ISSN: 2146-9466

IJTASE

International Journal of New Trends in Arts, Sports & Science Education

IJTASE

INTERNATIONAL JOURNAL OF NEW TRENDS IN ARTS, SPORTS & SCIENCE EDUCATION

JANUARY 2019

Volume 8 - Issue 1

Message from the Editor

I am very pleased to publish first issue in 2019. As an editor of International Journal of New Trends in Arts, Sports & Science Education (IJTASE), this issue is the success of the reviewers, editorial board and the researchers. In this respect, I would like to thank to all reviewers, researchers and the editorial board. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to International Journal of New Trends in Arts, Sports & Science Education (IJTASE), For any suggestions and comments on IJTASE, please do not hesitate to send mail.

Assoc. Prof. Dr. Erdal ASLAN
Editor

Published in TURKEY

Contact Address:
Assoc. Prof. Dr. Erdal ASLAN - IJTASE Editor, İzmir-Turkey

Table of Contents
Articles

ISSN: 2146-9466

ISSN: 2146 - 9466
www.ijtase.net
International Journal of New Trends in Arts, Sports &Science Education - 2019, volume 8, issue 1

PRE-SERVICE TEACHERS' UNDERSTANDING AND USAGE OF SCIENTIFIC AND DAILY LIFE LANGUAGE*

Neslihan ÜLTAY**
Giresun University, neslihanultay@gmail.com, ORDCID: 0000-0002-9783-0486

Received Date: 20-11-2018 **Accepted Date:** 10-01-2019 **Published Date:** 31-01-2019

ABSTRACT
The purpose of this study is to investigate how pre-service teachers understand six selected dual meaning words (freezing, combustion, bond, organic, salt and stable) before and after traditional chemistry instruction. A qualitative study approach was used to answer the research questions. The study was carried out in a university on the north coast of Black Sea Region in Turkey. Participants were 29 freshmen pre-service teachers between 18-21 ages. As data collection tool, a questionnaire consisting 42 questions for 6 dual meaning words was prepared and administered as pre- and posttests. In data analysis, after reduction, similar answers were classified and code lists were created. Then, themes were formed according to the codes. After data analysis, it was found that pre-service teachers mostly constructed the meanings of dual meaning words in their daily lives. After learning the scientific meanings of the words, they continued to use both scientific and daily life meanings together. This may be associated with their inability to contextualize and a lack of conceptual understanding, or some combination of two.

Key words: scientific language, daily life language, learning chemistry, dual meaning words, chemistry education research

INTRODUCTION

A key factor learning chemistry and predicting performance is language comprehension (Pyburn, Pazicni, Benassi & Tappin, 2013). Students' first requirement for understanding what they read in chemistry is to understand the language or vocabulary of the content within text and classroom instruction. Despite this fact, teachers do not always give sufficient thought to the precise words that they use in the classroom and how this use may affect students' understanding (Jasien, 2010). Furthermore, teaching vocabulary is not only allocated to the language teachers, but also allocated to the content-area teacher (Young, 2005). Content-area teachers make their greatest contribution to science literacy when they set up situations in which students actively write or speak about their science experiences.

A great challenge to students learning chemistry and to teachers teaching chemistry is the academic language in which chemistry is written. Academic language includes language of education, schooling, and science language (it is Turkish in Turkey) (Snow, 2010). Academic language varies from discipline to discipline. Specific terms in a discipline make the academic language more sophisticated and precise. Introducing a lot of words makes chemistry too difficult to understand and complicated, whereas developing understandings would make it possible for students to develop their vocabulary as they need new words (Miller, 2005). But sometimes the meanings of new words contradict everyday meanings. Because students primarily use the words' in the everyday meanings in the class (because it is known that students come to the class with pre-existing knowledge), they have difficulty in interpreting the scientific words' correct meanings (Itza-Ortiz, Rebello, Zollman & Rodriguez-Achach, 2003). As Michaels, Shouse and Schweingruber (2008) stated in their study unfortunately there are no native speakers of science; scientific language is foreign for all students. In this case, it is acceptable to make some interpretations to newly learned terms or concepts from daily life. For example teacher can use 'double talk' in his/her speeches to give more information about the words which appear both students' daily lives and science courses (Brown & Spang, 2008). In double talk, teacher provides a definition for students they assume is not familiar with an idea, the teacher may choose to offer two versions of the idea like, "a frog is an amphibian, it can live on water and on

* This study was granted by Giresun University Scientific Research Projects Unit (GUBAP – Project No: EĞT-BAP-A-250414-67.
** Doç. Dr., Giresun University Faculty of Education Primary Education Department 28200 Giresun/TURKEY neslihanultay@gmail.com

land," provides students with multiple points of entry for understanding phenomena. In addition, one who uses such a mode of talk also gains insight into understanding the phenomenon in both vernacular and nonvernacular modes of talk. Therefore, double talk involves a subtext of attempting to provide multiple points of access.

To show the transition from daily life meanings to scientific meanings and contrasting two meanings of dual meaning words is necessary for a teacher (Song & Carheden, 2014) because students with their initial understandings -that are incorrect scientifically- may have difficulty at learning the scientific meanings and it may cause the formation of some alternative conceptions or misconceptions. In science education, it is quite well-known that it is hard to change students' initial understandings which may include alternative conceptions or misconceptions (Guzzetti, Williams, Skeels & Wu, 1997; Ültay, 2012). Once students have alternative conceptions or misconceptions, traditional instruction is become useless in eliminating them (Harrison & Treagust, 2001; Hewson & Hewson, 2003; Palmer, 2003; Ültay, 2015; Ültay & Ültay, 2014). However, it is quite difficult to learn academic terms and concepts in science courses. In addition, there are some words causing dilemmas for students because of difference between the word's daily life meaning and scientific meaning (Ünsal, 2010). There is a set of science vocabulary that needs special attention; they are called dual meaning vocabulary by Song and Carheden (2014). Dual meaning vocabulary includes words which are used in both daily life and scientific contexts. Work, energy, salt, organic, elastic, reaction, infrared, neutral, sugar, etc., can have been counted as dual meaning words in different studies (Jasien, 2010; Kızılcık, 2013; Song & Carheden, 2014). Specifically for Turkish language, salt, stable, organic, bond, freezing, combustion, and some other words have dual meaning because of their using both in chemistry and daily life. Students faced these words in their daily lives before formal teaching experience. For example, many of students may have been asked to pass the salt to put in food by their mother or father for many times. It is expected that students know that salt is something to put the food making it more delicious. Thus, when students were asked to define the salt, they explained it as "salt that you put on your food". When students were asked to define "organic", they explained it "something healthier because I think of organic food and because they talk about it all the time on television" (Song & Carheden, 2014). Thus, students' everyday ideas and ways of knowing and talking are largely different from and incompatible with those of science (Warren, Ballenger, Ogonowski, Rosebery & Hudicourt-Barnes, 2001). In many studies, this conceptualization is called misconception which is defined as students' everyday ideas are strongly held, may interfere with learning, and need to be replaced with correct conceptions (Clement, 1982; McDermott, Rosenquist & van Zee, 1987). And so, everyday experience is viewed as a principal source of the educational problem (Warren et al., 2001). For this reason, in recent years, researchers have focused on what students have misconceptions or alternative conceptions, how misconceptions or alternative conceptions can be remedied, how learning can be improved, how conceptual learning and development can be provided. Although the language of science has great importance on learning, there are limited numbers of studies arguing the effect of language in chemistry learning. According to Song and Carheden (2014) and Pyburn et al. (2013), research on language in science education has been mainly conducted at the pre-college level and too little attention was paid to the role of language in chemistry teaching. Nevertheless, it was found that there was a strong relationship between understanding and right usage of language and the success of general chemistry course (Pyburn et al., 2013). In this case, the purpose of this study is to investigate how pre-service teachers understand six selected dual meaning words (freezing, combustion, bond, organic, salt and stable) before and after traditional chemistry instruction.

Research questions

The following research questions guided this study:

(1) What are the pre-service teachers' initial understandings of dual meaning words before being introduced the scientific meanings?

(2) What are the pre-service teachers' final understandings of dual meaning words after instruction?

METHODOLOGY

Research Design and Sample

A qualitative study approach was used to answer the research questions. Qualitative studies are used when something is more important than the numbers. While quantitative studies focus on how much the students learn or know the research questions or the information about something, qualitative studies focus on the process of learning and a more detailed whole picture of the research. This study is aimed to show the whole picture of what the pre-service teachers know about the dual meaning words and how their knowledge is affected by the instruction.

The study was carried out in a university on the north coast of Black Sea Region in Turkey. Participants were 29 freshmen pre-service science teachers between 18-21 ages and 18 of them were females and 11 of them were males. Pre-service teachers had learned chemistry from the first year of the high school and in the first year of the university education they learned chemistry by General Chemistry Course four hours in a week and General Chemistry Laboratory Course two hours in a week in the first semester. Pretest was administered at the beginning of the semester and the posttest was administered at the end of the semester during one class period (40 minutes).

Before the pretest, pre-service teachers were asked if they wanted to participate in such a study and three pre-service teachers in the sample did not want to participate in the study, so they were excluded from the study and their data were not used. The rest of pre-service teachers willingly participated in the study. Pre-service teachers in the sample did not participate such a research design before. The researcher asked pre-service teachers about their willingness to participate in the study. She assured pre-service teachers that they were not obliged to participate in the study and that they would not be awarded extra points for their participation. The consent of the participants was requested before their responses in the questionnaire were shared with the reader. Also, the participants were informed about sharing some demographic information and their consent was requested beforehand. Before and after the test, some of the dialogue between the researchers and the participants were not reflected in the study and remained between the two because of the principles of privacy and confidentiality.

Data collection tools

In the study, firstly some dual meaning words were determined by the help of the chemistry textbook. Selected dual meaning words were freezing, combustion, bond, organic, salt and stable because pre-service teachers were accustomed to hear these words in their daily lives and the school and because the study was implemented in the first semester of the academic year (fall semester) so the words students faced in the content of their chemistry textbooks (for example Petrucci, Harwoon and Harring, 2008). Then, after the literature review (reviewing the well-known databases (i.e. Academic Search Complete, Education Research Complete, ERIC, Springer LINK Contemporary) and Google Scholar with the keywords of “language of science”, “dual meaning”), the questions asking about these dual meaning words were prepared. The questionnaire included 42 questions for 6 words and each word had 7 questions. The questionnaire was administered two times, at the beginning of the first semester and at the end of the first semester. There were 13 weeks between the pre- and posttests. An example for one dual meaning word in the questionnaire which was administered as pre- and posttest is given in the following:

ISSN: 2146 - 9466
www.ijtase.net
International Journal of New Trends in Arts, Sports &Science Education - 2019, volume 8, issue 1

Table 1: Questions for "freezing" word in the questionnaire

"Freezing" in the pretest	"Freezing" in the posttest
1. What firstly comes to your mind when you hear "freezing"? If helps, you can draw a picture.	1. What firstly comes to your mind when you hear "freezing"? If helps, you can draw a picture.
2. How did you learn the meaning of that word? Does it have significance to you? Please explain.	2. Has the meaning of the word changed after learning in the lesson? Please explain.
3. How often do you use that word when writing or reading? Please explain.	3. How often do you use that word when writing or reading? Please explain.
4. When you hear that word in a scientific context, does the meaning of the word change for you? If so, what is that meaning?	4. When you hear that word in a scientific context, does the meaning of the word change for you? If so, what is that meaning?
5. Which meaning comes to your mind firstly, when you hear that word in the class? Please explain.	5. Which meaning comes to your mind firstly, when you hear that word in the class? Please explain.
6. If the meaning of daily use came to your mind, why was it hard to retain the scientific meaning of the word? Please explain.	6. Has the lesson been effective to learn the meaning of the word for you? Please explain.
7. Please use that word in a sentence.	7. Please use that word in a sentence.

Some example students responses are given in the following for the pre and posttests. Because the study was carried out in Turkey and in Turkish, it is added their translations to English.

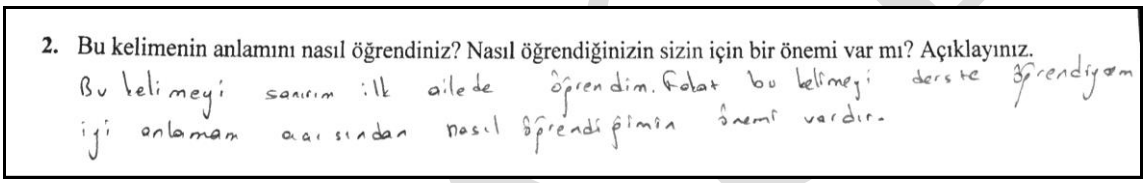

Figure 1. 8 number of pre-service teacher's response for the pretest

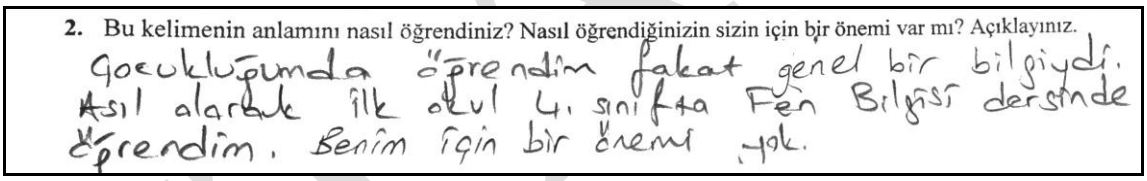

Figure 2. 10 number of pre-service teacher's response for the pretest

In Figure 1, the question was "How did you learn the meaning of that word? Does it have significance to you? Please explain". The pre-service teacher answered this question as "I guess I learned this concept in my family, but it makes difference how I learned this concept for good understanding". The same question was responded 10 number of pre-service teacher in Figure 2 in that way "I learned it in my childhood but it was a general knowledge. The real learning was in a science course in the 4th grade of primary school. It does not make difference how I learned it".

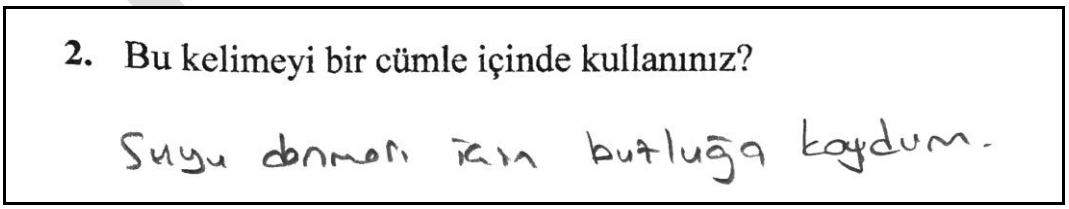

Figure 3. 2 number of pre-service teacher's response for the posttest

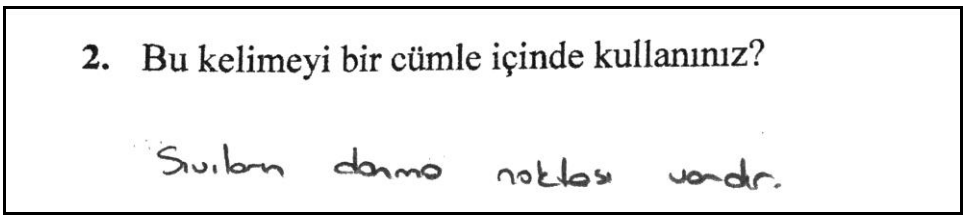

Figure 4. 1 number of pre-service teacher's response for the posttest

In Figure 3, the question was "Please use that word in a sentence", the answer of 2 number of pre-service teacher was "I put the water to the freezer to freeze", and in Figure 4, 1 number of pre-service teacher responded it as "Liquids have a freezing point".

The same questions with the other selected dual meaning words were asked to pre-service teachers. In the study, pre-service teachers took the questionnaires and wrote their answers for each word. They completed to write the answers in approximately 40 minutes.

Validity and Reliability

The validity and reliability in qualitative researches have not been thought separately (Golafshani, 2003). To be more specific with the term of reliability in qualitative research, Lincoln and Guba (1985, p. 300) use "dependability", in qualitative research which closely corresponds to the notion of "reliability" in quantitative research. They further emphasize "inquiry audit" (p. 317) as one measure which might enhance the dependability of qualitative research.

To ensure reliability in qualitative research, examination of trustworthiness is crucial. Seale (1999), while establishing good quality studies through reliability and validity in qualitative research, states that the "trustworthiness of a research report lies at the heart of issues conventionally discussed as validity and reliability" (p. 266).

To improve the analysis and understanding of construction of others, triangulation is a step taken by researchers to involve several investigators or peer researchers' interpretation of the data at different time or location (Johnson, 1997). The reliability of the measurement results, two chemistry education experts read pre-service teachers' answers and each of them created their own codes and themes. Then the researcher checked and compared the codes and themes with her own codes and themes. The interrater reliability coefficient (Cohen's Kappa) between the experts and the researcher was calculated as 0.90. After that, the researcher used her own codes and themes while evaluating the data.

