.08	4	44.7	0.0	6-10 years and 1-5 years
	6-10 years	45	111.89				11-15 years and 1-5 years
	11–15 years	50	148.36				16-20 years and 1-5 years
	16- 20 years	67	148.10				
	21 years or more	119	187.76				
Source person	1–5 years	24	113.58	4	16.1	0.03	21 years or more and 1-5 years
	6-10 years	45	136.64				
	11–15 years	50	142.28				
	16- 20 years	67	144.74				
	21 years or more	119	176.29				
Total	1–5 years	24	96.69	4	28.8	0.00	21 years or more and 1-5 years
	6-10 years	45	123.86				21 years or more and 6-10 years
	11–15 years	50	141.98				
	16- 20 years	67	148.80				
	21 years or more	119	182.37				

P <0.05.

Table 7. Comparison of the classroom teachers based on their educational background (the results of the Kruskall-Wallis H Test).

Sub-dimension	Educational background	N	Mean rank	sd	χ²	p	Significance
Literary work	Two-year education	36	154.57	2	1.34	0.511	No
	Undergraduate	252	151.18				
	Graduate	17	176.65				
Mass communication and technology	Two-year education	36	141.63	2	1.1	0.556	No
	Undergraduate	252	153.55				
	Graduate	17	168.94				
Outside school space	Two-year education	36	185.58	2	6.26	0.044	Two year education-undergraduate
	Undergraduate	252	147.50				
	Graduate	17	165.56				
Source person	Two-year education	36	166.83	2	1.36	0.506	No
	Undergraduate	252	150.34				
	Graduate	17	163.21				
Total	Two-year education	36	168.83	2	2.03	0.361	No
	Undergraduate	252	149.69				
	Graduate	17	168.47				

sources in social studies courses. As can be seen in Table 7, the mean scores of the participants in the sub-dimension of outside school spaces significantly differ based on their educational background (χ^2 (2) = 6.26, p <0.05). This difference was found to be between those with two-year education and those with undergraduate education. In other words, those with two-year education made use of outside school spaces more frequently than those with undergraduate education. The results of the Kruskall Wallis test showed that educational background of the participants did not have any significant effect on their use of sources in social studies courses (p >0.05 Kruskall-Wallis test). Table 8 presents the results of the Kruskall Wallis H test concerning the effects of dwelling unit on the use of sources.

As shown in Table 8, the dwelling unit had significant effects on teachers' use of sources in social studies courses (χ^2 (2) = 56.10, p < 0.05). It was found that mean score of those who work at city schools was higher than that of those who work at town and village schools. Use of source persons is found to be significantly affected by dwelling unit (χ^2 (2) =8.31, p < 0.05; χ^2 (2) =22.66, p < 0.05). It was found that mean score for the use of source persons of those who work at city schools was higher than that of those who work at village schools.

Qualitative findings

Qualitative findings are grouped under four headings. These are discussed as follows:

Use of literary work in social studies courses

Table 9 presents sub-themes and categories related to the use of literary work in social studies courses. As shown in Table 9, concerning the use of literary work the views of teachers working at different SES schools were different. They mostly used myths, folk songs and stories. Literary work was found to be used most frequently by those teachers working at lower SES schools. The participants working at higher SES schools and medium SES schools reported that they sometimes made use of literary work in social studies courses. One of the participants working at a lower SES school, Inci, reported "*for me there are many sources to be used in social studies courses. For instance, I teach Turkish war of independence. We have storybooks in the library. Students find a storybook about Kazım Karabekir, or about Hasan Tahsin or about the occupation of İzmir and read these books. They also share it in the class. Children like stories.* "Another participant working at a

Table 8. Comparison of the participants based on dwelling unit (the results of the Kruskall-Wallis H Test).

Sub-dimension	dwelling unit	N	Mean rank	sd	χ^2	p	Significance
Literary work	City	260	156.08				
	Town	33	134.48	2	2.15	0.574	No
	Village	12	137.25				
Mass communication and technology	City	260	155.34				
	Town	33	134.83	2	1.59	0.786	No
	Village	12	152.21				
Outside school	City	260	168.31				City-town
	Town	33	51.35	2	56.10	0.000	City-village
	Village	12	100.79				
Source person	City	260	158.66				
	Town	33	112.58	2	8.31	0.011	City-town
	Village	12	141.63				
Total	City	260	162.63				
	Town	33	87.15	2	22.66	0.000	City-town
	Village	12	125.50				

Table 9. Views of the participants about the use of literary work in social studies courses.

Theme	Subtheme	High SES schools	Categories	
			Medium SES schools	**Lower SES schools**
Using literary work in social studies courses	Topics	myths folk songs; National cultural elements	Old children games myths	Turkish war of Independence folk songs Cultural inheritance myths life of folk artists old children games
	Activities	Search for myths through oral history Singing folk songs in the class Research projects Sharing with the class Listening to myths in education information network	Research projects Sharing with the class Listening to myths in education information Network Oral history	Stories Myths Folk songs; Research project Oral history; Listening to myths in Education information; Network lullabies and traditional Turkish quatrain forms
	Frequency of use	Rarely	Rarely	Frequently

lower SES school, Sinan, stated "*I use lullaby and short poems in the course of teaching in the unit cultural inheritance. I wanted students to find local lullaby and short poems.* "Fatih, a classroom teacher working at a higher SES school, reported "*while teaching folk songs as a national cultural element in the social studies course students listened to folk songs from different regions and they liked it.*" The view of Bahadır, a classroom teachers working at a medium SES school, stated "*I gave a homework on myths in Afyon and in Turkey. They asked question to their family members. They provided*

examples from both Afyon and from Turkey. They searched for myths of Çayda Çıra and Gazlıgöl hot spring. They presented their findings in the class. Children are interested in myths."

Use of mass communication and technology in social studies courses

In the study, it was found that there are two major themes: the use of mass communication and the use of

Table 10. Views of the participants about the use of mass communication and technology.