The chemistry education experts ensured the appearance (the page setup, the font size, etc), readability and content validity. Also, six pre-service teachers apart from the participants were read the items and they let the researcher about any unclear or not understandable points. After that, some minor changes were made to the items in the questionnaire.

Data Analysis

In data analysis, all data were firstly written as a paragraph concept by concept. After reduction, similar answers were classified and code lists were created. Then, themes were formed according to the codes. The same process was repeated for the posttest. Because some questions were different in pre- and posttests, different codes and themes were appeared in pre- and posttests.

Because data were written as a paragraph, the common answers were outstanding. Almost all pre-service teachers had started to answer with a definition of the concept, although the first question was asking a different thing. In the first question, it was asked that "what firstly comes to your mind when you hear 'freezing'? If helps, you can draw a picture." Because pre-service teachers defined 'freezing', thus, from these answers the first theme was formed: definition of the concept. Then in the second

question, students explained how they learned the meaning of the concept but they did not explain whether it had significance to them. So, from these answers the second theme was formed: learning. Thus, all themes were created in this way for pre- and posttests apart from the questions but depending on the pre-service teachers' responses.

RESULTS AND DISCUSSION

To answer the research questions the results and discussion from the questionnaire are presented in this section.

'Freezing' Concept

Pre-service teachers' initial and final understandings of 'freezing' concept are shown in Figure 5 and 6.

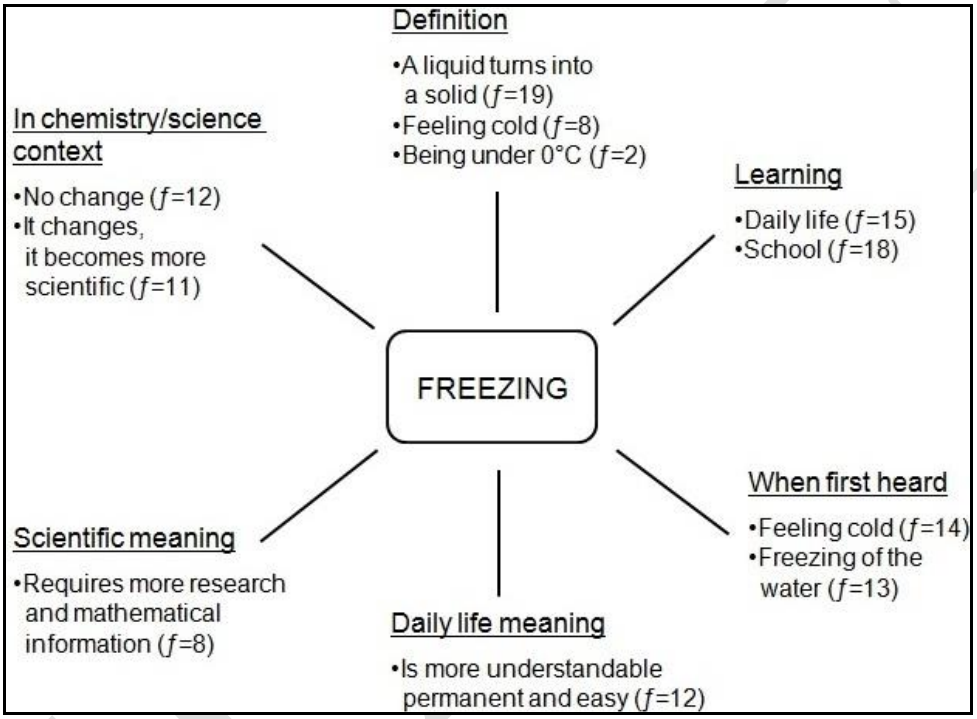

Figure 5. Pre-service teachers' initial understandings of 'freezing' concept

According to Figure 5, pre-service teachers defined 'freezing' as a liquid turned into a solid (f=19), feeling cold (f=8) and being under 0°C (f=2). Pre-service teachers mostly learned this concept in school (f=18) and daily life (f=15).

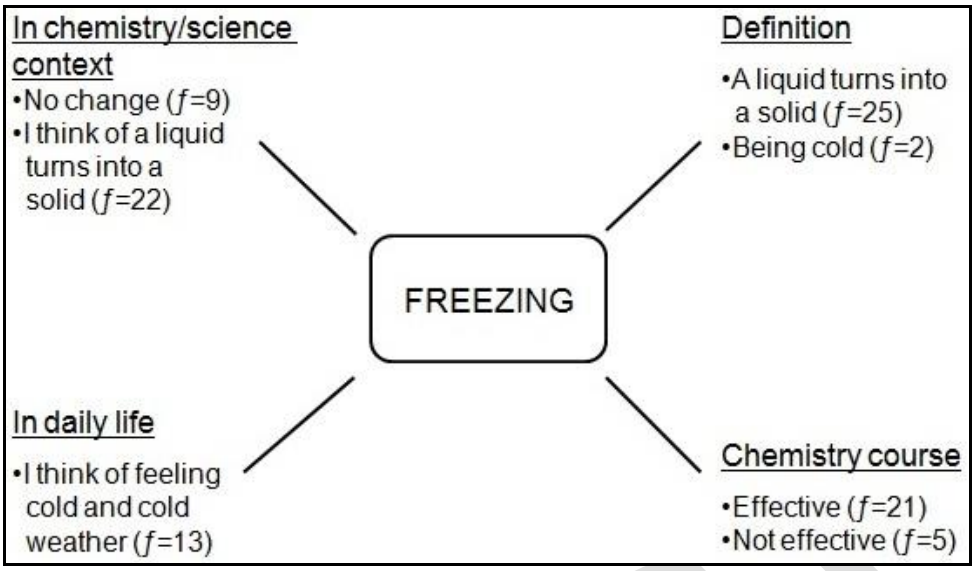

Figure 6. Pre-service teachers' final understandings of 'freezing' concept

As can be seen in Figure 6, in posttest, pre-service teachers mostly defined the 'freezing' concept as a liquid turned into a solid (*f*=25). On the other hand, some of them kept relating 'freezing' and 'cold' (*f*=2).

When pre-service teachers' understandings are considered, it is seen that their understanding of 'freezing' concept is highly based on their daily life experiences. Furthermore, some pre-service teachers used 'freezing' concept instead of feeling cold especially in winter days. While some of them defined 'freezing' as a liquid turned into a solid, they gave examples of turning water to ice from daily life. When pre-service teachers heard 'freezing', they instantly maybe unconsciously related water and ice. The reason of this may be that most teachers used daily life experiences that students were more familiar (Çalık, 2005). It may cause a contextual difficulty with the freezing concept associated with pre-service teachers lack of experience with different substances (Jasien, 2013). Students sometimes try to use ideas from daily life to explain scientific conceptions, but they may not have a deep understanding of the scientific view which leads them to make inappropriate applications of daily life experiences and terminology to scientific matters (Ültay, Durukan & Ültay, 2015). After chemistry course, although pre-service teachers changed their understandings about 'freezing' and they gained more scientific point of view, there are still some pre-service teachers stated that they thought feeling cold. Their wrong perception about 'freezing' may prevent their scientific understanding because in the literature some studies have revealed the wrong perception of some terms and these kind of wrong perceptions and thoughts are get into the language as term misconceptions (Kızılcık, 2013; Ünsal, 2010). Nevertheless it is claimed that coldness is amisconception (Vosniadou, 2013). It would be quite difficult to change the alternative conceptions and misconceptions with the scientifically understandings. In recent years, conceptual learning and overcoming alternative conceptions and misconceptions have been the most popular research areas in science education (Ültay & Çalık, 2016). Besides applying different techniques and methods to remedying alternative conceptions and misconceptions, it should be noted that language comprehension is the key factor (Pyburn et al., 2013).

'Combustion' Concept

Pre-service teachers' initial and final understandings of 'combustion' concept is shown in Figure 7 and 8.

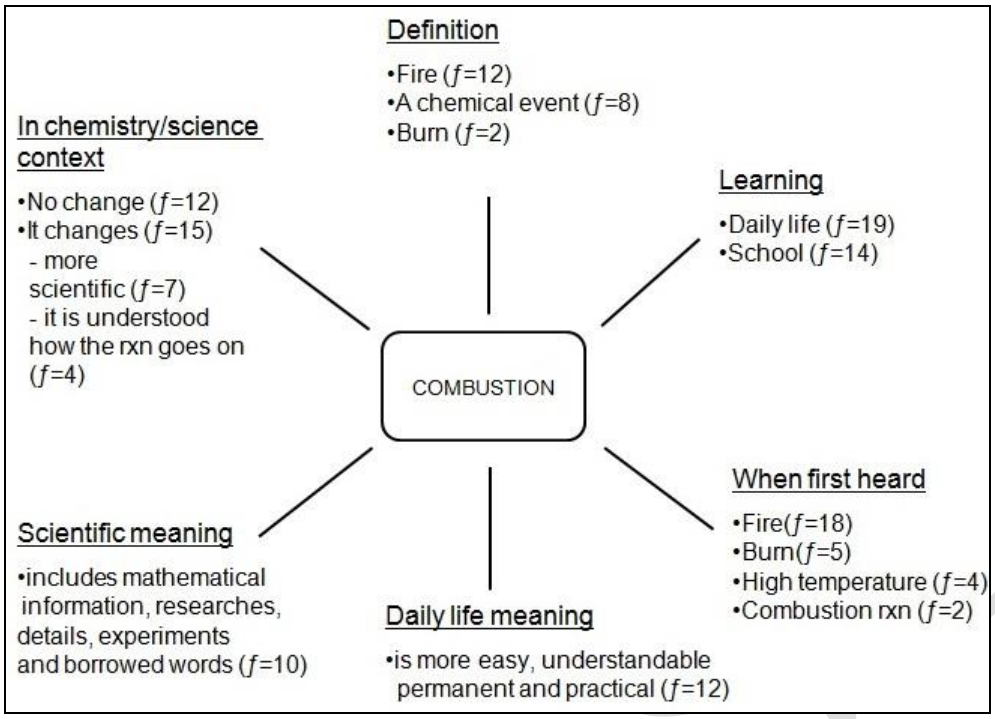

Figure 7. Pre-service teachers' initial understandings of 'combustion' concept

According to Figure 7, pre-service teachers defined 'combustion' as a fire (f=12), a chemical event (f=8) and burn (f=2) in pretest. Pre-service teachers mostly learned this concept in daily life (f=19) and in school (f=14). In addition, they thought that the daily life meaning was more easy, understandable, permanent and practical (f=12).

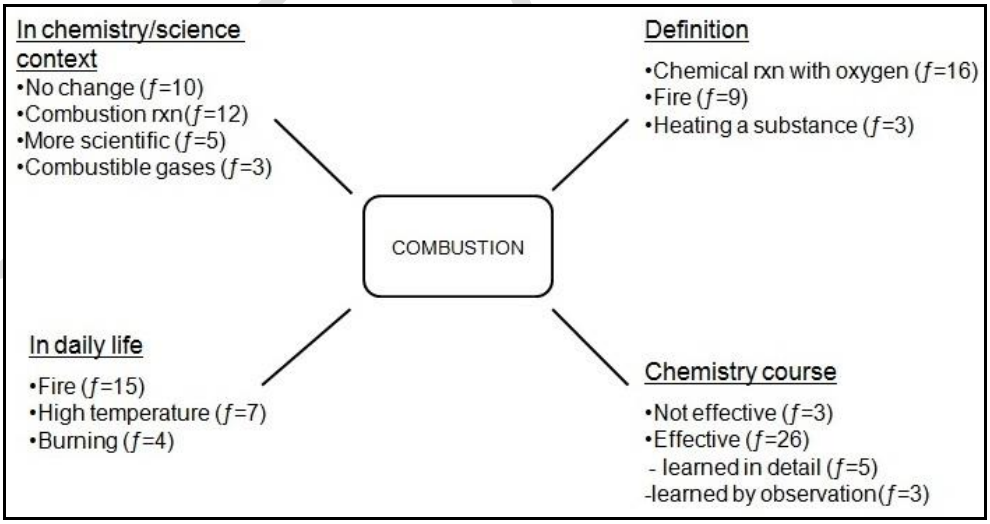

Figure 8. Pre-service teachers' final understandings of 'combustion' concept

As can be seen in Figure 8, in posttest, pre-service teachers mostly defined the 'combustion' as a chemical reaction with oxygen (f=16), a fire (f=9) and heating a substance (f=3). Most of pre-service teachers found the course effective in learning the 'combustion' (f=26) because learning was provided in detail (f=5) and by observation (f=3), but a few of them found the course ineffective (f=3).

When 'combustion' concept is considered, it is seen that much more pre-service teachers defined combustion as a fire in pretest than it was in posttest. It reveals that the chemistry course was effective

at teaching this concept because most of pre-service teachers defined combustion as a chemical reaction with oxygen. In addition, pre-service teachers stated that they had learned in detail and they got the opportunity to make experiments in the chemistry laboratories. Therefore, learning was become more meaningful and permanent by the chemistry laboratories (Domin, 1999; Hofstein, 2004). Some chemistry concepts such as dual meaning words often assign strange meanings to well-known colloquial words and present a special problem when chemists require an exact meaning in a given context (Jasien, 2011). For instance, while pre-service teachers could have defined combustion in a scientific way in scientific context, they tended to use 'fire' or 'burn' in daily life context. Because of this reason, in today's society, it is becoming important to have an understanding of the concepts and processes of science, as well as a grasp of the language of science, to be an informed citizen (Holbrook & Rannikmae, 2007; Miller, 2005). An understanding of science and the processes of science is essential to full participation in life Despite the centrality of science to our life and to the progress of our society, many students fail to acquire scientific knowledge, understanding, and abilities (Fang, 2004).

'Bond' Concept

Pre-service teachers' initial and final understandings of 'bond' concept are shown in Figure 9 and 10.

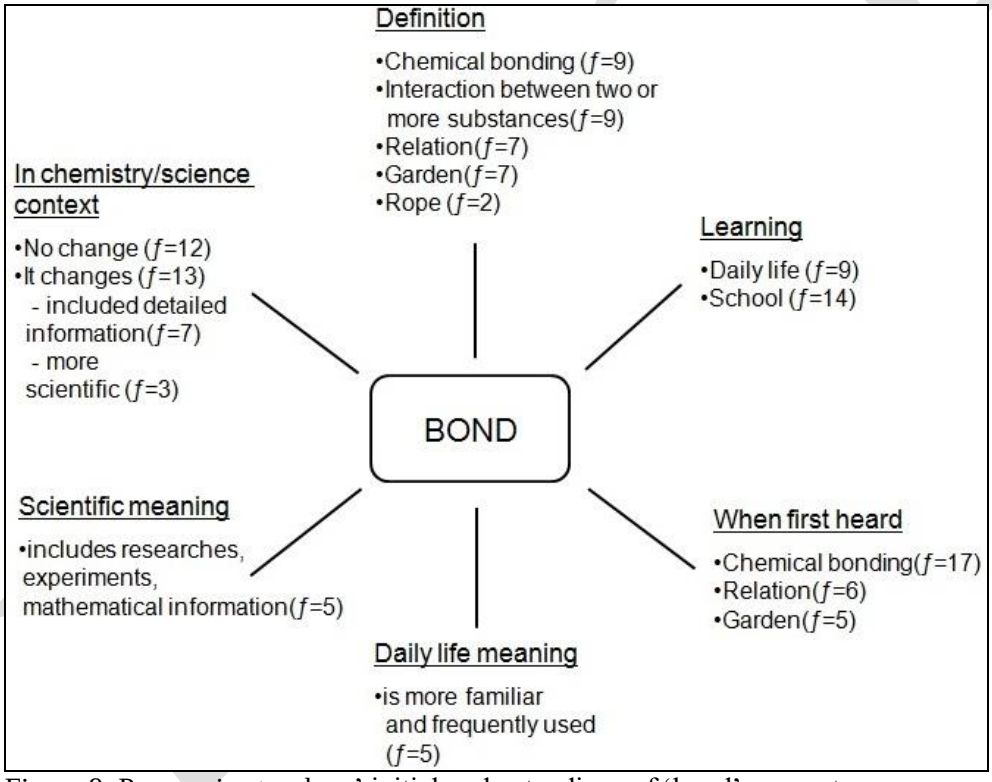

Figure 9. Pre-service teachers' initial understandings of 'bond' concept

In Figure 9, pre-service teachers' initial understandings of 'bond' concept are seen. Pre-service teachers related 'bond' with 'chemical bonding' (*f*=9), relation (*f*=7), garden (*f*=7), rope (*f*=2) and they defined it as an interaction between two or more substances (*f*=9). Pre-service teachers mostly learned this concept in school (*f*=14), and some of them learned this concept in daily life (*f*=9).

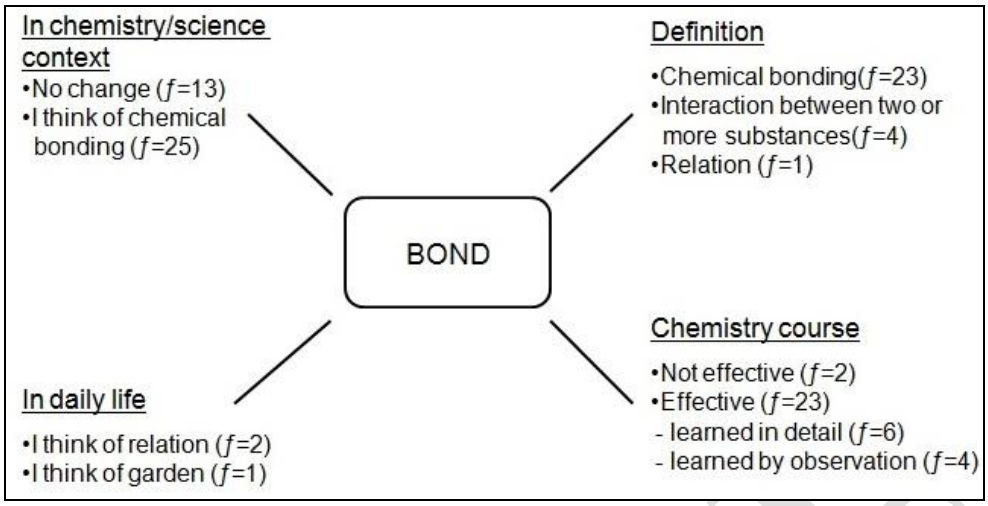

Figure 10. Pre-service teachers' final understandings of 'bond' concept

As can be seen in Figure 10, pre-service teachers related 'bond' concept with chemical bonding (*f*=23) and relation (*f*=1), and defined it as an interaction between two or more substances (*f*=4). Most of pre-service teachers found the chemistry course effective at understanding the meaning of the 'bond' concept (*f*=23) because they stated that they learned in detail (*f*=6) and by observation in the course (*f*=4).

In pretest, because pre-service teachers mostly learned the meaning of 'bond' at school, they defined it by using 'chemical bonding' and 'interaction between two or more substances' instead of daily life meanings. But still, some of them related 'bonding' concept with relation, garden and rope. In Turkish language, 'bonding' have different meanings such as relationship between friends or family members, garden in which fruits are growing and rope which was used to tie something. Science terms are used with very specific meanings, yet because many of these terms have different meaning in everyday life, students can become confused (Jasien, 2010; Haider & Abraham, 1991). Nevertheless, when most of pre-service teachers first heard 'bonding', they thought of 'chemical bonding'. In the former dual meaning words, pre-service teachers found the scientific meaning was difficult because of mathematical information and including researches, they found the daily life meaning was more familiar. In posttest, surprisingly, almost all pre-service teachers defined 'bonding' scientifically except one person. They found the chemistry course was effective at learning the concept and they tended to think scientific meaning almost all the time.

'Organic' Concept

Pre-service teachers' initial and final understandings of 'organic' concept are shown in Figure 11 and 12.

According to Figure 11, all pre-service teachers related 'organic' concept with natural and pure (*f*=30) and organic fruits and vegetables (*f*=3). A few of pre-service teachers defined 'organic' as a substance containing C, H and O elements (*f*=2). Pre-service teachers mostly learned this concept in daily life (*f*=17) and school (*f*=13).

As can be seen in Figure 12, pre-service teachers related 'organic' concept with natural and pure (*f*=16) and they defined it as a substance containing C, H and O elements (*f*=11). A few of pre-service teachers related 'organic' with organic fruits and vegetables (*f*=3). Most of pre-service teachers found the chemistry course effective at understanding the meaning of the 'organic' concept (*f*=15) because they stated that they learned in detail (*f*=5) and by observation in the course (*f*=1).

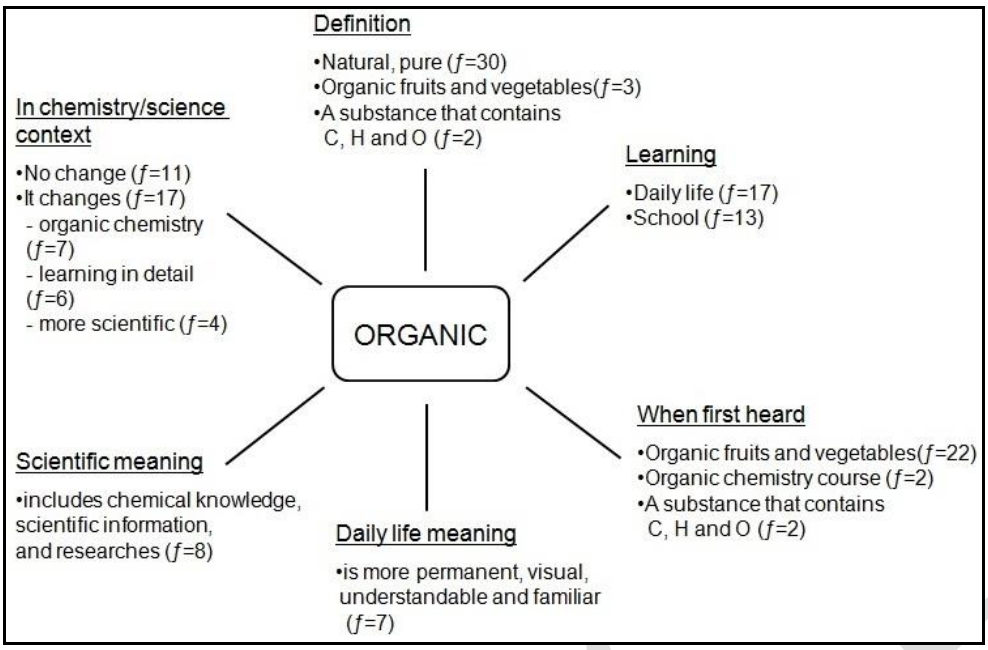

Figure 11. Pre-service teachers' initial understandings of 'organic' concept

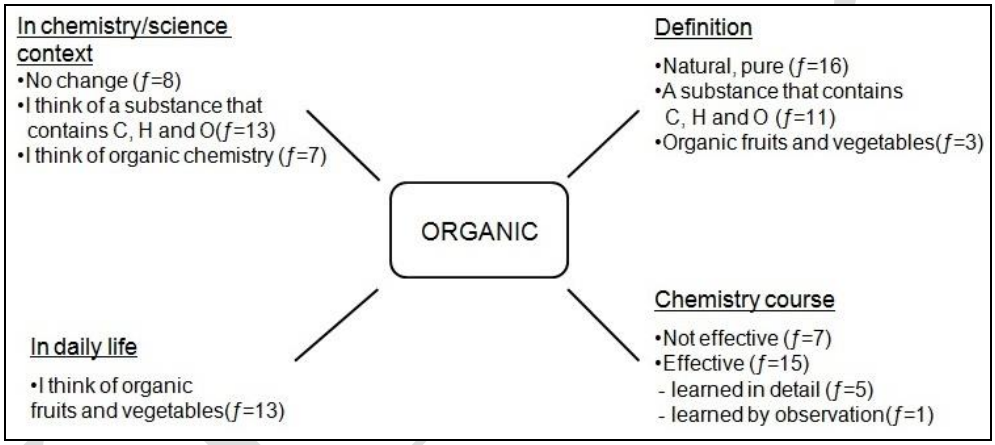

Figure 12. Pre-service teachers' final understandings of 'organic' concept

Before the instruction, pre-service teachers often defined the 'organic' concept by its everyday meaning. The reason of this may be pre-service teachers did not have many opportunities to use them in scientific contexts (Song & Carheden, 2014). Pre-service teachers mostly related 'organic' concept with natural and pure because they often saw some news about a fruit or vegetable was organic if it was grown naturally. It was also understood that pre-service teachers' knowledge about 'organic' was limited with organic fruits and vegetables and being natural. A few pre-service teachers related 'organic' concept with a substance containing carbon, hydrogen and oxygen atoms. After the instruction, most of pre-service teachers kept using 'natural and pure' to define 'organic' concept. It shows that the everyday meanings of 'organic' concept were rooted in pre-service teachers' thinking after instruction so that they struggled with retaining the scientific meanings of it (Song & Carheden, 2014). In addition, some pre-service teachers learned the scientific meaning of 'organic' and used it in their responses. On the other hand, they still continued to think organic fruits and vegetables in daily life context. This shows us that pre-service teachers' everyday meanings and ways of using language differed from those of science (Warren et al., 2001). According to Itza-Ortiz et al. (2003), students give different responses depending upon the context. For instance, they make a scientific explanation

if the teacher asks the question in a scientific context; they say the daily life meaning of the concept, if the question is asked in a daily life context.

'Salt' Concept

Pre-service teachers' initial and final understandings of 'salt' concept are shown in Figure 13 and 14.

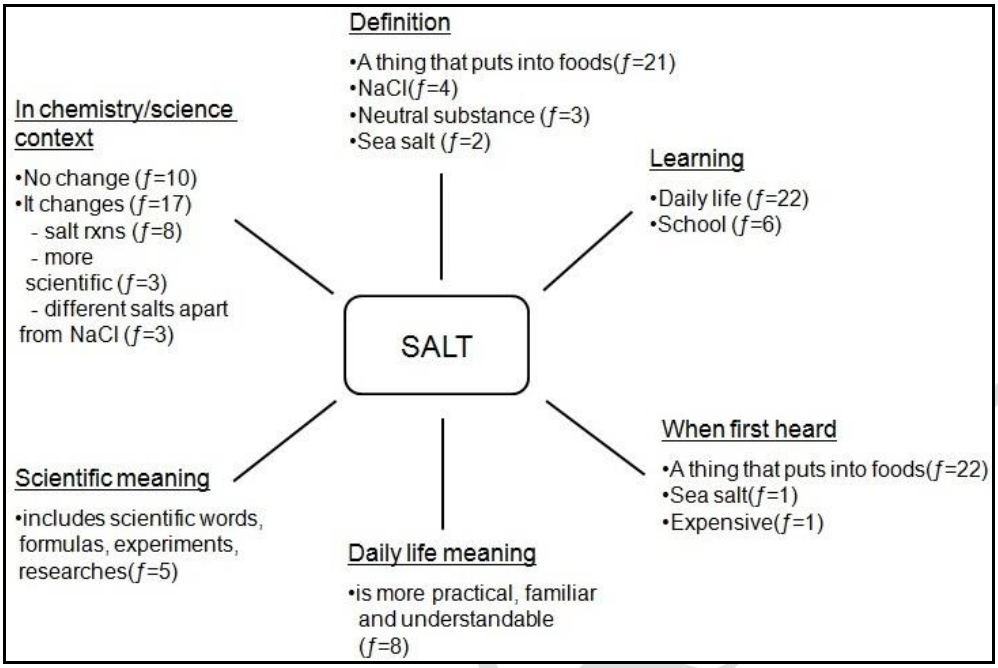

Figure 13. Pre-service teachers' initial understandings of 'salt' concept

In Figure 13, most of pre-service teachers defined 'salt' concept as a thing that can be put into foods (f=21) in pretest. Some of them related 'salt' concept with NaCl (f=4), neutral substance (f=3) and sea salt (f=2). Because 'salt' concept was frequently used in daily life, most of pre-service teachers stated that they had learned this concept in their daily lives during eating something (f=22). A few of them stated that they learned the scientific meaning of the concept in school (f=6), although they had heard in their daily lives before school. Because pre-service teacher found the daily life meaning was more practical, familiar and understandable (f=8), 'a thing that can be put into foods' came in their minds (f=22) when they firstly heard 'salt'.

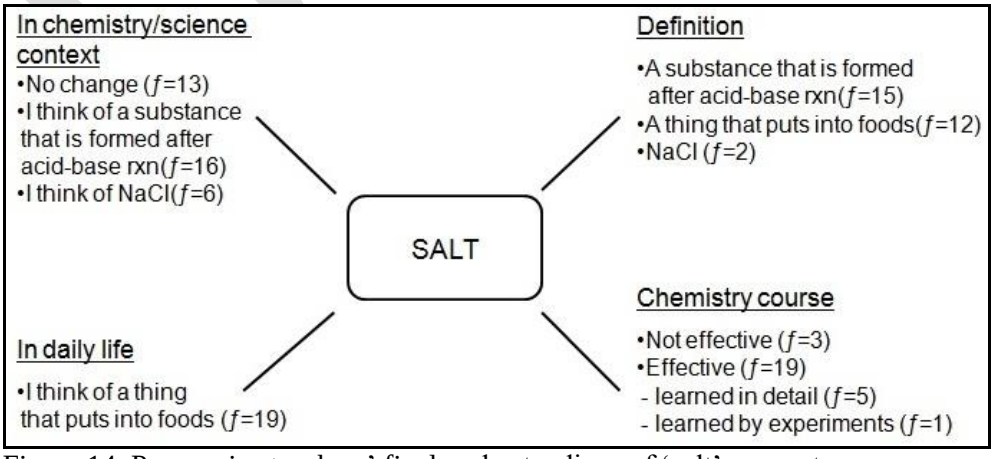

Figure 14. Pre-service teachers' final understandings of 'salt' concept

According to Figure 14, pre-service teachers defined 'salt' as a substance that was formed as a resultant of acid-base reaction (*f*=15) in posttest. But many of pre-service teachers held the thought that 'salt' was a thing that can be put into foods (*f*=12) and NaCl (*f*=2).

Another dual meaning word was 'salt' which pre-service teachers faced much more time before school. Besides, most of them stated that they had learned this concept in their daily lives during eating. Pre-service teachers defined 'salt' as a thing that can be put into foods before the instruction. It was acceptable because 'salt' concept has different meanings from those in chemistry. After the instruction, half of the pre-service teachers could have explained 'salt' scientifically while anyone could not have explained in the pretest. It shows that the chemistry course was effective as seen in their responses about the course. But still, most of pre-service teachers insisted on thinking 'salt' as a thing that can be put into foods in daily life context. Even if they knew the scientific meaning of the word, they insisted on using everyday meaning (Itza-Ortiz et al., 2003). This confusion can be overcome by using 'double talk' (Brown & Spang, 2008). In double talk, teacher provides a definition for students they assume is not familiar with an idea, the teacher may choose to offer two versions of the idea like, "salt is a chemical compound, it is formed from the reaction between an acid and a base". Thus, pre-service teachers hear the scientific definition with the dual meaning word and they do not imagine the daily life meaning all the time when they hear the word.

'Stable' Concept

Pre-service teachers' initial and final understandings of 'stable' concept are shown in Figure 15 and 16.

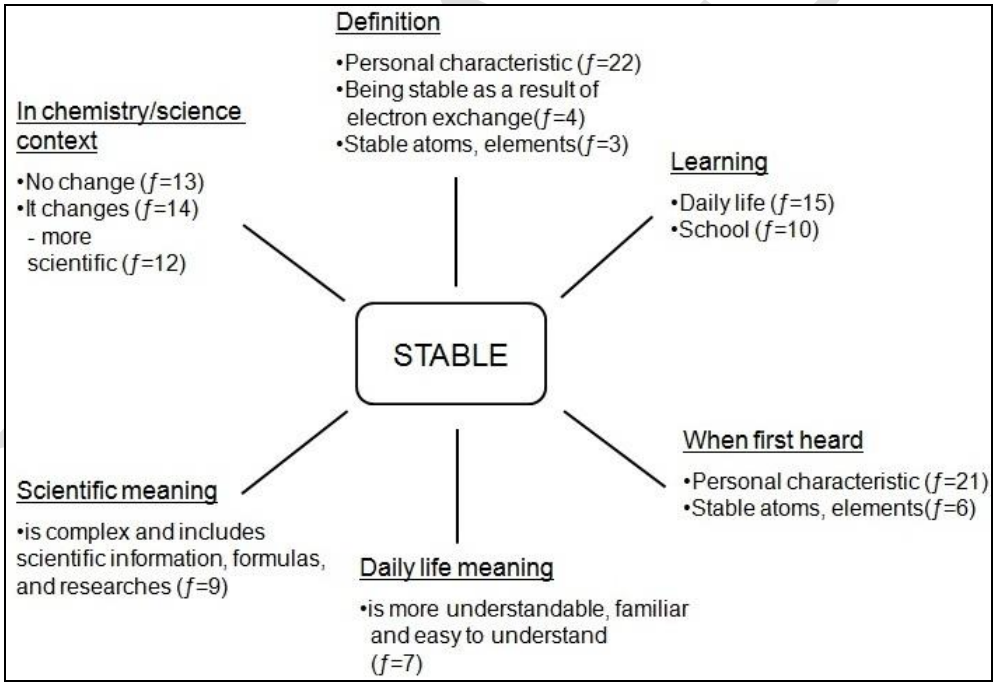

Figure 15. Pre-service teachers' initial understandings of 'stable' concept

As can be seen in Figure 15, most of pre-service teachers related 'stable' concept with personal characteristic (*f*=22) and stable atoms and elements (*f*=3). Some of them defined 'stable' as a result of electron exchange (*f*=4). Most of pre-service teachers learned this concept in their daily lives (*f*=15), while some learned in school (*f*=10). Pre-service teachers found the scientific meaning was difficult because it was complex and included scientific information, formulas and researches (*f*=9).