Theme	Sub theme	High SES schools	Categories	
			Medium SES schools	**Lower SES schools**
Mass communication	Topics	National holiday Natural disasters Environmental pollution	Natural disasters	Natural disasters Individual differences; Incorrect behavior national holiday; Environmental pollution NGO
	Activities	Discussion of news	Discussion of news Bringing newspaper clippings Hanging them onto panels	Discussion of news Case study Bringing newspaper clippings
	Frequency of use	Rarely	Rarely	Sometimes
Technology use	Topics	Turkish war of Independence Natural disasters NGO	Natural disasters Turkish war of independence NGO	Turkish war of independence; Natural disasters; Life of local poets NGO
	Technology	Smart board; Animated movies; Documentary; Video; Visuals	Video; Documentary	Video; Documentary; Animated movies
	Used websites	EBA Morpakampus Okulistik	EBA Morpakampus Okulistik	EBA Morpakampus Okulistik
	Frequency of use	Frequently	Frequently	Frequently

technology. Table 10 shows subthemes and categories related to these two themes. Table 10 shows that the participants generally use mass communication tools in teaching of natural disasters. In addition, teachers working at either higher or lower SES schools employed these tools in the topics of natural holidays and environmental education. These were used by teachers working at lower SES schools in relation to the topics of individual differences and incorrect social behavior. The participants used the discussion of news in the class. The teachers working at either medium or lower SES schools also used the newspaper clippings. Case studies were used only by teachers working at lower SES schools. One of the participants, Bahadır, stated "*I use both written and visual media in the courses. Students collect news and information about natural disasters from internet. They make internet research. They collect news and bring it to the class. We use their data in discussion of these events .We hang this news onto panel in the classroom.*" As shown in Table 10, teachers used educational technology such as documentaries and animated movies in relation to the topics of Turkish war of independence, natural disasters, and non-governmental organizations. Those working at higher SES schools also used smart boards and visuals. Educational websites used by the participants were found to be Morpa

Kampüs, Okulistik and educational information network. They stated they frequently used technology in social studies courses. Sinan, a classroom teacher working at a lower SES school, stated "*I use BBC videos for the topics in social studies courses. For instance, they watched a video about Aşık Veysel. They also listen to his folk songs. They also watched a documentary about him.*" Another participant, Umut, stated "*In the introduction part students watch animated movies. Their interest improves .In general I use the websites of Morpa Kampüs and Okulistik about democracy, NGOs, and occupations.*"

Use of outside school spaces in social studies courses

Table 11 shows subthemes and categories related to the use of outside school spaces in social studies courses. As shown in Table 11 spaces are mostly used by the teachers working at higher SES schools. They used such activities for the topics of social workers, local governments, weather events, environmental education, Turkish war of independence and they sometimes visited NGOs, public institutions, museums, exhibitions and theatres. The teachers working at medium SES school reported that they rarely visited public institutions during

Table 11. Views of the participants about the use of outside school spaces in social studies courses.

Theme	Sub theme	Higher SES schools	Categories	
			Medium SES schools	Lower SES schools
Use of outside spaces	Field trips	NGO (TEMA, AFAD); Public institutions (Municipality, District Governance, Meteorology) Museums Exhibition Theatre	Public institutions (forestry directorate, Municipality)	-
	Topics	Social workers Local Government weather Events Environmental education Turkish war of independence and Çanakkale	Local government Environmental education	-
	Frequency of use	Rarely	Rarely	Never

the teaching of local government and environment. The participants reported that in relation to the duties of the local administrators they visited the municipality and district government. About this Fatih stated "*I bring students to municipality while teaching the topics of local governments and elections. There the students ask several questions to the administrators.*" Another participant, Bahadır, who was working at a higher SES school, reported "*we visited an exhibition about Çanakkale war in Afyon. I also brought them to the victory museum and archeology museum.*"Another participant, İrem, stated "*I bring them to children's theatre when the play is about our topics, but it is not frequent. The class joined tree planting activity of non-governmental organizations. I always bring my students to the victory museum and we visited Çanakkale.*"The statement by another participant, Funda, is as follows: "*The class visited forestry directorate and we wanted tree seedlings. Then we planted trees in schoolyard. But such activities are not common, because time is limited.*" The participants working at lower SES schools reported that they experienced several problems in carrying out visits such as getting permission, demanding procedures, transport and finance.

Source people in social studies courses

Table 12 shows the subthemes and categories about the use of source persons in the content of the social studies courses. Table 12 indicates that participants either invited source persons to the class or they visited them. Those participants working at higher SES schools reported that

they invited various professionals, mayor and representatives of several NGOs to the class for the topics of occupations, local governance, elections and society. Those participants working at medium SES schools stated that they sometimes invited businessmen, mayor and family members to the class to teach topics of production-consumption, local governance, the Turkish war of independence. Those participants working at higher and medium SES schools also stated they visited mayor and NGOs for the topics of local governance, elections, and social workers. They reported that they sometimes organized such activities. A participant, working at a higher SES school, Irem, stated "*We visited mayor during the teaching of the topic local government. He told us his duties and responsibilities as a mayor. In addition, several professionals from emergency unit visited the class and they informed the students about their job.*"The participants working at lower SES schools reported that they could not invite any source person to the class. They also reported that they could rarely visit source persons.

DISCUSSION

The findings showed that the participants mostly used media, technological sources and literary work in the social courses. Outside school, source people were found to be less used by the participants. The findings of the study showed that the classroom teachers mostly made use of mass communication tools and technology in social studies courses. The qualitative findings indicated that the participants frequently made use of

Table 12. Views of the participants about source people in social studies courses.