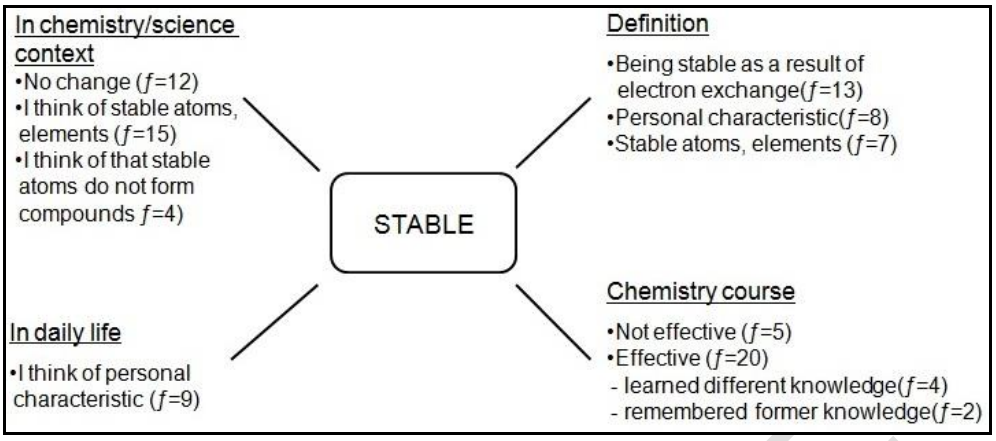

Figure 16. Pre-service teachers' final understandings of 'stable' concept

According to Figure 16, pre-service teachers defined 'stable' as a result of electron exchange (*f*=13). Some of pre-service teachers related 'stable' with personal characteristic (*f*=8) and stable atoms and elements (*f*=7). Most of pre-service teachers found the chemistry course effective (*f*=20) at learning the meaning of the concept because they stated that they learned different knowledge (*f*=4) and remembered former knowledge in the course (*f*=2).

When pre-service teachers' understandings of 'stable' concept, it was seen that they related it with a personal characteristic which meant 'self-confident' in English. Because the dual meaning word 'stable' had many different meanings in scientific and daily life contexts, pre-service teachers preferred to remind the daily life meanings as happened in the other dual meaning words. After the instruction, most of pre-service teachers defined 'stable' as a state of happened after electron exchange. In these scientific explanations, traditional chemistry teaching was effective but some pre-service teachers still held the idea of 'self-confident' as a personal characteristic. The results of the questionnaire indicated that, although the majority of students were able to "correctly" contextualize the meaning of stable, significant confusion still remained. This problem may be associated with an inability to contextualize, a lack of conceptual understanding, or some combination of the two (Jasien, 2010).

CONCLUSIONS

The research findings reported here suggest that pre-service teachers mostly constructed the dual meaning words in their daily lives in this study because they met them before formal education. So, it was quite difficult to change their understandings. When these pre-service teachers learned the dual meaning words scientifically, they continued to use both scientific and daily life meanings together. The reason of this was explained by pre-service teachers as being more familiar to daily life meanings of dual meaning words. This can be overcome by providing much more opportunities to use dual meaning words in scientific contexts (Song & Carheden, 2014). For instance, pre-service teachers should be given some opportunities to make experiments in chemistry laboratories because it is well-known that learning becomes meaningful and permanent by hands-on activities (Domin, 1999).

As Jasien (2011) reported in his study, some dual meaning chemistry concepts often assign strange meanings to well-known colloquial words and present a special problem when chemists require an exact meaning in a given context. In this research, all concepts have different meanings from their daily life meanings. After the instruction, majority of pre-service teachers learned the scientific meanings, they used scientific meanings in a scientific context, and they continued to use daily life meanings in a daily life context as found in other studies in the literature (Itza-Ortiz et al., 2003; Jasien, 2011; Warren et al., 2001). This may be associated with their inability to contextualize and a lack of conceptual understanding (Jasien, 2010). It can be suggested that to use context-based learning approach may provide students the needed context to understand the concepts in their scientific

contexts. Context-based learning approach provides the relevant contexts that contribute positively to the learning of the concepts (Ültay, 2017). In this sense, it is expressed that an effective learning takes place if students can relate a concept and its practices to the real world that includes their own culture, family or friends (Tekbıyık, 2010; Yam, 2005).

In developing world, to be an informed citizen, it is becoming important to have an understanding of the science and processes of science (Holbrook & Rannikmae, 2007; Miller, 2005). This can be provided as follows: Teachers can support their speeches by using 'double talk' (Brown & Spang, 2008). For example the teacher may provide two versions of the meaning (scientific and daily life). Pre-service teachers hear the scientific definition with the dual meaning word and they do not imagine the daily life meaning all the time when they hear the word. If pre-service teachers' first understandings including alternative conceptions or misconceptions are not taken into account, in following stages of learning, it will be impossible to change their hard-core understandings (Lakatos, 1970).

REFERENCES

Brown, B. A. & Spang, E. (2008). Double talk: Synthesizing everyday and science language in the classroom. *Science Education, 92*, 708 – 732.

Clement, J. (1982). Students' preconceptions in introductory mechanics. *American Journal of Physics, 50*, 291-299.

Çalık, M. (2005). A cross-age study of different perspectives in solution chemistry from junior to senior high school. *International Journal of Science and Mathematical Education, 3*, 671–696.

Domin, D.S. (1999). A content analysis of general chemistry laboratory manuals for evidence of higher-order cognitive tasks. *Journal of Chemical Education, 76*(1), 109-111.

Fang, Z. (2004). Scientific literacy: A systematic functional linguistics perspective. *Science Education, 89*, 335-347.

Guzzetti, B. J., Williams, W. O., Skeels, S. A. & Wu, S. M. (1997). Influence of text structure on learning counterintuitive physics concepts. *Journal of Research in Science Teaching, 34*(7), 701–719.

Harrison, A. G. & Treagust, D. F. (2001). Conceptual change using multiple interpretive perspectives: Two case studies in secondary school chemistry. *Instructional Science, 29*, 45–85.

Hewson, M. G. & Hewson, P. W. (2003). Effect of instruction using students' prior knowledge and conceptual change strategies on science learning. *Journal of Research in Science Teaching, 40*, 86-98.

Hofstein, A., (2004). The laboratory in chemistry education: Thirty years of experience with developments, implementation, and research. *Chemistry Education: Research and Practice 5*(3), 247-264.

Holbrook, J. & Rannikmae, M. (2007). The nature of science education for enhancing scientific literacy. *International Journal of Science Education, 29*(11), 1347-1362.

Itza-Ortiz, S. F., Rebello, N. S., Zollman, D. A. & Rodriguez-Achach, M. (2003). The vocabulary of introductory physics and its implications for learning physics. *Physics Teaching, 41*(6), 330–336.

Jasien, P. G. (2010). You said ''neutral'', but what do you mean? *Journal of Chemical Education, 87*(1), 33–34.

Jasien, P. G. (2011). What do you mean that "strong" doesn't mean "powerful"? *Journal of Chemical Education, 88*, 1247-1249.

Jasien, P. G. (2013). Roles of terminology, experience, and energy concepts in student conceptions of freezing and boiling. *Journal of Chemical Education, 90*(12), 1609-1615.

Johnson, B. R. (1997). Examining the validity structure of qualitative research. *Education, 118*(3), 282-292.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. The Qualitative Report, 8(4), 597-606. Retrieved [20.12.2016], from http://www.nova.edu/ssss/QR/QR8-4/golafshani.pdf

Haider, A. H. & Abraham, M. R. (1991). A comparison of applied and theoretical knowledge of concepts based on particulate nature of matter. *Journal of Research in Science Teaching, 28*, 919-938.

Kızılcık, H. Ş. (2013). The relationship between preferences among some synonym physics terms and conceptual perceiving of pre-service teachers. *H. U. Journal of Education, 28*(3), 266-278.

Lakatos, I. (1970). *Falsification and the Methodology of Scientific Research Programmes*. Taken from: Lakatos, I. ve Musgrave, A. (Eds.), Criticism and the Growth of Knowledge, Cambridge University Press, Cambridge, UK.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.

McDermott, L., Rosenquist, M. & van Zee, E. (1987). Student difficulties in connecting graphs and physics: Examples from kinematics. *American Journal of Physics, 55*, 503-513.

Michaels, S., Shouse, A. W. & Schweingruber, H. A. (2008). *Ready, set, science! Putting research to work in K-8 science classrooms.* Board on Science Education, Center for Education, Division of Behavioral and Social Sciences and Education, Washington, DC: The National Academies Press.

Miller, J. S. (2005). The language of science is in daily conversation. *Science Activities: Classroom Projects and Curriculum Ideas, 42*(2), 3-4.

Palmer, D. H. (2003). Investigating the relationship between refutational text and conceptual change. *Science Education*, *87*(5), 663 – 684.

Petrucci, R. H., Harwood, W. S. & Herring, F. G. (2008). *Genel Kimya İlkeler ve Modern Uygulamalar 1*, 8.baskıdan çeviri, Palme Yayıncılık, Ankara.

Pyburn, D. T., Pazicni, S., Benassi, V. A. & Tappin, E. E. (2013). Assessing the relation between language comprehension and performance in general chemistry. *Chemistry Education Research and Practice, 14*, 524-541.

Seale, C. (1999). Quality in qualitative research. *Qualitative Inquiry, 5*(4), 465-478.

Snow, C. E. (2010). Academic language and the challenge of reading for learning about science. *Science, 328*, 450-452.

Song, Y. & Carheden, S. (2014). Dual meaning vocabulary (DMV) words in learning chemistry. *Chemistry Education Research and Practice, 15*(2), 128-141.

Tekbıyık, A. (2010). Development of course materials integrating context based approach into 5E model in terms of energy unit for 9th grade secondary students. Unpublished PhD thesis, Karadeniz Technical University, Trabzon, Turkey.

Ünsal, Y. (2010). Differences arising from language in perceiving some terms in physics education. *H. U. Journal of Education, 39*, 348-358.

Ültay, E. (2012). Implementing REACT strategy in a context-based physics class: Impulse and momentum example. *Energy Education Science and Technology Part B: Social and Educational Studies, 4*(1), 233-240.

Ültay, E. (2017). Examination of context-based problem-solving abilities of pre-service physics teachers. *Journal of Baltic Science Education, 16*(1), 113-122.

Ültay, E. & Ültay, N. (2014). Context-based physics studies: A thematic review of the literature. *H. U. Journal of Education, 29*(3), 197-219.

Ültay, N. (2015). The effect of concept cartoons embedded within context-based chemistry: Chemical bonding. *Journal of Baltic Science Education, 14*(1), 96-108.

Ültay, N. & Çalık, M. (2016). A comparison of different instructional designs of 'acids and bases' subject. *Eurasia Journal of Mathematics, Science and Technology Education*, *12*(1), 57-86.

Ültay, N., Durukan, Ü. G. & Ültay, E. (2015). Evaluation of the effectiveness of conceptual change texts in the REACT strategy. *Chemistry Education Research and Practice*, *16*(1), 22-38.

Vosniadou, S. (2013). Conceptual change in learning and instruction: The framework theory approach. In S. Vosniadou (Ed.), *The international handbook of conceptual change* (2nd ed., pp. 11–30). New York: Routledge.

Warren, B., Ballenger, C., Ogonowski, M., Rosebery, A. S. & Hudicourt-Barnes, J. (2001). Rethinking diversity in learning science: The logic of everyday sense-making. *Journal of Research in Science Teaching, 38*(5), 529-552.

Yam, H. (2005). What is contextual learning and teaching in physics? Retrieved 07.05.2016, from http://www.phy.cuhk.edu.hk/contextual/approach/tem/brief_e.html.

Young, E. (2005). The language of science, the language of students: Bridging the gap with engaged learning vocabulary strategies. *Science Activities: Classroom Projects and Curriculum Ideas, 42*(2), 12-17.

ISSN: 2146 - 9466
www.ijtase.net
International Journal of New Trends in Arts, Sports &Science Education - 2019, volume 8, issue 1

ORTAOKUL 7. SINIF ÖĞRENCİLERİNİN CEBİR KONUSUNDAKİ KAVRAM YANILGILARININ GİDERİLMESİNDE ETKİLEŞİMLİ TAHTA KULLANIMININ ETKİSİ

THE EFFECT OF USING SMART BOARDS ON ELLIMINATING 7TH GRADE MIDDLE SCHOOL STUDENTS MISCOCEPTIONS IN ALGEBRA

Cenk KEŞAN*
Dokuz Eylül Üniversitesi, cenk.kesan@deu.edu.tr, ORCID: 0000-0003-2629-8119

Ezgi Sevda AKBULUT**
Atatürk Ortaokulu Matematik Öğretmeni, ezgi_akbulutt@hotmail.com, ORCID: 0000-0002-6652-3483

Received Date: 07-01-2019 **Accepted Date:** 25-01-2019 **Published Date:** 31-01-2019

ÖZ
Bu araştırmanın amacı, ilköğretim 7. Sınıf öğrencilerinin matematik dersinde cebir konusunda etkileşimli tahta ile zenginleştirilmiş öğrenme ortamında kavram yanılgılarını gidermeye yönelik farklı teknikler kullanılarak ortaya çıkan öğrenme sonucunu incelemektir. Bu araştırma, 2016-2017 eğitim-öğretim yılında İzmir il merkezinde bulunan bir Ortaokulda iki farklı şubede öğrenim gören 38 öğrenci ile yapılmıştır. Öğrencilerin cebir konusunda sahip oldukları kavram yanılgılarını belirlemek için Thelma Perso'nun (1992) hazırlamış olduğu "Diagnostic Test-Conceptions in Algebra" testindeki sorular kullanılmıştır. Bu sorularla hedefimiz ThelmaPerso' nun ortaya koyduğu 19 kavram yanılgısını tespit etmektir. Her bir soru belli bir kavram yanılgısını ortaya çıkarmak için yöneltilmiştir. Bazı sorular ise birden fazla kavram yanılgısını ölçmektedir. Veriler SPSS 10.0 yazılımı yardımıyla analiz edilerek sonuçlar tablolara dönüştürülmüştür. Bu çalışma bize etkileşimli tahtanın, cebir konusunda yaşanan kavram yanılgılarının giderilmesinde, deney grubu ile kontrol grubu arasında anlamlı bir fark olduğunu göstermiştir.
Anahtar Terimler: Etkileşimli Tahta, Kavram Yanılgısı, Cebir

ABSTRACT
The main goal of this research is to analyze the result of learning outcomes that occurs by using different techniques to prevent miscoceptions that exits in the learning process which is enrichened by smart boards for algebra class at 7 th grades. This study was carried out at a Secondary School in İzmir, at the two classes of with 38 students, during 2016-2017 education year. An algebra test that has 30 questions was carried out to identify the miscoceptions of students about algebra. The questions in the test were taken from the study "Diagnosic Test-Conceptions in Algebra" which belongs to Thelma Perso (1992). Our goal in term of asking these question is to analyse 19 miscoceptions that was revealed by ThelmaPerso. Each question was asked to reveal a certain concept error. Some questions reveals more than one miscoceptions. The datas were analysied by SPSS 10.0 software. Followingly the result were showed in the charts.This research indicates that these is a significant difference between the experimental and control group in terms of preventing miscoceptions that occurs in the process of using smart boards for the algebra class.
Key Words: Smart Board, Miscoceptions, Algebra

GİRİŞ

Matematiğin, düşünme becerisini geliştiren en önemli araçlardan biri olduğu bilinir. Biz insanların diğer canlılardan en temel farkı düşünebilmemiz ve karşılaştığımız olayları değerlendirip şartları kendimize göre yeniden hazırlayabilme becerimizdir. Bu sebeple temel eğitimin önemli yapı taşlarından biri belki de en önemlisi matematiktir (Umay, 2003). Matematik birçok alana ayrılır, bu alanlardan en önemlilerinden biri kuşkusuz cebirdir. Cebir, örüntülerin, kuralların ve sembollerin bir dilidir (O'Bannon, ReedandJones, 2002). Cebir konularının matematik derslerinde öğretilmeye

* Doç. Dr., Dokuz Eylül Üniversitesi, Buca Eğitim Fakültesi Matematik Eğitimi, Buca-İzmir

** Atatürk Ortaokulu Matematik Öğretmeni, Menemen-İzmir

başlandığı andan itibaren öğrencilerin bu konuları öğrenmede zorlandıkları fark edilmiştir. Birçok çalışma neticesinde öğrencilerin cebir kavramlarını (denklem, eşitlik, değişken, cebirsel ifadeler, bilinmeyen gibi) anlamada zorluk yaşadıkları ve kavram yanılgısına sahip oldukları belirlenmiştir (Baki, 1998; Dede ve Argün, 2003; Ersoy & Erbaş, 1998; Kaput, 1999; Kieran, 1992; MacGregor & Stacey, 1993).

Kavram yanılgısı ise, bir öğrencinin uzun süreden beri doğru olarak kabul ettiği, birden fazla durumda ortaya çıkan, kolay değişmeyen ve matematiksel gerçeklerle çelişen kavramalarıdır (Chiu, Kessel, Moschkovich&Muñoz-Nuñez, 2001). Kavram yanılgıları başarıyı olumsuz etkilediği gibi matematiğe karşı olumsuz tutumun ortaya çıkmasına da sebep olduğu açıktır. Yaklaşık 25 yıldır yapılan araştırmalarda öğrencilerin düşünme biçimi, muhakeme etme gücü (reasoning) ve problem çözme becerileri ile birlikte sahip oldukları kavram yanılgıları da incelenmektedir (Heinze, 2005; Henningsen&Stein, 1997) Son yıllarda diğer ülkelerde olduğu gibi ülkemizde de kavram yanılgıları ile ilgili olan çalışmalar artmıştır.

Thelma Perso (1992), öğrencilerin cebir ile ilgili sahip oldukları kavram yanılgılarını incelemiş ve bu kavram yanılgılarını üç kategoride gruplandırmıştır:
1-harflerin cebirdeki yerini anlama,
2-değişkenleri kullanma ve
3-denklem çözerken cebirsel kuralları kullanma.

Perso'ya (1992) göre bu gruplandırma şunları içermektedir:
Harflerin cebirdeki yerini anlama:
1) Öğrenciler harflerin matematikte bir anlamının olmadığını düşünmektedirler.
2) Öğrencilere göre harfler alfabede olduğu gibi sıralanır.
3) Harflerin alfabetik sıralamada olduğu gibi sayısal konum belirttiklerini düşünmektedirler
4) Öğrenciler katsayısı bir olan harflerin değerinin"1" e eşit olduğunu düşünmektedirler.
5) Her harfin sadece bir değerinin olduğuna inanmaktadırlar. Bir soruda b = 4 ise diğer bütün sorularda da b = 4 kabul edilmektedir.
6) Öğrenciler, harflerin sadece rakam olabileceğini düşünmektedirler. Yani ab gibi bir ifadeyi iki basamaklı bir sayı gibi düşünmektedirler. Onlara göre a ve b birer rakam olmalıdır. Bu nedenle ab=8 eşitliğinin mümkün olmadığını düşünmektedirler.
7) Öğrencilere göre harfler nesneleri gösterir. 2m+3n gibi bir cebirsel ifadesi 2 muz ve 3 narı temsil etmektedir.
8) Harfler sayılar gibi davranmaz. Örneğin, x + y + z = x + t + z eşitliğinde "y" nin hiçbir zaman "t" ye eşit olmaması gibi.

2-Değişkenleri Kullanma
9) Öğrenciler "+" veya "-" ile "=" işaretlerinin daima sonuç ürettiklerine inanmaktadırlar. Örneğin, 2+a=2a.
10) Öğrenciler işlemlerin sırasını dikkate almamaktadırlar. Yapabileceklerini düşündükleri işlemden başlamayı tercih etmektedirler.
11) Cebirsel olarak "=" işareti bir eylem belirtmesine rağmen öğrenciler 2s+5 ya da 5-c işlemlerinde olduğu gibi cebirsel ifadeleri bir matematiksel işlem yapma şeklinde yorumlamamaktadırlar.
12) Matematikte her zaman soldan sağa doğru işlem yapıldığını düşünmektedirler.
13) Öğrenciler cebirde parantezlerin önemini dikkate almamaktadırlar. Örneğin, 2(a+b) ifadesini 2a+b olarak yorumlayabilmektedir.

3-Denklem Çözerken Cebirsel Kuralları Kullanma
14) Öğrenciler bir denklemin diğer tarafında ters işlem yapma yerine, aynı işlemi yapmayı düşünmektedirler.
15) Sayıları, değişkenleri ve işaretleri birbirinden ayrı düşünmektedirler.
16) Çıkarma işleminin değişme özelliğine sahip olduğunu düşünmektedirler.

17) Ters işlemlerin gereksizliğine inanmaktadırlar.
18) Harflerin soldan sağa eşleştiklerine inanmaktadırlar.
19) Harflerin kelimeler için bir etiket olduklarını düşünmektedirler.

Günümüzde öğrencilerin ilgileri ve ihtiyaçları doğrultusunda matematik dersini teknolojik gelişmelerden ayrı bir ders olarak düşünemeyiz. Bu sebeptendir ki 20. yüzyılın sonlarında Amerika başta olmak üzere çoğu ülke eğitim sistemlerinin temeline teknolojik sınıflar almıştır. Ülkemizde de devlet okullarında etkileşimli tahtalar öğrencilerin eğitimine sunulmuştur. Bu araçları sınıf içersinde kullanarak öğrencilerin bilgilere rahat bir şekilde ulaşmaları ve öğrenme ortamında veya dışında bilgiyi rahatça birbirleriyle paylaşmaları sağlanabilir. Bu şekilde öğrenciler yaşadıkları kavram yanılgılarının daha kolay farkına varabileceklerdir.

Ülkemizin kalkınması için; toplumumuzu oluşturan bireylerin düşünmesi, üretmesi ve sorgulaması gerekir. Bu niteliklere sahip bireyleri yetiştirmek için, çağa ayak uyduran eğitim sistemine ve öğretim programlarına gereksinim duyarız. Toplumun; bilgi sahibi, kendini geliştiren, yeniliklere açık, bilgiyi araştıran ve kullanan, uyumlu insanlara ihtiyacı vardır. Bu ihtiyaç ancak, ilerleyen teknolojinin sahip olduğu imkânları öğrencilerin ve eğitimcilerin kullanması sayesinde gerçekleşir (Keşan & Kaya, 2007).

Çok hızlı bir şekilde kendini değiştiren ve geliştiren teknoloji, şüphesiz günümüzde biz insanlar için vazgeçilmez bir gereksinimdir. Bireylerin bu teknolojiye uyum sağlaması, öğrenebilmesi ve sunduğu imkânlardan faydalanabilmesi için bilgi, beceri, tutum ve alışkanlık sahibi olmaları gereklidir. Aynı zamanda, tıpkı diğer alanlardaki gibi, eğitim alanında da değişim ve gelişim olması şarttır (Oral, 2004). Günümüzde insanların; bilgiye ulaşması, bilgiyi analiz edebilmesi ve düzenleyebilmesi sağlanmak istenir (Akkoyunlu, 1995).

Bilişim teknolojisinde oldukça gelişme sağlayan oluşumlardan biri de etkileşimli tahtalardır. Etkileşimli tahtalar bilgisayar, projeksiyon makinesi ve dokunmaya duyarlı geniş bir elektronik tahtadan oluşmaktadır (BECTA, 2010). Etkileşimli tahta, bilgisayar ve dijital projeksiyonun bağlanmasıyla çalışan ve dokunmaya duyarlı olarak kontrol edilebilen sunum cihazıdır (Shenton & Pagett, 2007).

Eğer öğrenme ortamında tesirli olarak kullanılırsa birçok fırsat sunabilen etkileşimli tahta; görselliğin tesirli kullanılabilmesi, animasyonların kullanılabilmesi ve iletişim açısından değerlendirildiğinde matematik öğrenimi için çok faydalıdır. Etkileşimli tahtanın matematik öğretimine farklı bir boyut kazandırdığı açıktır (Yuan & Yi Lee, 2012). Diğer derslere nazaran öğrenilmesi ve öğretilmesi oldukça güç olan matematik derslerinde, etkileşimli tahtadan faydalanılmasının sağladığı olumlu yönlerin ilerleyen zamanlarda ortaya çıkması kaçınılmazdır. Bu araştırmanın amacı, ilköğretim 7. Sınıf öğrencilerinin matematik dersi cebir konusunda etkileşimli tahta ile zenginleştirilmiş öğrenme ortamında, kavram yanılgılarını gidermeye yönelik farklı teknikler kullanılarak ortaya çıkan öğrenme sonucunu incelemektir.

Bu çalışmada matematik eğitiminde seçilen cebir alt öğrenme alanında etkileşimli tahta kullanımının, öğrencilerin akademik başarılarına ve kavram yanılgılarının giderilmesine etkisi araştırılacaktır. Elde edilecek sonuçların araştırmacı, idareci ve öğretmenlerde etkileşimli tahta kullanımına ilişkin bir görüş oluşturacağı düşünülmektedir. Etkileşimli tahta kullanımı sayesinde öğrencilerin öğrenmeye daha hevesli hale gelmeleri, bilgi ile teknoloji arasındaki bağı kurabilmeleri, beklenmektedir.

Problem Cümlesi

Araştırma Problemi: "Ortaokul 7. sınıf matematik dersi cebir konusunda etkileşimli tahta ile zenginleştirilmiş öğrenme ortamının öğrencilerin başarısı ve kavram yanılgılarının giderilmesinde etkisi var mıdır?" sorusunun araştırılmasıdır.

Alt Problemler

1.Etkileşimli tahta ile zenginleştirilmiş öğrenme ortamının ortaokul 7. Sınıf cebir konusunda öğrencilerin kavram yanılgısı ölçeğinden aldıkları puanlar arasında anlamlı bir fark var mıdır?

2.Etkileşimli tahta kullanımının 7. sınıf öğrencilerinin cebirdeki harflerin anlamına yönelik sahip oldukları kavram yanılgılarının giderilmesinde etkisi var mıdır?

3.Etkileşimli tahta kullanımının 7. sınıf öğrencilerinin değişkenleri kullanmaya yönelik sahip oldukları kavram yanılgılarının giderilmesinde etkisi var mıdır?

4.Etkileşimli tahta kullanımının 7. sınıf öğrencilerinin denklem çözerken cebirsel kuralları kullanmaya yönelik sahip oldukları kavram yanılgılarının giderilmesinde etkisi var mıdır?

YÖNTEM

Araştırma Modeli

Araştırma iki farklı bölüm şeklinde geliştirilmiştir. Araştırmanın birinci aşamasında; literatür taraması yapılarak farklı kaynaklar incelenmiştir. Bu kaynaklar genel matematik eğitimine, cebire, kavram yanılgısına ve etkileşimli tahtaya yönelik çalışmalar olarak sınıflandırılmış, yararlı olabilecek tüm kaynaklar edinilmiştir.

Araştırmanın problemi; ortaokul 7. Sınıf öğrencilerin cebir konusundaki kavram yanılgılarının giderilmesinde, etkileşimli tahta kullanımının etkisinin incelenmesidir. Etkileşimli tahta ile zenginleştirilmiş öğrenme ortamının 7. sınıf öğrencilerinin matematik derslerinde akademik başarısına ve kavram yanılgılarını gidermeye yönelik araştırmayı amaçlayan bu çalışmada, deneysel desen uygulanmıştır. Bu araştırmada deney ve kontrol gruplarını oluştururken deneklerin ya da grupların seçkisiz atanması ya da eşleştirilmesi gibi bir durum gerçekleştirilmemiştir. Bu, çalışmanın bir sınırlılığı olarak tanımlanmıştır. Deneysel yöntem çeşitlerinden olan yarı-deneysel desen; eğitim araştırmalarında sıklıkla kullanılan, kişilerin deney ve kontrol grubuna rastgele dağıtılamadığı durumlarda kullanılan deneysel yöntemdir (Çepni, 2007). Araştırmamızda da gruplar tamamen rastgele seçilmemiştir. Çünkü seçtiğimiz okulda sınıflar sabittir ve bu araştırma için sınıflarda herhangi farklılık yapmak olası değildir. Uygulama yapılmadan önce, bilgi seviyeleri birbirlerine paralel olan iki sınıfın seçimi için çalışmalar yapılmıştır. Öğrencilerin bilişsel ve duyuşsal olarak yakın seviyede olmaları için okul idaresinin, ders öğretmenlerinin ve rehber öğretmenin görüşleri alınmıştır. 6. Sınıfta öğrencilerin not ortalamalarına göre sınıf seviyeleri eşit olacak şekilde 4 ayrı sınıfa bölünmesi, sene sonunda yapılan yılsonu öğretmenler kurulunda alınan kararlara göre yapıldığı görülmüştür. Bu sebeple araştırmanın yöntemi yarı deneysel desen olarak tasarlanmıştır.

Çalışma Grubu

Araştırmanın çalışma grubunu İzmir il merkezindeki bir ortaokulda 7. Sınıfta iki farklı şubede öğrenim gören toplam 38 öğrenci oluşturmaktadır.

Veri Analizi

Araştırmanın ikinci kısmında öğrencilerin cebir konusunda sahip oldukları kavram yanılgılarını belirlemek için Thelma Perso'nun hazırladığı 30 soruluk "Cebir Testi" kullanılmıştır. Cebir testi ve soruların cevapları Ek 1'da verilmiştir. Testte olan tüm sorular çoktan seçmeli şeklindedir. Test üç bölümden oluşmaktadır. Birinci bölümdeki sorular, araştırmanın ilk kavram yanılgısına, ikinci bölümdeki sorular ikinci kavram yanılgısına ve üçüncü bölümdeki sorular üçüncü kavram yanılgısına yönelik, kavram yanılgılarını ortaya çıkarıcı sorulardan oluşmuştur. Testteki sorular, Thelma Perso 'nun (1992) hazırlamış olduğu " Diagnostic Test- Conceptions in Algebra" testindeki soruların Türkçeye uyarlanmış, daha sonra alan ve dil uzmanlarıyla yapılan görüşmeler sonucunda yeniden düzenlenmiş halidir. Testin güvenirliği Recai Akkaya'nın "İlköğretim 6-8. Sınıf öğrencilerinin cebir öğrenme alanındaki kavram yanılgıları (2006)" adlı makalesindeki örneklem üzerinde yapılan analizlerle belirlenmiştir. Testin alfa güvenirlik katsayısı 0,74 olarak hesaplanmıştır. Bu sorular ile Thelma Perso' nun ortaya koyduğu 19 kavram yanılgısını tespit etmek amaçlanmıştır. Her bir soru

belli kavram yanılgısını ortaya çıkarmak için yöneltilmiştir. Bazı sorular birden fazla kavram yanılgısını ölçmektedir.

Bulgular ve Yorumlar

Bulgular

Çalışmamızın bu bölümünde öğrencilerin verdiği yanıtların istatistiki değerlendirme ışığında deney ve kontrol grubundaki kavram yanılgıları ile ilgili bulgular ve yorumlar yer alacaktır.

Etkileşimli tahta ile zenginleştirilmiş öğrenme ortamının ortaokul 7. Sınıf öğrencilerinin cebir konusunda başarısına etkisi var mıdır?

Tablo 1. Normallik Testi

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
Grup	İstatistik	SD	P değeri	İstatistik	SD	P değeri
Deney	,149	20	,200(*)	,918	20	,092
Kontrol	,160	18	,200(*)	,915	18	,105

Deney ve kontrol grubundaki öğrencilerin yaptıkları her doğru için 1 puan vererek okuduğumuz test sonuçlarına göre puanlar normal dağılım gösterip göstermediği tespit edilmiştir. 50 den az veriye sahip olduğumuz için shapiro-wilk kullanılmıştır ve p değeri 0,05 ten büyük olduğu için normal dağılım gösterdiği kabul edilmiştir.

Tablo 2. Descriptives

	Grup			İstatistik	StandarHata
Puan	Deney	Ortalama		14,9500	1,31284
		95% Confidence Interval for Mean	Lower Bound	12,2022	
			Upper Bound	17,6978	
		5% Trimmed Mean		14,5556	
		Median		13,5000	
		Variance		34,471	
		Std. Deviation		5,87121	
		Minimum		7,00	
		Maximum		30,00	
		Range		23,00	
		Interquartile Range		8,50	
		Skewness		,989	,512
		Kurtosis		,687	,992
	Kontrol	Ortalama		12,8889	,78336
		95% Confidence Interval for Mean	Lower Bound	11,2361	
			Upper Bound	14,5416	
		5% Trimmed Mean		12,6543	
		Median		12,5000	
		Variance		11,046	
		Std. Deviation		3,32351	
		Minimum		9,00	
		Maximum		21,00	
		Range		12,00	
		Interquartile Range		5,25	
		Skewness		,877	,536
		Kurtosis		,357	1,038

Normal dağılım gösterdiğini anlamak için bir başka yol olan çarpıklık ve basıklığa baktığımızda da çarpıklık basıklık değerlerinin -1,5 ile +1,5 arasında olduğunu görüyoruz. O halde normallik sağladığı ikinci defa görülmüştür ve t testi yapılmaya karar verilmiştir.

Tablo 3. Bağımsız Örneklemler için T-Testi

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
Puan	Equal variances assumed	4,713	,037	1,311	36	,198	2,06111	1,57193	-1,12691	5,24913
	Equal variances not assumed			1,348	30,602	,187	2,06111	1,52879	-1,05852	5,18075

T testi sonuçlarına baktığımızda sig değerinin 0,05 ten küçük olduğunu görüyoruz. O halde deney grubu ve kontrol grubu arasında anlamlı bir fark vardır.