Theme	Sub theme	Higher SES	Categories	Lower SES
			Medium SES	
Source person use	Topics used	Occupations Local government Elections Work for society	Production-consumption Local government Turkish war of independence	-
	Invited speakers	Mayor Parents from different professions NGOs	Businessman Mayor Family members	-
	Frequency of use	Frequently	Sometimes	Never
Visits to source persons	Topics	Local government Elections Social workers	Local government	Local government
	Visited people	Mayor NGO	Mayor NGO	Mayor
	Frequency of use	Sometimes	Sometimes	Rarely

mass communication tools and technology in social studies courses about natural disasters, national holidays and environmental education. In general, they used discussions of news through newspaper clippings and case studies. The qualitative findings also showed that the participants also used education technologies in social studies courses. Selanik Ay et al. (2015) found that in social studies courses classroom teachers used newspapers, journals, books, documentaries, movies and animated cartoons for the topics of traffic accidents, disasters, national and religious events, fairs, etc. Yeşiltaş and Kaymakçı (2014) concluded that social studies courses require the use of educational technologies in terms of general goals, content, learning-teaching processes, assessment tools and methods. Technology-assisted social studies courses are much more suitable for accessing information and for gaining skills which are hard to achieve in traditional courses. Social studies courses should employ educational technologies to expand learning opportunity of student sand to make it possible for them to make a connection between the past, present and future learning (Mason, 2000). The participants stated that they used movies and documentaries for the topics of historical events and natural disasters. Marcus et al. (2010) argued that in social studies courses, historical events are mostly taught through textbooks and movies. They suggested that teachers should made use of movies in teaching historical events due to their significant positive effects on students. The use of movies in social studies courses improves students' empathy, interpretive skills and analytical skills. Kaya and Çengelci (2011) concluded that for pre-service teachers using movies in social studies

courses is significant in terms of assisting students' learning and skills about the content. They also argued that teachers play a crucial role in using movies in social studies courses.

The second common source used by the participants was found to be literary work. The quantitative findings showed that experienced teachers more use literary working social studies courses. The qualitative findings also indicated that the participants employed myths, folk song and stories. It was found that the use of literary work was much more frequent among classroom teachers working at lower SES schools. On the other hand, those working at higher or medium SES schools sometimes used literary work in the courses. It can be said that the participants less used literary work in social studies courses. The reason for not using literary work in social studies courses can be stated as follows: time constraints, inefficient knowledge about the use of literary work for teaching purposes and lack of necessary sources (Smith, 2008). Yeşilbursa and Sabancı (2015) found that pre-service teachers had insufficient training about how to use literary work in social studies courses. However, research suggests that the use of literary work in social studies courses has many advantages. More specifically, the use of literary work significantly contributes to gain affective skills. If literary work is used in social studies courses, the potential gains are mostly affective and cognitive skills including recognizing significant points, improving students' interest, flexible learning environment, reminiscence, thinking about the topics mentally, making connections between past and present learning (Öztürk and Otluoğlu, 2002).

The social studies education program developed in

2005 is much more suitable for using literary work as teaching material in contrast to the program developed in 1998. More specifically, the fourth grade social studies program covers specific literary work, including in the unit of "everybody has an identity", there are stories of Mevlana; in the unit of "I am learning my past", there is a song of Barış Manço, there are also letters and poems about the Turkish war of independence; in the unit of "our living places", there are myths, stories, folk songs and poems; in the unit of "from production to consumption", there are stories, and in the unit of "people and administration", there are anecdote completion activities (Şimşek, 2009). Kaymakçı (2013) found that the fourth grade social studies textbook mostly included stories, biographies, memories, and proverbs as literary work. However, there were less examples of poetry, travel writing, conversation, proverbs, legends, anecdotes, starter, tables, letters, novels, plays, songs / ballads, daily and politics books roll in the textbook. Given that using literary work in social studies courses is significant, pre-service and in-service teachers should be informed about how to use teaching material literarily.

Conclusion

The findings of the study showed that the participants could not employ visits to outside school spaces very commonly. This activity seems to be closely related to the SES of the schools. Those participants working at city schools seem to use these visits more frequently in contrast to those working at either town or village schools. It was also found that teachers with two-year education organized more frequent visits than those with undergraduate education. Given that those participants with two-year education are much more experienced and mostly work at city schools, it can be stated that they are much more informed about how to use visits as teaching activity and that city conditions are much more appropriate for conducting field trips. It is also possible that if schools have necessary facilities and financial support for visits, such activities are much easier. The qualitative findings showed that visits are mostly used by those participants working at higher SES schools and by experienced teachers. The participants working at higher SES schools reported that they sometimes organized visits to outside school places. The participants working at lower SES schools reported that they experienced several problems in carrying out visits such as getting permission, demanding procedures, transport and finance. Çengelci (2013) found that teachers in social studies courses used visits to teach topics related to historical event, geography, local government, environment, social help, solidarity and occupations. It was found that teachers organized visits to cinema, meeting with professionals. The participants also

reported that they experienced several problems in discipline, finance and bureaucratic procedures. The findings are consistent with the present ones. Social studies courses are mostly limited to textbooks and therefore, only abstract concepts are given to the students. Under such conditions, social studies courses are seen as boring. Field trips should be used in social studies courses to produce active citizens. Active students' participation is needed to produce individuals with the skills and values aimed by the social studies education program. Field trips in the context of social studies courses provide invaluable opportunity with students to discover the natural environment in a direct way and to better understand their immediate environment (Foran, 2008).

In the study it was found that the participants did not employ source persons. In addition, the use of source persons is found to significantly vary based on teaching experience and the SES of the schools. The qualitative findings suggested that experienced teachers employed much more frequently source persons. It was also found that those working at city schools much more frequently used source persons in contrast to those working at town schools or at village schools. It was found that those with 20 years of teaching experience and those working at city schools made use of source persons more frequently. This is a result of schools' services and transportation facility. It was found that classroom teachers either invited source persons to the class or the class visited these people. Çelikkaya and Kuş (2009) found that teachers less use source persons, observations and visits. School administrators may encourage teachers to use field specialists in social studies courses.

Conflict of Interests

The authors have not declared any conflict of interests.

RECOMENDATİONS

Based on the findings of the study the following suggestions have been developed: Classroom teachers can be informed about the use of literary work in social studies courses through in-service training activities. Lower SES schools can be financially supported to make it possible for classroom teachers to make use of field trips and source persons. In regard to field trips bureaucratic requirements can be reduced to make it much more possible for classroom teachers to use it and teachers should be encouraged to make use of field visits. Activity guides can be developed for teachers, which may help classroom teachers in using mass communication, field trips, and source persons in social studies courses.

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Full Length Research Paper

The development desire of Non-English major teachers in small rural primary schools in Thailand: Participatory action research

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The purpose of this study was to explore some problems and desires of developing self-confidence in teaching English of non-English major teachers in rural small primary schools in Thailand with participatory action research. This study also aims to develop teacher's confidence in teaching English, enhance communicative competence and to assess effectiveness of teaching English of non-English major teachers in the rural small primary schools in Thailand with participatory action research. 5-step procedure of the research included; pre-research phase, planning phase, research phase, verification and reflection phase and monitoring and evaluation phase. There were 6 methods for developing teachers this include; direct training, self-direct learning, teacher networks, coaching and mentoring, informal meeting and, and school visit. The results revealed that the operation through a semester lead the development of the 6 approaches to elevate non-English major teachers' confidence in teaching English, and also enhance their communicative competence in order to makes teaching *more* effective. The results were: Non-English major teachers had self confidence in teaching at high level $(\overline{X} = 4.41)$; Non-English major teachers had communicative competence at a higher level $(\overline{X} = 3.54)$, the pre-test score was 28.33% and the post-test score was 67.08%; in order to assess the effectiveness of teaching, non-English major teachers who graduated from major field finished their tasks with observations, both participatory and non-participatory research throughout the one year assessment of students' achievement. The students' achievement showed higher effectiveness including 2013 and 2014 English achievement. It showed that students at Ban Khok Klang School gained higher achievement approximately 3.47% with 4.41 standard deviation. Those students at Ban Lao-ngong School gained 3.72% higher than pre-test average with 1.60 standard deviation. It showed that the effectiveness of teaching was higher. All 6 approaches could be supported to elevate self-confidence for non-English major teachers in small primary schools in teaching and communicative competence, and also to improve effective teaching.

Key words: Self-confidence in teaching, communicative competence, effectiveness.

INTRODUCTION

The development of English language is not possible because most English teachers in small primary school in

distant area of Thailand did not graduate from English major and they were poor at English (Sinlarat et al.,

2013). Thai students did not use English language outside classroom. They had very few opportunities to take English course and never used it in real lives. Due to the students with non-English communication, it was difficult to encourage students to learn and use English effectively (Chaikiattidham et al., 2010). Moreover, teachers did not have enough teaching skills, and could not use English for communication in the classroom. Therefore, the teaching and learning process focused on the understanding of language more than the communicative approach. The context of Thai students was that they learn vocabularies from books but grammar cannot be used in the same way (Hongsachart, 2010).

Teaching English was a consequence from imperialism of the British Empire until The United States became powerful country (Foley, 2005). Thai people believed that the British and American English were different but the ways of teaching English like "English is a common language for communication" or "English is the language of the world" could be compromised between the two (Talebinezhad and Aliakbari, 2002). Most Thai student used English only in classroom but not in their daily life communication. Majority of English language was used as capability evaluation, achievement assessment for lessons learning only (Boriboon, 2011). In addition, the pronunciation was different from native speakers.

In former time, we had a lot of problems and challenges of teaching English. It was found that the students could not speak English and did not realize the importance of learning English, too (Tongaht, 2012). Thai student did not use English in daily life but only in a classroom or test. So many problems occurred in small primary schools in rural area, for example, there was not enough budget, resources, media, no internet connection for class or even staff to help out.

Wongsothorn (2005) said that Thai English teachers were not satisfy because of lack of promotion. Some teachers were so poor at English proficiency. The amount of English teachers majoring in English decreased everyday (Tulasuk, 2012). Office of Policy and Planning Education (2008) said that the study reported that those small schools were in a troubled situations as they are located in small and poor communities. So they could not manage quality education. Nomnian (2009) said, "Most teachers did not have a good attitude in teaching English, lacked confidence because they did not major in English''. The National Institute of Educational Testing Service (Public Organization, 2010) said that "The teachers in a small primary school were not English major, lacked both quantity and quality teaching."

The development of English language in the present does not properly progress in small primary school in Thailand because there is not enough English-major teacher especially in the distant schools under the office of the basic education (Sinlarat, 2014). In addition, some of the English teachers have insufficient effective aptitude on teaching English. There are so many problems in small primary schools in remote area (Tulasuk, 2013). The Office of Policy and Plans Basic Education (2006) has reported that almost all small primary schools in Thailand had a lot of problem in quality of Education.

The problems came from the teachers who cannot use English to communicate so there is need to help them gain higher skills in order to build up practice, accuracy and ability to teach effectively like as Canale and Swain (Wiriyachittra, 2013) noted 5 indicators which aims to help teachers in higher English communication they are:

1. Linguistic competency
2. Sociolinguistic competency
3. Discourse competence
4. Strategic competence and
5 Intercultural competence

Hedge (2008) mentioned 5 factors of capability on communicative competence this include (Table 2):

1. Linguistic competence
2. Pragmatic competence
3. Discourse competence
4. Strategic competence and
5. Fluency.

Hoy and Miskel (1991) presented the criteria for effectiveness evaluation containing adaptation, attainment approach or goal attainment, integration, and latency; used in both time and multiple constituencies.

With the establishment of self-confidence for teaching and communicative competence of the teachers, Office of the Education Council (2013), recommended that the implementation of teacher and educator development were: self-learning, training, learning, work shop or academic activity and exchanging teachers among institutions or schools. Furthermore, Loucks-Horsley (2003) suggested that the best way to develop teachers were to make teacher gain more knowledge, understand curriculum and apply to different context, school network, including training and technology. To develop teachers from other countries, EU for example, OECD (2010) said that those countries used so many methods to develop teachers this include:

1. Informal talks
2. Courses and workshops

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3. Reading professional development literature
4. Education conferences and seminars
5. Professional development network
6. Individual and collaborative research or collective research on a topic of professional interest
7. Peer observation
8. Observation visit to other schools and
9. Qualification programs.

Improving professional learning for educators in USA is a crucial step in transforming schools and improving academic achievement (Tangchaung, 2012) these were:

1. Internet network
2. Professional development
3. Visiting classroom.

The teachers who fail should:
1. Formulate an employee improvement plan
2. Peer assistance
3. Seminar and
4. Other resources.

The improvement of school teachers in Australia (Department of Education and Training and Tang Chaung, 2012) were:

1. Ongoing
2. School-based
3. Daily work of teacher and
4. Individual and self-improvement task such as seminar, conference, workshops etc.

The different forms to develop teachers in part could help researcher take dissimilar styles for usage in a good practice and highest benefit for them. 6 methods that help teachers include;

1. Direct training
2. Self-direct learning
3. Teacher networks
4. Coaching and mentoring
5. Information meeting and
6. Visit school.