Harflerin Cebirdeki Yerini Anlama

Tablo 4. Harflerin Matematikte Bir Anlamı Yoktur**.**

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı				
1.Öğrencilere göre harflerin cebirde hiçbir anlamı yoktur.	1-c, 2-a, 3-c, 7-c		0	1	2	3	4
		Deney grubu	19 %95	1 %5	0	-	-
		Kontrol grubu	6 %33,3	9 %50	3 %16,6	-	-

Öğrencilere göre harflerin cebirde hiçbir anlamı yoktur, kavram yanılgısına baktığımızda deney grubunun %95 inin bu kavram yanılgısına sahip olmadıklarını ve kontrol grubunda ise sadece %33,3 lük bir öğrenci grubunun bu kavram yanılgısına sahip olmadığını görüyoruz. O halde öğrencilere göre harflerin cebirde hiçbir anlamı yoktur, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi olduğu açıktır.

Tablo 5. Harfler Alfabede Olduğu Gibi Sıralanır.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı	
1.Öğrencilere göre harfler alfabede olduğu gibi sıralanır.	6-b		0	1
		Deney grubu	20 %100	-
		Kontrol grubu	18 %100	-

Öğrencilere göre harfler alfabede olduğu gibi sıralanır kavram yanılgısına baktığımızda hem deney grubundan hem de kontrol grubundan bu kavram yanılgısına düşen herhangi bir öğrenci olmamıştır.

Tablo 6. Harfler Alfabetik Sıralamada Olduğu Gibi Sayısal Konum Belirttir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı		
1.Öğrencilere göre harfler alfabetik sıralamada olduğu gibi sayısal konum belirtir.	4-a, 10-c		0	1	2
		Deney grubu	14 %70	4 %20	2 %10
		Kontrol grubu	8 %44,4	9 %50	1 %5,5

Öğrencilere göre harfler alfabetik sıralamada olduğu gibi sayısal konum belirtir, kavram yanılgısına bakıldığında deney grubunda %70 lik bir öğrenci grubunda bu kavram yanılgısına rastlamamış olmamıza rağmen kontrol grubunda %44,4 lük öğrenci grubunda bu kavram yanılgısı görülmemiştir. O halde öğrencilere göre harflerin alfabetik sıralamada olduğu gibi sayısal konum belirtir, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi vardır.

Tablo 7. Katsayısı Bir Olan Harflerin Değeri "1" e Eşittir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı					
			0	1	2	3	4	5
1.Tek kalan harfler 1 e eşittir.	4-d, 5-c, 5-d, 8-c, 9-c	Deney grubu	13 %65	7 %35	-	-	-	-
		Kontrol grubu	8 %44,4	7 %38,8	1 %5,5	2 %11,1	-	-

Tek kalan harfler 1 e eşittir, kavram yanılgısına bakıldığında deney grubunda %65 lik bir öğrenci grubunda bu kavram yanılgısı görülmez iken kontrol grubunda % 44,4 lük bir öğrenci grubunda bu yanılgıya rastlanmamıştır. O halde tek kalan harfler 1 e eşittir, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi vardır.

Tablo 8. Her harfin Sadece Bir Değeri Vardır.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı			
			0	1	2	3
Her harfin sadece bir değeri vardır.	1-a, 3-a, 6-b	Deney grubu	17 %85	3 %15	-	-
		Kontrol grubu	14 %77,7	2 %11,1	2 %11,1	-

Öğrencilere göre her harfin sadece bir değeri vardır, kavram yanılgısına bakıldığında deney grubunda % 85 lik bir öğrenci grubunda bu kavram yanılgısı görülmez iken kontrol grubunda ise % 77,7 lik bir öğrenci grubunda bu kavram yanılgısına rastlanılmamıştır. O halde öğrencilere göre her harfin sadece bir değeri vardır, kavram yanılgısının giderilmesinde az da olsa etkileşimli tahtanın etkisi vardır.

Tablo 9. Harfler Sadece Rakamdır.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı	
			0	1
1.Öğrencilere göre harfler sadece rakam olabilir.	4-b	Deney grubu	20 %100	-
		Kontrol grubu	18 %100	-

Öğrencilere göre**,** ab gibi bir ifade iki basamaklı bir sayıdır. Onlara göre a ve b birer rakam olmalıdır. Bu nedenle ab=8 eşitliğinin mümkün olmadığını düşünmektedirler**.** Öğrencilere göre, harfler sadece rakam olabilir, kavram yanılgısına bakıldığında hem deney grubunda hem de kontrol grubunda bu kavram yanılgısına rastlanılmamıştır.

Tablo 10. Harfler Nesneleri Gösterir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı					
			0	1	2	3	4	5
1.Öğrencilere göre harfler nesneleri gösterir.	1-d, 2-b, 5-d, 7-a, 9-d	Deney grubu	16 %80	4 %20	-	-	-	-
		Kontrol grubu	8 %44,4	7 %38,8	3 %16,6	-	-	-

Öğrencilere göre 2m+3n gibi bir cebirsel ifadesi 2 muz ve 3 narı temsil etmektedir. Öğrencilere göre, harfler nesneleri gösterir, kavram yanılgısına bakıldığında deney grubunda %80 lik bir öğrenci grubunda bu yanılgıya rastlanılmamışken kontrol grubunda sadece %44,4 lük bir öğrenci grubunda bu yanılgı görülmemiştir. O halde demek ki öğrencilere göre harfler nesneleri gösterir, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi vardır.

Tablo 11. Harfler Sayılar Gibi Davranmaz.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı		
			0	1	2
1.Öğrencilere göre harfler sayılar gibi davranmaz.	2-d, 8-b	Deney grubu	16 %80	4 %20	-
		Kontrol grubu	13 %72,2	5 %27,7	-

Öğrencilere göre, x + y + z = x + t + z eşitliğinde “y” hiçbir zaman “t” ye eşit değildir. Öğrencilere göre harfler sayılar gibi davranmaz, kavram yanılgısına bakıldığında deney grubunda % 80 lik bir öğrenci grubunda bu kavram yanılgısına rastlanılmamışken kontrol grubunda bu kavram yanılgısının rastlanılmadığı öğrenci grubu oranı %72,2 dir. Oranlar birbirine yakın olmasına rağmen arada yine de bir fark vardır. O halde demek ki öğrencilere göre harfler sayılar gibi davranmaz, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi vardır.

Değişkenleri Kullanma

Tablo 12. “+” veya “-“ ile “=” İşaretleri Daima Sonuç Üretir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı					
			0	1	2	3	4	5
1.Öğrencilere göre “+” ve “-“ işaretleri daima sonuç üretir.	11-b, 12-a, 13-b, 14-b, 15-a	Deney grubu	6 %30	5 %25	9 %45	-	-	-
		Kontrol grubu	4 %22,2	8 %44,4	4 %22,2	2 %11,1	-	-

Öğrencilere göre, 2+a=2a örneği gibi “+” ve “-“ işaretleri daima sonuç üretir, kavram yanılgısına bakıldığında deney grubunda % 30 luk bir öğrenci grubunda bu yanılgı görülmez iken kontrol grubunda % 22,2 lik bir öğrenci grubunda görülmemiştir. Bu yanılgını giderilmesinde etkileşimli tahta etkili olmuştur.

Tablo 13. İşlemlerin Sırası Önemli Değildir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı	
			0	1
1.Öğrencilere göre işlemlerin sırası önemli değildir.	18-a	Deney grubu	2 %10	18 %90
		Kontrol grubu	4 %22,2	14 %77.7

Öğrencilere göre işlemlerin sırası önemli değildir, yapabileceklerini düşündükleri işlemden başlamayı tercih etmektedirler. Bu kavram yanılgısına bakıldığında deney grubunda %10 luk bir öğrenci grubunda bu yanılgıya rastlanılmamışken kontrol grubunda bu oran % 22,2 dir. O halde işlemlerin sırası önemli değildir, kavram yanılgısının giderilmesinde beklenenin aksine akıllı tahtanın olumlu bir etkisi görülmemiştir.

Tablo 14. Cebirsel Olarak "=" İşareti Bir Eylem Belirtmesine Rağmen Öğrenciler Cebirsel İfadeleri Bir Matematiksel İşlem Yapma Şeklinde Yorumlamamaktadırlar.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı					
			0	1	2	3	4	5
Öğrencilere göre cebirsel olarak "="işareti bir eylem belirtmesine rağmen öğrenciler 2s+5 ya da 5-c işlemlerinde olduğu gibi cebirsel ifadeleri bir matematiksel işlem yapma şeklinde yorumlamamaktadırlar.	11-b, 12-b, 13-b, 14-b, 15-c	Deney grubu	14 %70	4 %20	2 %10	-	-	-
		Kontrol grubu	10 %55	8 %44,4	-	-	-	-

Öğrencilere göre cebirsel olarak "=" işareti bir eylem belirtmesine rağmen öğrenciler 2s+5 ya da 5-c işlemlerinde olduğu gibi cebirsel ifadeleri bir matematiksel işlem yapma şeklinde yorumlamaması, kavram yanılgısına bakıldığı zaman bu kavram yanılgısı deney grubunda % 70 lik bir öğrenci grubunda görülmez iken kontrol grubunda % 55 lik bir kontrol grubunda bu kavram yanılgısına rastlanılmamıştır. O halde etkileşimli tahta cebirsel olarak "=" işareti bir eylem belirtmesine rağmen öğrenciler 2s+5 ya da 5-c işlemlerinde olduğu gibi cebirsel ifadeleri bir matematiksel işlem yapma şeklinde yorumlamama, kavram yanılgısını giderilmesinde etkili olmuştur.

Tablo 15. Matematikte Her Zaman Soldan Sağa Doğru İşlem Yapılır.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı	
			0	1
1.Öğrencilere göre matematikte her zaman soldan sağa doğru işlem yapılır.	14-a	Deney grubu	17 %85	3 %15
		Kontrol grubu	18 %100	-

Öğrencilere göre matematikte her zaman soldan sağa doğru işlem yapılır, kavram yanılgısına bakıldığında deney grubunda % 85 lik bir öğrenci grubunda bu yanılgı görülmemişken kontrol grubunda ise hiçbir öğrenci de bu yanılgıya rastlanılmamıştır. O halde beklenenin aksine öğrencilere göre matematikte her zaman soldan sağa doğru işlem yapılır, kavram yanılgısının giderilmesinde etkileşimli tahtanın olumlu etkisi söz konusu değildir.

Tablo 16. Parantezlerin Önemini Yoktur.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı		
			0	1	2
1.Öğrencilere göre cebirde parantezler önemli değildir. .	17-a, 18-a	Deney grubu	2 %10	12 %60	6 %30
		Kontrol grubu	4 %22,2	11 %61,1	3 %16,6

Öğrencilere göre cebirde parantezler önemli değildir, örneğin, 2(a+b) ifadesini 2a+b olarak yorumlayabilmektedir. Bu kavram yanılgısına bakıldığında deney grubunda % 10 luk bir öğrenci grubunda bu yanılgı görülmemişken kontrol grubunda ise % 22,2 lik bir öğrenci grubunda bu yanılgıya rastlanılmamıştır. O halde öğrencilere göre cebirde parantezler önemli değildir, kavram yanılgısına göre etkileşimli tahtanın olumlu bir etkisi görülmemiştir.

Denklem Çözerken Cebirsel Kuralları Kullanma

Tablo 17. Denklemin Diğer Tarafında Aynı İşlem Yapılır.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı						
1.Öğrencilere göre bir denklemin diğer tarafına da aynı işlem yapılır.	20-b, 21-a, 22-c, 23-a, 25-c, 26-c		0	1	2	3	4	5	6
		Deney grubu	3 %15	10 %50	4 %20	2 %10	1 %5	-	-
		Kontrol grubu	2 %11,1	9 %50	2 %11,1	5 %27,7	-	-	-

Öğrenciler denklemin diğer tarafında ters işlem yapma yerine, aynı işlemi yapmayı düşünmektedirler**.** Öğrencilere göre bir denklemin diğer tarafına da aynı işlem yapılır, kavram yanılgısına bakıldığında deney grubunda % 15 lik bir öğrenci grubunda bu kavram yanılgısı görülmemiş iken kontrol grubunda bu kavram yanılgısını görülmediği öğrenci grubu % 11,1 lik bir kesimdir. O halde öğrencilere göre bir denklemin diğer tarafına da aynı işlem yapılır, kavram yanılgısının giderilmesinde az da olsa etkileşimli tahtanın etkisi vardır.

Tablo 18. Sayılar, Değişkenler ve İşaretleri Birbirinden Ayrıdır.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı			
1.Öğrencilere göre sayılar, değişkenler ve işaretler birbirinden farklıdır.	24-c, 25-d, 26-c		0	1	2	3
		Deney grubu	8 %40	11 %55	1 %5	-
		Kontrol grubu	4 %22,2	6 %33,3	8 %44,4	-

Öğrencilere göre sayılar, değişkenler ve işaretler birbirinden farklıdır, kavram yanılgısının giderilmesinde deney grubunda % 40 lık bir öğrenci grubunda bu yanılgı görülmemişken kontrol grubunda % 22,2 lik bir öğrenci grubunda bu yanılgıya rastlanılmamıştır. O halde öğrencilere göre sayılar, değişkenler ve işaretler birbirinden farklıdır, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi vardır.

Tablo 19. Çıkarma İşleminin Değişme Özelliği Vardır.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı		
1.Öğrencilere göre çıkarma işleminin değişme özelliği vardır.	22-b, 24-d		0	1	2
		Deney grubu	13 %65	7 %35	-
		Kontrol grubu	11 %61,1	5 %27,7	2 %11,1

Öğrencilere göre çıkarma işleminin değişme özelliği vardır, kavram yanılgısına bakıldığında deney grubunda % 65lik bir öğrenci grubunda bu kavram yanılgısı görülmemişken kontrol grubunda % 62,1 lik bir öğrenci grubunda bu kavram yanılgısına rastlanılmamıştır. O halde öğrencilere göre çıkarma işleminin değişme özelliği vardır, kavram yanılgısının giderilmesinde etkileşimli tahtanın az da olsa etkisi vardır.

Tablo 20. Ters İşlemler Gereksizdir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı		
1.Öğrencilere göre ters işlem gereksizdir.	20-b, 24-d		0	1	2
		Deney grubu	12 %60,1	3 %15	5 %25
		Kontrol grubu	3 %16,6	9 %50	6 %33,3

Öğrencilere göre ters işlem gereksizdir, kavram yanılgısına bakıldığında deney grubunda % 60,1 lik bir öğrenci grubunda bu kavram yanılgısına rastlanılmamışken kontrol grubunda % 16,6 lık bir

öğrenci grubunda bu kavram yanılgısı görülmemiştir. O halde öğrencilere göre ters işlem gereksizdir, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi vardır.

Tablo 21. Harfler Soldan Sağa Eşleşir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı			
			0	1	2	3
1.Öğrencilere göre harfler soldan sağa doğru eşleşirler.	27-a, 29-b, 30-a	Deney grubu	9 %45	11 %55	-	-
		Kontrol grubu	8 %44,4	8 %44,4	2 %11,1	-

Öğrencilere göre harfler soldan sağa doğru eşleşirler, kavram yanılgısına bakıldığı zaman deney grubunda %45 lik bir öğrenci grubunda bu kavram yanılgısına rastlanılmamışken kontrol grubunda % 44,4 lük bir öğrenci grubunda bu kavram yanılgısı görülmemiştir. O halde öğrencilere göre harfler soldan sağa doğru eşleşirler, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi yoktur.

Tablo 22. Harfler Kelimeler İçin Bir Etikettir.

Kavram yanılgısı	Hangi soruda geçtiği		Kavram yanılgısı sayısı			
			0	1	2	3
1.Öğrencilere göre harfler kelimeler için birer etikettir.	27-b, 28-a, 29-d	Deney grubu	12 %60	4 %20	3 %15	1 %5
		Kontrol grubu	5 %27,7	9 %50	3 %16,6	1 %5,5

Öğrencilere göre harfler kelimeler için birer etikettir, kavram yanılgısına bakıldığı zaman deney grubunda %60 lik bir öğrenci grubunda bu kavram yanılgısına rastlanılmamışken kontrol grubunda % 27,7 lük bir öğrenci grubunda bu kavram yanılgısı görülmemiştir. O halde öğrencilere göre harfler kelimeler için birer etikettir, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi vardır.

Deney ve Kontrol Grubu Arasındaki Fark

"Harflerin yerini anlama"(1-8), "Değişkenleri kullanma"(9-13) ve "Denklem çözerken cebirsel kuralları kullanma"(14-19) kavram yanılgılarının deney grubu ve kontrol grubu arasında anlamlı bir fark var mıdır?

Tablo 23. Deney ve Kontrol Grubu Arasındaki Fark

Şube * KY Türü Crosstabulation

			KY Türü			Total
			denk yorum	Harfleri kullan	Harflerin Anl	
Şube	A	Count	108	61	65	234
		% within Şube	46,2%	26,1%	27,8%	100,0%
		% within KY Türü	56,0%	44,5%	72,2%	55,7%
		% of Total	25,7%	14,5%	15,5%	55,7%
	B	Count	85	76	25	186
		% within Şube	45,7%	40,9%	13,4%	100,0%
		% within KY Türü	44,0%	55,5%	27,8%	44,3%
		% of Total	20,2%	18,1%	6,0%	44,3%
Total		Count	193	137	90	420
		% within Şube	46,0%	32,6%	21,4%	100,0%
		% within KY Türü	100,0%	100,0%	100,0%	100,0%
		% of Total	46,0%	32,6%	21,4%	100,0%

"Harflerin yerini anlama"(1-8), "Değişkenleri kullanma"(9-13) ve "Denklem çözerken cebirsel kuralları kullanma"(14-19) kavram yanılgılarının deney grubu ve kontrol grubu arasında anlamlı bir

fark olup olmadığı hipotenizi incelediğimiz zaman frekanslar üzerinden analiz yapacağımız için Chi-Square testini yapıldığında anlamlı bir fark ortaya çıktığı görülmüştür.

Sonuç, Tartışma ve Öneriler

Elde edilen bulgulara göre araştırmanın sonuçları şöyle sıralanabilir.

1.Harflerin matematikte bir anlamı yoktur, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 65 etkisi vardır.

2.Harfler alfabede olduğu gibi sıralanır, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi yoktur çünkü hem deney grubunda hem de kontrol grubunda bu yanılgıya rastlanılmamıştır.

3.Harflerin alfabetik sıralamada olduğu gibi sayısal konum belirtir, kavram yanılgısının giderilmesinde etkileşimli tahtanın% 30 etkisi vardır

4.Katsayısı bir olan harflerin değeri "1" e eşittir, kavram yanılgısının giderilmesinde etkileşimli tahtanın %25 etkisi vardır.

5.Her harfin sadece bir değeri vardır, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 15 etkisi vardır.

6.Harfler sadece rakam olabilir, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi yoktur çünkü hem deney grubunda hem de kontrol grubunda bu kavram yanılgısına rastlanılmamıştır.

7.Harfler nesneleri gösterir, kavram yanılgısının giderilmesinde etkileşimli tahtanın %40 etkisi vardır.

8.Harfler sayılar gibi davranmaz, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 15 etkisi vardır.

9. "+" veya "-" ile "=" işaretleri daima sonuç üretir, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 10 etkisi vardır.

10. İşlemlerin sırası önemli değildir, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi yoktur.

11.Cebirsel olarak "=" işareti bir eylem belirtmesine rağmen öğrenciler 2s+5 ya da 5-c işlemlerinde olduğu gibi cebirsel ifadeleri bir matematiksel işlem yapma şeklinde yorumlamamaktadırlar, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 20 etkisi vardır.

12.Matematikte her zaman soldan sağa doğru işlem yapılır, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi yoktur.

13. Cebirde parantezlerin önemi yoktur, kavram yanılgısının giderilmesinde etkileşimli tahtanın etkisi yoktur.

14.Bir denklemin diğer tarafında ters işlem yapma yerine, aynı işlemi yapmak gerekir, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 5 etkisi vardır.

15.Sayılar, değişkenler ve işaretleri birbirinden ayrıdırlar, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 20 etkisi vardır.

16.Çıkarma işlemi değişme özelliğine sahiptir, kavram yanılgısının giderilmesinde etkileşimli tahtanın %10 etkisi vardır.

17.Ters işlemler gereksizdir, kavram yanılgısının giderilmesinde etkileşimli tahtanın %45 etkisi vardır.

18.Harfler soldan sağa eşleşirler, kavram yanılgısının giderilmesinde etkileşimli tahtanın % 5 etkisi vardır.

19.Harfler kelimeler için bir etikettir, kavram yanılgısının giderilmesinde etkileşimli tahtanın %35 etkisi vardır.

İlköğretim birinci ve ikinci kademesinde öğrenciler matematiksel kavramların farkına varırlar ve bu kavramları aktif bir şekilde kullanmaya başlarlar. Bu kavramları kullanmalarını sağlayan gerekli bilgi, beceri, terimler bu kademede öğretilir (Duran, 2013). Bu sebeple öğrencilere her ünitede oldukça çok kavram öğretilir. Her bir okul kademesinde öğrendikleri kavramları düşünürsek, bir üst kademede zorluk yaşamamaları için, öğrencilerin bu kavramları doğru yapılandırılmaları ve uygun şemalara yerleştirmeleri gerekir. Bu süreçte öğrencilerde olan kavram yanılgıları belirlenmeli ve giderilmelidir. Bu çalışmada etkileşimli tahtanın 7. Sınıf cebir konusunda kavram yanılgılarının giderilmesinde etkili olduğu sonucu elde edilmiştir. Eğer etkileşimli tahta kullanımı tüm okullardaki öğretmenler tarafından etkili bir şekilde kullanılırsa ülke genelinde öğrencilerde kavram yanılgısının azaltılmasında etkili olabilir.

Etkileşimli tahta ile öğrencilere izletilen videolar ve etkinlikler çeşitlendirilir ve öğretime doğru bir şekilde entegrasyonu sağlanırsa cebir başarısı daha ileri düzeye taşınabilir ve cebir konusunda karşılaştığımız kavram yanılgıları azalabilir. Bu konu araştırmacılar tarafından daha derinlemesine incelenebilir.

Bu çalışmayı yaparken incelenen makalelerin daha çok kavram yanılgılarını tespit etmeyi amaçladıkları fark edilmiştir. Buna karşın kavram yanılgılarının yok edilmesi için yapılan çalışmaların oldukça az olduğu görülmüştür (Türkdoğan, vd. 2015). Literatürde yurt dışında yapılan çalışmalarda matematik eğitiminde kavram yanılgısını gidermek üzere yapılan araştırmalar mevcuttur. (Golan, 2011; Prescott & Mitchelmore, 2005; Swedosh & Clark, 1997; Yazdani, 2006). Yurt içi literatürüne baktığımızda ise kavram yanılgısı giderme araştırmalarının genelde fen eğitiminde yapıldığını görürüz (Cepni, 2009; Çetingül & Geban, 2011; Taşlıdere, 2013). Bu çalışma ve benzer çalışmalar ile matematik eğitiminde karşılaştığımız kavram yanılgılarını gidermeye yönelik katkı sağlanabilir.

Aynı zamanda, teknolojiyi aktif kullanmak için öğretmenlere verilen hizmet-içi eğitimlerin uygulama yapmaya yönelik, uzun süreçte, küçük gruplar şeklinde ve branş bazında olması daha faydalıdır. Ayrıca düzenlenecek hizmet içi eğitimlerde yaşça ve mesleki kıdemce fazla olan öğretmenlerin teknoloji bilgilerini arttırmak için çeşitli önlemler alınmalıdır. Teknolojinin öğretime başarılı bir şekilde entegre edebilmesi için gerekli önlemler alınmalı, öğretmenlere uygulamalı eğitimler verilmelidir. Bu hizmet içi eğitimler sonucunda öğretmenlerin, aldığı eğitimleri öğrenme ortamında öğrenciler ile paylaşması faydalı olacaktır.

Şu da bir gerçek ki lisans eğitimi sırasında teknoloji kullanılarak eğitim olan öğretmen adayının meslek hayatına başladığı zaman sınıf ortamında teknoloji kullanmaya daha yatkın ve istekli olduğu görülür. Dolayısıyla lisans eğitimi sırasında ne kadar teknoloji destekli eğitim verilirse öğretmen adayı da aynı doğrultuda ilerleyecektir. Ayrıca öğretmen adayı teknolojiyi kullanmaya ne kadar olumlu tutum içerisinde olursa olsun lisans eğitimi sırasında uygulamalı eğitim almadığı takdirde meslek hayatına başladığında teknolojiyi kullanmama ihtimali yüksektir. Bu yüzden öğretmen adaylarına bu teknolojiyi kullanarak uygulama yapabilecekleri öğretim alanları sunulmalıdır.

Kaynakça

Akkaya, D. (2006) İlköğretim 6-8 Sınıf Öğrencilerinin Cebir Öğrenme Alanındaki Kavram Yanılgıları H.Ü. Eğitim Fakültesi Dergisi 31 1-12 9

Akkoyunlu, B. (1995).Bilgi teknolojilerinin okullarda kullanımı ve öğretmenlerin rolü. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 11, 105–109

Baki, A. (1998). Cebirle İlgili İşlem Yanılgılarının Değerlendirilmesi, 3. Ulusal Fen Bilimleri Eğitimi Sempozyumu, Karadeniz Teknik Üniversitesi, Fatih Eğitim

Çelik, H. C. & Kahyaoğlu, M. (2007). İlköğretim Öğretmen Adaylarının Teknolojiye Yönelik Tutumlarının Kümeleme Analizi. Türk Eğitim Bilimleri Dergisi.

Cepni, S. (2007). Araştırma ve proje çalışmalarına giriş. Celepler Matbacılık, Trabzon.

Cepni, S. (2009). Effects of computer supported instructional material (CSIM) in removing students' misconceptions about concepts: Light, light source and seeing. Energy Education Science and Technology Part B: Social and Educational Studies, 1(2), 51-83.

Champagne, A.,Gunstone, R., Klopler, L. (1985). Effective changes in cognitive structures among physics students. In L. H.

Chi, M. T. H. (2005). Commonsense conceptions of emergent processes: Why some misconceptions are robust. Journal of the Learning Sciences, 14(2), 161-199.

Chiu, M. M., Kessel, C., Moschkovich, J., & Muñoz-Nuñez, A. (2001). Learning to graph linear functions: A case study of conceptual change. Cognition and Instruction, 19(2), 215–252.

Çetingül, İ. & Geban, Ö. (2011). Using conceptual change texts with analogies for misconceptions in acids and bases. Hacettepe University Journal of Education, 41,112- 123.

Dede, Y. ve Argün, Z. (2003). Cebir, Öğrencilere Niçin Zor Gelmektedir? Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 24, 180-185.

Duran, M. (2013). İlköğretim 7.sınıf öğrencilerinin görsel matematik okuryazarlığı hakkındaki görüşleri. Mehmet Akif Ersoy Üniversitesi Eğitim Bilimleri Enstitü Dergisi, 2 (2), 38-51.

Ersoy, Y. ve Erbaş, K. (1998). İlköğretim Okullarında Cebir Öğretimi: Öğrenmede Güçlükler ve Öğrenci Başarıları. Cumhuriyetin 75. Yılında İlköğretim I. Ulusal Sempozyumu. (27-28 Kasım 1998). Ankara: Başkent Öğretmenevi.

Golan, M. (2011). Origametria and the van Hiele theory of teaching geometry. P. Wang Iverson, R. J. Lang & M. Yim (Eds.), Origami 5: Fifth international meeting of origami science, mathematics and education (5OSME) içinde (s. 141-150). Boca Raton: CRC Press.

Heinze, A. (2005). Mistake-Handling activities in the mathematics classroom. Psychology of Mathematics Education, 1 (3), 105-112.

Henningsen, M. & Stein, M. K. (1997). Mathematical tasks and student cognition: Classroom- based factors that support and inhibit high-level mathematical thinking and reasoning. Journal for Research in Mathematics Education, 28 (5), 524-549.

Kaput, J. J. (1999). Teaching and Learning a New Algebra with Understanding. In E. Fennema & T. Romberg (Ed.) Mathematics Classrooms that Promote Understanding (pp. 133-155). Mahwah, NJ: Lawrence Erlbaum Associates.

Keşan, C. ve Kaya, D. (2007). "Bilgisayar Destekli Temel Matematik Dersi Öğretimine Sınıf Öğretmenliği Öğrencilerin Bakış Açıları". Bilim, Eğitim ve Düşünce Dergisi, 7(1). (http://www.universite-toplum.org/text.php3?id=305 Erişim Tarihi:26.07.2013)

Kieran, C. (1992). The Learning and Teaching of School Algebra. In: Grouws DA (ed.). Handbook of Research on Mathematics Teaching and Learning. New York: Macmillan Publishing Company.

MacGregor, M. & Stacey, K. (1993). Cognitive models underlying students' formulation of simple linear equations. Journal for Research in Mathematics Education, 24, 217-232.

O'Bannon, F.G.; Reed, S.and Jones, S. (2002). Indiana's Academic Standards. Grade 7 English/ Language Arts, Mathematics, Science, Social Studies. Indiana State Dept. of Public Instruction, Indiana State Department of Education, Indianapolis, Indiana State Commission for Higher Education, Indianapolis.

Oral, B. (2004). Öğretmen adaylarının internet kullanma durumları. XIII. Ulusal Eğitim Bilimleri Kurultayı. İnönü Üniversitesi, Eğitim Fakültesi. Malatya.

Perso, Thelma (1992). Using Diagnostic Teaching to Overcome Misconceptions in Algebra. The Mathematical Association of Western Australia.

Prescott, A. & Mitchelmore, M. (2005) Teaching projectile motion to eliminate misconceptions. In: H.L. Chick, and J.L. Vincent (Eds.), Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education, 4, 97-104.

Shenton, A. & Pagett, L. (2007). From 'bored' to screen: the use of the interactive whiteboard for literacy in six primary classrooms in England. Literacy.41(3).

Swedosh, P. & Clark, J. (1997). Mathematical Misconceptions-Can We Eliminate Them? F. Biddulf & K. Carr (Eds.), People in Mathematics Education (2) içinde, (s. 492-499). Waikato: Mathematics Education Research Group of Australasia.

Taşlıdere, E. (2013). Effect of conceptual change oriented instruction on students' conceptual understanding and decreasing their misconceptions in DC electric circuits. Creative Education, 4 (4),273-282.

Türkdoğan, A., Güler, M., Bülbül, B. Ö., & Danışman, Ş. (2015). Türkiye'de matematik eğitiminde kavram yanılgılarıyla ilgili çalışmalar: tematik bir inceleme. Mersin Üniversitesi Eğitim Fakültesi Dergisi, 11(2), 215-236.

Umay, A. (2003). Matematiksel Muhakeme Yeteneği. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 24, 234-243.

Yazzani, M. A. (2006)The Exculision of the Student's Dynamic Misconceptions in College Algebra: A Paradigm of Diognasis and Treatment Jounal of Matematical Science and Mathematics Education,3(2),56-61.

Yuan, Y. and Yi Lee, C. (2012). Elementary school teachers' perceptions toward ict: the case of using magic board for teaching mathematics. The Turkish Online Journal of Technology, 11(4), 108-118.

EXTENDED ABSTRACT

The main goal of this research is to analyze the result of learning outcomes that occurs by using different techniques to prevent miscoceptions that exits in the learning process which is enrichened by smart boards for algebra class at 7 th grades. At this research our model is last test control model. Our research was carried out quasi-experimental study. İn this method, the group which existed previously were taken without a change, but one of this groups was chosen as a control group by drawing lots. However, it is paid attention that the groups that were included in the research have the same qualities. This study was carried out at Kestelli Şerife Eczacıbaşı Secondary School in İzmir, at the classes of 7/A and 7/B with 38 students, during 2016-2017 education year. For the experimental group, the teaching was done by using just smart boards in 12 teaching hours, just as it was carried out in the curriculum. Lots of animations were watched on the internet sites as z-books and vitamin, algebra games were played on the smart boards, students attended to all the activities during the teaching process. İn the control group, the classical way was used to teach. An algebra test that has 30 questions was carried out to identify the miscoceptions of students about algebra. The questions in the test were taken from the study "Diagnosic Test-Conceptions in Algebra" which belongs to Thelma Perso (1992). The questions in that study were translated into Turkish, then by negatiating with the language and area-related experts, they were regulated. The test reliability is determined by analysing the samples that are used by Recai Akkaya in his studies. The alpha reliability coefficient of the test is 0,74. Our goal in term of asking these question is to analyse 19 miscoceptions that was revealed by ThelmaPerso. Each question was asked to reveal a certain concept error. Some questions reveals more than one miscoceptions. The datas were analysied by SPSS 10.0 software. Followingly the result were showed in the charts. This research indicates that these is a significant difference between the experimental and control group in terms of preventing miscoceptionsthat occurs in the process of using smart boards for the algebra class.

EK A

CEBİR TESTİ

AÇIKLAMA: Sevgili arkadaşlar aşağıda soruları dikkatlice okuyup size doğru gelen seçeneği işaretleyiniz. Soruları boş bırakmayınız. Süreniz 30 dakikadır. Katılımınızdan dolayı teşekkür ederim.