All of these methods could help support the non -English major teachers in a small primary school who had self-confidence for teaching and communicative competence to make an effective teaching. Every teacher must acquire this in order to increase his/her chances of goal achievement and to apply knowledge to instill better character in their students. The aim of this study is to develop methods and practices to obtain effective principle and quality (Kemmis and McTaggart, 1988). Chantavanich (2012) said, "it is a method that helps community to do research". Kemmis and Wilkinson (Creswell, 2002) said, "this research could help man participate actively". Iemjinda (2005) and Atay (2006)

said, "the short workshop changes teaching behavior by 5 to 10%" and Iemjinda (2005) said that 9 months' workshop can help teachers to acquire knowledge for their classroom activities.

OBJECTIVES OF THE RESEARCH

The current study aims to:

1. Develop the self-confidence of non-English major teachers in small primary schools with participatory action research.
2. Develop the communicative competence of non-English major teachers in small primary schools with participatory action research.
3) Evaluate the effectiveness of non-English major teachers in small primary schools with participatory action research.

METHODOLOGY

Researchers used participatory action research. There were so many methods to work with the participants to achieve the objectives of this study. Sudprasert (2012) presented that the research was conducted as a part of research activities pursuits. The purpose of the research was

1. To do scientific research to help the society, to use effectively participatory action research to resolve the problems of the community, and to avoid waste of money.
2. To resolve problems with participation. At the end of the research project, the participants will have the knowledge of learning. They will have enough power to fix their own problems alone effectively without waiting for help outside.

The research suggested that the participatory action research model was the most appropriate professional development for teachers who completed a straight branch in small schools with limited resources, but they are ready to enhance themselves and learn their mean high quality.
    Participation is a method used to allocate and utilize the involvement of the public's right to provide policy that would benefit the people in the community. The involvement of the public makes them to express themselves. However, in the theoretical part, multi-dimensional could be classified into different dimensions containing

1. The first dimension joint study and analysis for the prioritization of needs for information in the preparation of preliminary consideration and planning research.
2. The second dimension is a joint plan developed after the introduction.
3. The third dimension is community co-operation; the participation of the population in the development process or the execution of the research plan.
4. The fourth dimension shares the benefits equally.
5. The fifth dimension involves monitoring the research and development of actions to achieve the goal. There were obstacles and limitations.

The participants in this research were 3 teachers from Ban Khok-klang school and 5 teachers from Ban Lao-ngong school under the office of Mahasarakham primary education service area 1. The

participants were collected by purposive sampling.

The form in this research

Participatory action research involves 5 steps:

1. Pre-research phase
2. Research phase
3. Planning phase
4. Implementation phase and
5. Monitoring and evaluation phase.

This is a simulation model or conceptual research for developing teachers (Figure 1).

The instruments in the research

This study used:

1. Observation
2. Interviewing student
3. Interviewing director
4. Interviewing participants
5. Pre-post test
6. Self-assessment
7. Informal meeting
8. Focus group
9. Other instruments such as video, record and students' achievement

Analysis

Induction approach was used for the qualitative research. Researcher solved problem using inductive holistic perspective and focused on contextual, empathy and insight means from the field. The reliability was verified with triangulation by Denis as:

1. Data triangulation
2. Multiple observer triangulation and
3. Empirical materials triangulation.

FINDINGS

This research was a qualitative research (Chantavanich, 2011). The procedures entails:

1. Data determination and
2. Data comparison for finding new relationship.

The findings were;

1. The research problem was that there was no English-major teacher and 8 non-English major teachers in 2 small primary schools. The interview was conducted on principals and those English teachers. It was found that they desired to enhance their English communicative competence and self-confidence in teaching English language (Figure 2).
2. Group discussion was provided to develop the two-school teachers. The master plan of 6 English teacher

development methods was discussed to elevate them simultaneously with the usual teaching hours.
3. The researcher participated in two schools one day a week each through one academic year.

The finding was that at the first phase of operation, the teacher developed very slowly because they had barely prepared to develop self confidence in teaching. After direct training and workshop with native speaker, they used English simulation to communicate daily. Even the teachers could not speak English with native speaker at the first time of the training but later on they could communicate more frequently. The atmosphere of the direct training was better when they had more time and filled up the happiness at the end of practice. The researcher assessed the participant's pleasure and found that they had highest level of pleasure and wanted more training.

Working with students, teachers used more tasks with them such as English project on daily English communication. The students could speak English to the researcher every time. The teachers had good attitude on teaching English. A school director attended and supported teachers and student by tutoring them every weekend. When teachers had self confidence in teaching, researcher used 5 approaches to develop teachers and tried to stimulate participant with "Informal Meeting" every week after that had used "Teacher Networks" and suggested "Self-direct Leaning" to them. The researcher suggested to the participants how to learn on online computer or world wide web for learning English communication. He also got a good idea from English supervisors of Office of Mahasarakham primary education service area 1 who were so generous with the "Coaching and Mentoring" and with their participation was so helpful. The study was also supported by the directors and the board from other schools in mentoring teachers' practice; they could motivate teachers and develop student's achievement, too. Results from the sixth to the development objectives of the research could answer the three questions below:

1. Non-English major teachers in small primary schools have more self-confidence in teaching. The study used self-assessment from 4 factors: 48 items in total from 8 participants. All the participants had a high level score in total. The mean score was 4.41 in total. When analyzing the data, each factor had very good level, 2 factors were; Attitude and Personality and have good level 2 factors were; knowledge of English and knowledge of the English language as shown in Table 1 and Figure 1.
2. Non-English major teachers in small primary schools have more communicative competence in both self-assessment and test.
3. They assesses ability of communicative competence by themselves and found five factors and 58 items, and the mean score was 3.54 in total average. When analyzing each factor it was found out that ability in

Table 1. The self confidence in teaching English by self-assessment.

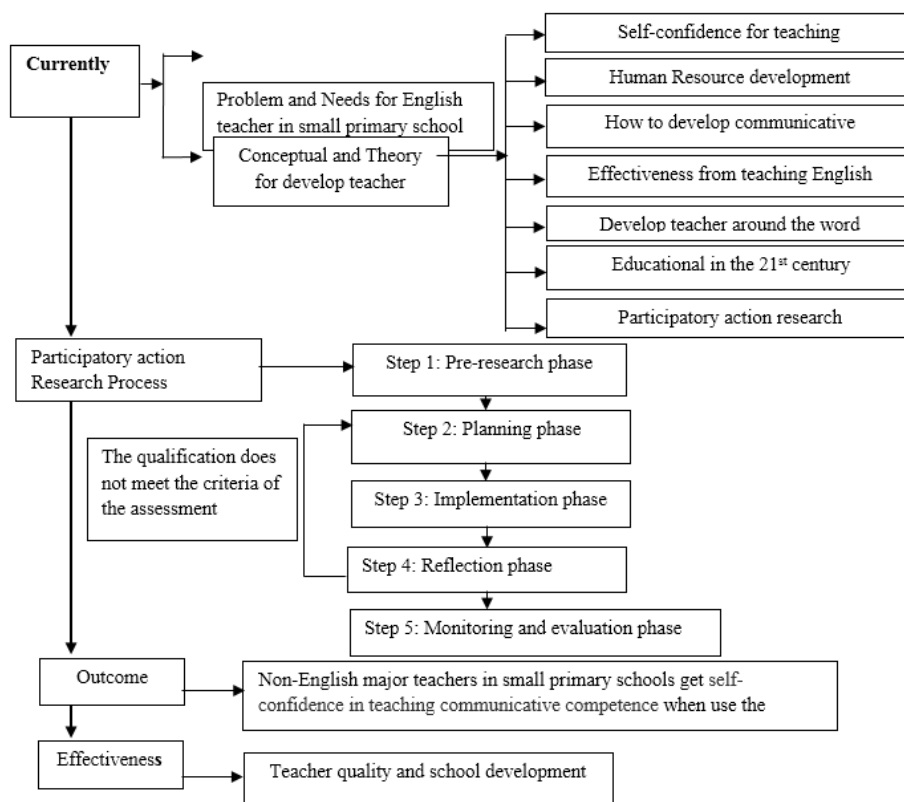| Dimensional	Average score	Standard deviation	Result
Knowledge	4.31	0.58	Good
Teaching	4.35	0.60	Good
Personality	4.48	0.63	Good
Attitude	4.62	0.56	Very good
Total / Average	4.41	0.59	Good

Figure 1. Conceptual research.

communicative competence has good level 2 factors which were; factor 5 and factor 3 and had a fair level 3 factors which were; factor 2, factor 4 and factor 1 (Table 2 and Figure 3).

4. When using pre-post test, It found that the participants had higher score when post-test had an average score of 67.08%, while the pre-test scores was 28.33% (Table 3 and Figure 4).

5. When the effectiveness of non-English major teachers in small primary schools in one academic year was evaluated, it was found that; 8 participants were more effective and their students had a better learning achievement, too.

The evaluation of teachers, who graduated elementary education, in teaching English at the end of the academic year with participatory action research resulted from observing both the participating and non-participating

researchers. The point to note was:

1. The use of English in the classroom communication between teachers and students
2. The English use of students
3. Assignments and practical work on the workload of English students
4. Students' work observation
5. Teaching observation and
6. The knowledge used on daily basis concluded in one academic year how teachers had more confidence in teaching and communication with students both in and out of the classroom. In addition, by comparing the academic achievement of the students in school A and school B, the results were (Figure 5);

How to develop teachers:

Table 2. Ability of communicative competence by self-assessment.

Dimensional	Average score	Standard deviation	Result
Linguistic competency	3.35	0.52	Fair
Sociolinguistic competency	3.49	0.54	Fair
Discourse competence	3.53	0.65	Good
Strategic competence	3.48	0.69	Fair
Intercultural competence	3.79	0.61	Good
Total average	3.54	0.61	Good
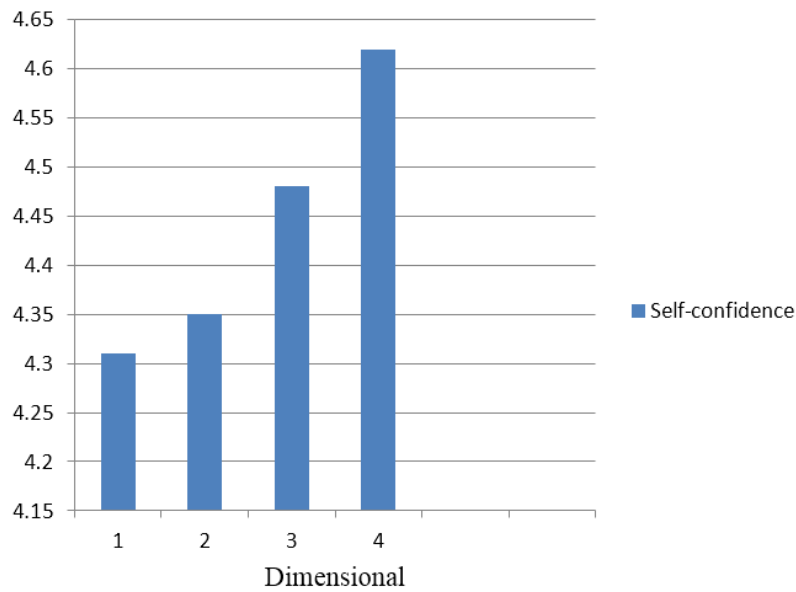
Figure 2. Self-confidence in teaching English.
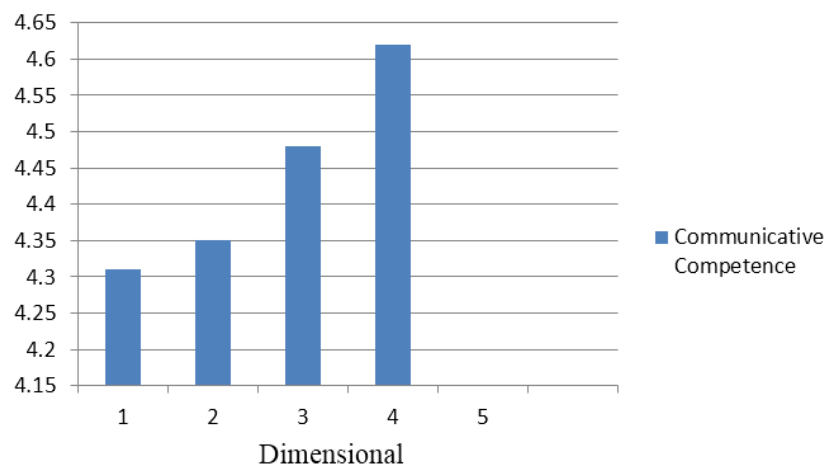
Figure 3. Communicative competence.

The participants included in the study were: 1. Researcher

Table 3. Pre-test and post-test.

Teacher	Pre-test			Post-test		
	Score	**Percentage**	**Ability**	**Score**	**Percentage**	**Ability**
A	9	30.00	Level 3	17	56.67	Level 5
B	4	13.33	Level 1	19	63.33	Level 6
C	12	40.00	Level 4	23	76.67	Level 8
D	5	16.67	Level 1	18	60.00	Level 6
E	4	13.33	Level 1	18	60.00	Level 6
F	7	23.33	Level 2	21	70.00	Level 7
G	17	56.67	Level 6	25	83.33	Level 9
H	10	33.33	Level 3	20	66.67	Level 6
Sum	68	226.66	-	161	536.67	-
Mean	8.5	28.33	Level 2	20.12	67.08	Level 6
S.D.	4.50	15.01	-	2.74	9.16	-
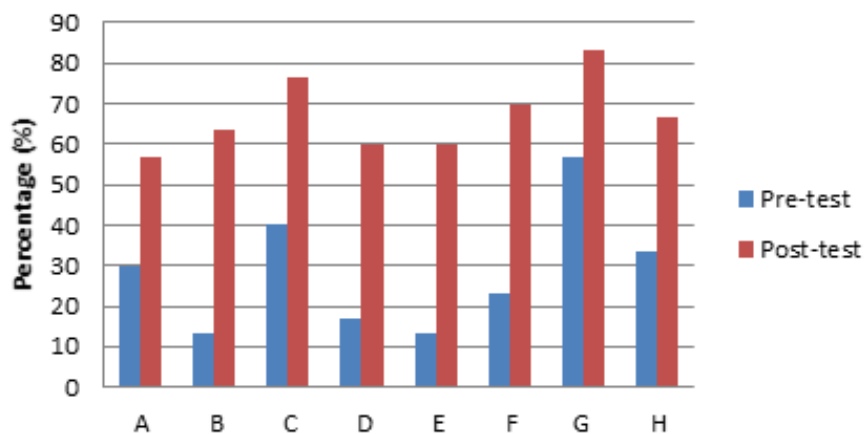
Figure 4. Communicative competence.
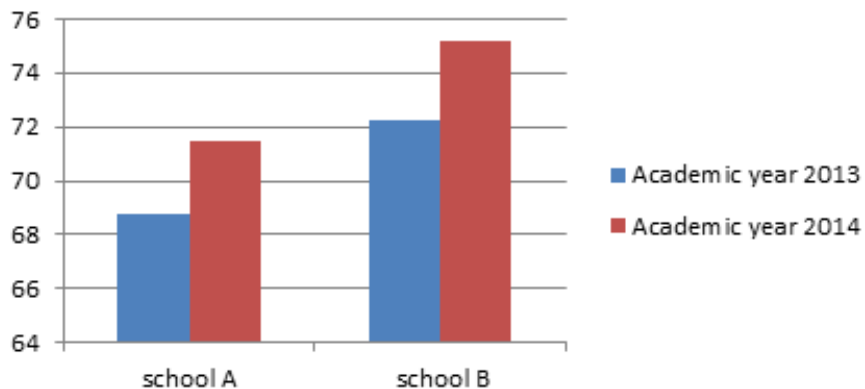
Figure 5. Student's achievement.

2. Participants and
3. Stakeholder

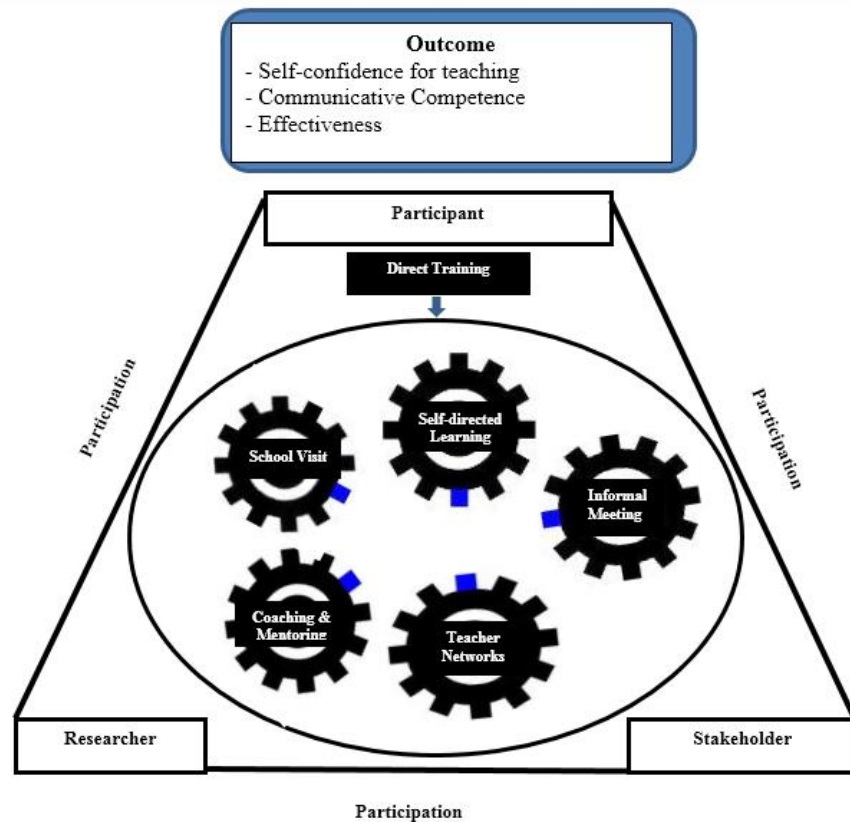There were 6 approaches to develop teachers they are (Figure 6):

Figure 6. How to develop teachers.

1. Direct trainings:

(a) The expert in English communication used workshop with English Teachers.
(b) Training with other materials such as video, satellite, etc.

2. Self-directed learning:

(a) Learning contract with participant; planning and setting guideline for learning English.
(b) Learning by me myself but researcher or others could monitor and assess.
(c) Learning by supporter.
(d) Learning by peer at same school.

3. Teacher networks by researcher and participant.
4. Coaching and mentoring

(a) Coaching and mentoring by formal approach with director, supervisor, or expert for 3 times.
(b) Coaching and mentoring by informal approach with someone whom the participant wanted to talk with.

5. Informal meeting between participant and researcher weekly. We took times for conversation such as break

time, after lunch, before final class, took places such as classroom, canteen, library, and auditorium. We could move or change date, time and place variously.
6. School visit with English good-practice schools. Before going to school they would prepare learning technique to develop teacher's English skills. Going back to school they could take the knowledge acquired and apply it in the classroom. The study was able to monitor and assess all the teachers' performance in the first semester, and also repeated assessment for effectiveness in the second semester. The study also assessed by checking the sustainability in performance for non-English major teachers in small primary schools.

This research found that all 6 approaches could link and support the performance, and help develop non-English major teachers in small primary schools having self-confidence in teaching and communicative competence in order to make an effective teaching.

DISCUSSION

Data analysis in the first step on problems of teaching and learning and needs to develop non-English major teachers in the small primary schools. Researcher used

interview approach with directors and teachers from the both schools. Interviewer found that all the interviewees had the same corresponding to be developed as lack of confidence in teaching and teaching techniques were consistent with Copley (2004) that the problems on teaching profession development was an obstacle because the teachers had insufficient time to prepare teaching materials, and teachers did not know their work clearly. Sometimes they were worried about problems on profession development which was relevant to the study of Nomnian (2009) that teaching English language is a barrier, and that most of the teachers had a negative attitude and were not confident in teaching English because they are not English language graduate.

According to the focus group, to find the ways to improve teacher, the researcher took the draft of analysis form how to develop an English teacher and let them share expression together to find ways to develop English teachers in the small schools. The finding was that all 10 teachers need to be developed in 6 ways:

1. Direct training
2. Self-directed learning
3. Teacher networks
4. Coaching and mentoring
5. Information meeting and
6. School visit.

The participants were in agreement that the 6 ways could be held and direct training should be the first step because they wanted to be assured of English literacy. Although the process at the first part ran slowly because the teachers did not feel free and seems trouble, but after the researcher who was also part of the training was able to have one on one interaction with them, the process ran smoothly. The number of small school teachers did not match the number of classes. The teachers were limited in development and training; they needed to train teachers outside the schools, for example, hotel and central conference places. These kinds of training made students to feel neglected.

The development procedure

The researcher participated in the study with the teachers, and found that the implementation of the first phase has been barely used. The participants were not ready to get involve as possible because of the lack of confidence in teaching. But after a direct training, practicing at school, the participants were more confident. After the first phase, the researcher led 5 development methods to the participants and kept motivation through informal meeting every week, then created the network and suggested the participants should learn by themselves. This was a very good suggestion which was supported by the two school principals and the supervisor of foreign languages essence from the Maha Sarakham

educational service area 1 office (MK ESAO1). As well as those who were assigned by the director of MK ESAO1 stimulating the implementation of OBEC and MK ESAO1's learning achievement raising project with increasing totally 3% was needed. This made the amount of teachers interested in developing language skills increased. The result was relevant to NIE which explored the performance in the Ministry of Education and GESL, and found that the potential of the teachers was taking curriculum as a part of their professional development and the important strategy was demonstration, inquiry, repetition, artificiality, clinical experience, self-conduction and collaboration. The examples of implementation were small-group, school-based, problem-based, case study, electronics portfolio, multifunction and role-play (The National Institute of Education, Singapore, 2009).

This study corresponded to MTD Training and Ventus Publishing ApS (2010) which studied on the development of teacher's capacity to use communication skill in the 21st century in Singapore with changing curriculum, teaching and assessment linking to practice theory and physical-based structure: Firstly, teachers need to have the 21st century skills and secondly additional self-assessment by learning the real world. Moreover, Silanoi (2011) studied management model for teaching professional development in the upper northeast region. The purpose was to synthetize the management model of teaching professional development in upper northeast region depending on environment context. The study concluded that:

1. The synthesis from documents found 5 management model on teaching professional development including action workshop at school-based learning, learning kids, online direct learning, network group learning, and then applied the training result to transfer for post graduate degree.
2. The finding from interviewing teachers in the northeast was that most teachers agree on the school-based learning workshop model and
3. The results of the confirmatory factor analysis by the statistical tests (Chi-square) was the ratio of teachers who agreed on all of the training processes. The results of the group-based seminar of national and regional experts was that a good model of school-based learning workshop which run under the action training process should contain planning, process, supervision, evaluation and improvement process.

Saavedra and Anna Rosefsky (2012) concluded that the teaching and learning in the 21st century were necessary for humans because it would enhance capacity and built up teacher's confidence as well. Full empowerment could build up the confidence for social network of teachers. In addition, the ability of teachers were built up to the exact capacity and enhance their performance and increase the capabilities and teaching skills of the teachers in the 21st century.

Conclusion

1. Non-English major teachers in small primary schools have more self-confidence in teaching.
2. Non-English major teachers in small primary schools have more communicative competence.
3. Non-English major teachers in small primary schools have more effectiveness in English teaching.

SUGGESTIONS

Suggestions on development approach for non-English major teacher:

1. The development duration was 1 semester minimum, and this would benefit those trainees if the duration was extended.
2. Suggestion for school and relevant institute.
3. The educational service institute should take the information and the guidelines in small school to implement and expand to others including how to plan the management, provide policy on non-English teacher development and enhance learner higher communicative competence.

For maximum efficiency, the institute should supervise the training periodically in order to stimulate teacher's performance. Moreover, supervision helped trainees break the wall and this leads to solution, help and support.

Conflict of Interests

The authors have not declared any conflict of interests.

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