1) a + 5 ifadesinde "a" için ne söyleyebilirsiniz?
a) 1 b) Bilinmeyen
c) Hiçbir anlamı yok d) Hiçbiri
2) 3c + 7c = ? işleminin sonucu nedir?
a) 10 ceviz b) 3c + 7c
c) 10c d) 100
3) 6 + b = ? işleminin sonucu nedir?
a) 7 b) 6 + b
c) Hiçbir anlamı yok d) b
4) a + b+ c = a + z + c ifadesinin doğruluğu hakkında ne söyleyebilirsiniz?
a) Her zaman doğru b) Her zaman yanlış
c) b = z d) Hiçbiri
5) Eğer 3 ile p çarparsam sonuç ne olur?
a) 3 x p yada 3p b) Sadece 3 x p
c) Sadece 3p d) Hiçbiri
6) a + b + c = ? ifadesinin sonucu nedir?
a) Üç sayı sırayla toplanmış b) 6
c) Neye eşit olduğunu söylenemez. d) 3

7) Hangisi daha büyüktür 3 x n mi yoksa n + 3 mü ?
a) 3 x n b) n + 3
c) ikisi birbirine eşittir d) " n" ye bağlı olarak değişir.
8) Eğer 2xy = 240 ve x = 4 ise y =?
a) y = 30 b) y = 0
c) y = 1 d) y =60
9) 2m = 10 ise m = ?
a) m = 8 b) m = 5
c) "m" harfi metreyi gösterir. d) Hiçbiri
10) a = 7 , c = 9 ise b = ?
a) b = 6 b) b = b
c) b = 8 d) b = 11
11) Eğer a + c = 7 ise a + b + c = ?
a) 8 b) 12
c) 7 + c d) 7 + b
12) 6 + c = ?
a) 6c b) 7
c) 6 + c d) Hiçbiri
13) 6x + 2y + x = ?
a) 7x + 2y b) 8x2y
c) 8xy d) 6x2 + 2y
14) m + 4 ifadesine 3 eklersem sonuç ne olur?
a) 3m + 4 b) 7m
c) m + 7 d) Hiçbiri
15) 6xy ifadesine 5 eklersem ne olur?
a) 11xy b) 6xy + 5
c) 30xy d) Hiçbiri
16) e + f = 29 ise e – 3 + f = ?
a) 33 b) 26
c) 32 d) 24
17) k = j + m ve k + j + m = 12 ise k =?
a) k = 3 b) k = 6
c) 221 d) 273
18) m = 5n + 1, n değeri 2 artarsa m değeri ne olur?
a) m = 7n +1 b) m = 53
c) m = 5n +11 d) m = 10n + 1
19) Yandaki şekil bir karedir. Ç = 4a ve A = a2 ise a = ?
a) a = 3 b) a = 4
c) a = a d) a = 9
20) b + 5 = 4b ise b= ?
a) b = 5/3 b) b = 4b +5
c) b= 3/5 d) b = 0
21) x – 53 = 220 ise x-54 = ?
a) 274 b) 219
c) 221 d) 273
22) m - 24 = 8 ise m = ?
a) 3 b) -16
c) 16 d) 32
23) k – m + 4 = 16 ise k – m = ?
a) 20 b) 8
c) 12 d) 16
24) 9 = 24 -5z ise z=?
a) 3 b) -3

c) 9/19 d) 10
25) 12 – 2x = 4x + 3 ise x=?
a) x =12 /15 b) x =16 /15
c) x =9 /6 d) x = 7 /10
26) z + 2 (y – 3) = 9y – 8 ise z = ?
a) z = 7y – 5 b) z= 11y – 2
c) z = 11y + 14 d) z = 7y – 2
27) Ceren kırtasiyeden tanesi 3 milyon olan kalemlerden ve tanesi 2 milyon olan defterlerden alıyor. k: aldığı kalemlerin sayısını; d: aldığı defterlerin sayısını göstermektedir. Ceren kasaya 15 milyon ödediğine göre aşağıdakilerden hangisi doğrudur?
a) 3d + 2k = 15 milyon b) k + d = 15 milyon
c) 3k+ 2d = 15 milyon d) 6k+ d = 15 milyon
28) Ebru pazardan tanesi 2 milyon olan limonlardan ve tanesi 3 milyon olan karpuzlardan alıyor.
a : aldığı limonların sayısı ; b : aldığı karpuzların sayısı ise 2a + 3b ne anlama gelir?
a) 2 tane limon ve 3 tane karpuz b) 32 milyon
c) 23 milyon d) Limon ve karpuza ödediği para
29) Ahmetlerin çiftliğinde tavuk ve horozları vardır. Tavukların sayısı horozların sayısının 5 katıdır. T : tavukların sayısını ve H : horozları sayısını gösterdiğine göre aşağıdakilerden hangisi doğrudur?
a) 5 = T + H b) 5T = H
c) T = 5H d) 5T x H
30) SORU : “Hangi sayının yarısının üç katından dört çıkartırsak on yedi eder?” Bu soruyu çözebilmek için yazılabilecek denklem aşağıdakilerden hangisidir?
a) 2 /3 x + 4 = 17 b) 3 /2x – 4 = 17
c) 3 /2x + 4 =17 d) Hiçbiri

ISSN: 2146 - 9466
www.ijtase.net
International Journal of New Trends in Arts, Sports &Science Education - 2019, volume 8, issue 1

EFFICACY OF GRAPHIC ORGANIZER ON PRIMARY SCHOOL STUDENTS' PERFORMANCE IN COGNITIVE WRITING SKILLS

ODEWUMI, Michael Olubunmi (Ph.D)
Department of Educational Technology,
University of Ilorin, Ilorin. Nigeria
agbegilerebunmi2@gmail.com

GAMBARI, Amosa Isiaka (Ph.D)
Department of Educational Technology,
Federal University of Technology, Minna, Nigeria
gambari@futminna.edu.ng & gambarii@yahoo.com

BADA, Tayo Abass (Ph.D)
Department of Library studies and Educational Technology
Faculty of Education,
Obafemi Awolowo University
Ile-Ife, Osun State, Nigeria
badatayo2@yahoo.com

Received Date: 08-11-2019 **Accepted Date:** 28-01-2019 **Published Date:** 31-01-2019

ABSTRACT
This study investigated the efficacy of graphic organizer on junior secondary school students' cognitive writing development skills. The study also determined the influence of school type and gender on the performance of students taught with graphic organizer (GO). The study was necessitated because of the problem of non-readable hand-writings of the pupils in junior secondary schools. The quasi-experimental design which involved the pre-test, post-test, control group design was employed for the study. The research sample was drawn from two randomly selected junior secondary schools from Ile-Ife, Oyo State, Nigeria. Students from the sampled class were further stratified along gender. The instruments used for collecting data were Graphic Organizer Achievement Test (GOAT) and the graphic organizer (GO). Graphic Organizer Achievement Test (GOAT) was pilot tested for reliability using the test-retest method of three weeks interval and Pearson Moment Product Correlation coefficient analysis revealed a reliability coefficient value of .78. The two hypotheses were tested using t-test. Findings indicated that, students taught with the graphic organizer performed better than those taught with conventional method. It was shown that the gender of pupils was not a factor in the performance of students when they were taught with Graphic Organizer. Based on the findings, it was recommended that teachers should used. Graphic Organizer in teaching Cultural and Creative Arts to enhance students' performance.

Keywords: Graphic Organizers, Cognitive Writing Development, Public and Private Primary Schools, Gender, Cultural and Creative Arts

Introduction

Learning is a shift from one behavioral act to another through experience, this is achieved when relative and useful information is delivers in systematically way to learners' cognitive sense in an organized, meaningful and useable format (McElroy & Coughlin, 2009). Reading children start with the reciting and identification of the twenty six letters of alphabets, this further leads to construction of words in different disciplines. An alphabet is the foundation on which Graphics Arts is built, and a very prominent aspect in visual arts. Graphics is an aspect of Creative Arts taught in the primary schools within the context of Cultural and Creative Arts (Usman, Odewumi, Obotuke, Apolola, & Ogunyinka, 2014). Graphics utilizes alphabets and visual or images to communicates idea and concept, it is conspicuously seen everywhere because the captions facilitates e-learning enhancement through sense of sight (Miller, 2011). Therefore, it is pertinent for learners to be tailored towards learning with the world of graphics and especially letterings and visuals from early stage.

In another word, graphics is a designing of alphabetic concepts. It belongs to non-verbal instructional media through which learners acquires crucial information and concepts (Githua & Nyabwa 2008). Along with this statement, Zaini, Mokhtar and Nawawi (2010) explained graphic organizers as a fraction of instructional media which emerge to substituting words articulated in linear form into visual structural updates of a designed content for easily assimilation by the learners.

Katayama and Crooks (2003) explained that graphic organizer is relative perfect in describing changes that carried out within the scope of visual in educating young one within the education process and method. It is a showcase of different visual affairs of learning content of concepts and ideas. It also a guardian to learner's thinking and reasoning which is established on a stronger visual map or diagram.

Although, Hall and Strongman (2008) submitted that graphic organizers is said to be a unique package, instant solution provider to learning difficult topics easily. Graphic organizer is unique tool of representation, illustration and modeling of information in visuals or graphics form in instructions. In essence, graphic organizer take proper care of students to identify the missing information or absent connections in one's strategic thinking (Ellis, 2004). Student embarking on graphic organizers as learning tool also assists them to see related facts in learning. Studies has confirmed that graphic organizer is mostly available for giving knowledge to learners, elicits progressive instruction and fun, rather than involving them in the traditional learning mode.

Researches confirmed effectiveness of graphic organizer in some disciplines such as Home Economics (Alshatti, 2012), Sciences (Kristina & Condidorio, 2010), Science and Technology (Ayuerdi, Nakiboslu, Ozayin, 2014), Mathematics (Mercer & Miller, 2003; Githua & Nyabwa (2007), Writing (Sundeen, 2007; Jasmine & Weiner 2007.), Health Education (Kools, Van de Wiel, Ruiter, Cruts, & Kok, 2006), and Social studies and special candidatures (Cleveland, 2005). Furthermore, students with learning disabilities also benefited from graphic organizer (Dexter & Hughes, 2011). In addition, Lovitt (1994) attested to the relevance of graphic organizers in organizing and highlight the essential content information on Vocabulary and Writing (Karsbaek, 2011). Meanwhile, most if these studies suggested that learners should be given the privilege to develop individual creativity to the optimum possible, for the benefit of their future and communities.

In this regards Burke (2007) submitted that creativity is bringing new and imaginative ideas into reality through the involvement of learners in critical thinking. Grosvenor (2007) explained that creativity shows case in the personal exhibition of creative imaginative behaviors and innate ability to produce something out of anything. Thus, creativity by learners is determined by their level of exposure to instructions.

Obviously, every learner begins to acquire basic learning skills from early age through day to day interactions with elders and their mates, storytelling, singing, pointing to and mention the names of objects and scribbling (Bohrer, 2005; Daimant-Cohen, 2007). Writing is imperative in child learning developmental process that further articulate knowledge, for feelings efficiently in the skill. Legibility of handwriting of learners is correlated with literacy skills and writing composition. Whereas cursive handwriting belongs to a skill and road map, through which the learners' thoughts and actions can be tailored right from birth through life education.

At this juncture, the educational establishment should be seen to plays a role model in writing, through training of instructors by the experts or competence hand (Hunt & O'Donnell, 1970; Cahill, 2009; Graham, 1999; Tompkins, 2004). Writing is acquire through constant repetition, moreover, the more the students form the habit of learning the more the writing skills is perfected and expressions are fluent and

efficiently. The learners regular connection with their instructor coagulate and give way for the developing of the cognitive skills which in turn inspire the legibility process and ideas of the learners (Richards, 1990; Cresewell, 2008).

Learners' writing can be improved through constant repetition and copy of graphical works and pictographic wordings this in turn assists in instruction strategies. Classics, originality and imagination are recognized with higher valued through creative writing, these further assist in given space to fabricate words content in unique to the beginners (Oberman & Kapka, 2001; Brookes & Marshall, 2004; Mak, & Coniam, 2008).

Instructor should inculcates avenue for the learners to become individual through writing habit formation on regular practices this will promotes, constant reading and elicit creative writing exercises. In line with this, Smith, (2000) further presented five writing stages as prewriting, drafting, revising, editing and publishing. Nevertheless, Oberman and Kapka, (2001) stressed that the constant visitation of writings by the learners fosters legibility, improves writing skills, and helps attaining good writing process in learners. Writing is a skills and also a talents which is of paramount to learners life education, because it helps learners to articulate their belief, `facts and view efficiently, this can be monitored from the cradle till the end (Smith, 2000; Zampardo, 2008; Tompkins, 2004).

Like the architect of creative writing, graphics are also seen and prominent everywhere. It is the illustrator and representative of information, data or knowledge intended to present vital information to targeted audience. It is further classified as a storytelling which people use to visualize and illustrates knowledge, experiences, in logically manner. Whereas, graphics is an extremely effective and powerful means of communication over traditional means (Fernando, 2012; Myers, 2013; Gallicano, Ekachai & Freberg, 2014). It is also the way visual information which is built on data or knowledge that intended to present crucial and complex information very urgent and clearly, it also combines beautiful visuals along with rich text to delivers clear messages of effective communication anywhere and anytime (Doug, 2004; Bostock, 2010).

The basic form of Creative Art is the ability to appreciate the beauty and quality of the nature within the environment and to skillfully restructure the natural environment by transforming the visual objects and materials into objects of greater value (Kalilu, 2013). Nevertheless, objects, materials and visuals are of paramount trend in educative instructional packages. These have contributed a great development in bringing strong impact to learners' educational needs, characteristics and pedagogy in implementing instructional procedure. Graphic elicit positive response mostly among the pupils in legible letterings, clear visual and the bright colors involves (Sewidan & Al-Jazar, 2007).

Recently, Nigerian students' handwritings were not legible and their style of writing was not encouraging. Legible writings foster permanent learning which graphic organizer promotes. The knowledge of good lettering is essential for reading and writing; construction of wordings and books. To promote effective graphics, there are several studies on graphics organizer and education globally. For instance, Stephanie Miller (2011) examined the impact of graphic organizers on pre-writing tool to increase students' writing proficiency, the study projected graphic organizers as a media of improving the students' legibility.

In another development, Meera and Aiswary (2014) explored the efficacy of graphic organizers in writing among the secondary schools; the results confirmed the graphic organizers as a great developer of the English writing skills among the learner. Josiah and Adaramati (2015) submitted that teacher efficiency is measured by the outcome of his students' performances therefore, researchers suggested the

learner-centered approach with appropriate interactive technology devices for impacting knowledge to the young ones.

Generally, studies established the positive influence of graphic organizers on the comprehension and reading of learners with disabilities. Kim, Vaughan, Wanzek, and Wei (2004) submitted that judicious use of graphic organizers in teaching process influence students' reading problem among the disable students. Also, Kools, van de Wiel, Ruiter, Cruts, and Kok (2006) reported that the use of text in health education increased reading comprehension. Chohan (2011) reacted to negative that poor handling of writing skill will have on the future generation of learners' developmental stage. However, the extent to which the motivational graphic organizer package in teaching of creative writing can enhance instructional delivery among the junior secondary students in Nigeria is still unknown.

Therefore, the study sought to determine the influence of motivation on graphic organizer instruction in teaching creative writing among the junior secondary students in Ile-Ife, Osun State. Nigeria. The study further determined the influence of gender on the performances of students taught with graphic organizer.

Research Hypotheses

The following two hypotheses were formulated and tested at .05 level of significance:

1. There is no significant difference in the mean performance score of students in public and private primary school students taught using graphic organizer.

2. There is no significant difference in the mean performance score of male and female primary school students taught with graphic organizer.

Methodology

This study was a quasi-experimental type of post-test, control group design. The target population for this study was basic five (primary 5) creative arts students in Ile-Ife, Nigeria. Purposive sampling technique was use for selecting two junior secondary schools based on the following criteria: Year of Enrolment (Primary school offering creative arts for the past five years); Facilities (Creative Arts Studio); Manpower (Experienced creative arts teacher); and Electricity (Uninterrupted Power Supply).

The instruments for this research were the treatment instrument "Graphic Organizer (GO)", the marking guide and the test instrument, "Graphic Organizer Achievement Test (GOAT)". The Graphic Organizer, was built on the ideology of Instructional Design. However, Babalola (2007) explained that the Instructional Design (ID) is an organized procedure for producing educative, training and instructional programme.

Morrison, Ross, and Kemp instructional design model was adopted for this study. It has nine stages ranges from identifying instruction design problems to evaluation the instrument. Graphic Organizer was a self-instructional, interactive package stored in a Compact Disk (CD) and projected using multimedia projector. The package contained the operating buttons such as: Stop, Play, Next, Pause, and Previous to provide easier control of the package. The package was used for six weeks.

It contained six topics which include: Element of Design, Family of Alphabets, Gothic Letterings, Lower Case, and Upper Case Letterings. The validation and evaluation of the package was done by Fine and Applied Arts experts, Educational Technology and Computer Science specialists. They conducted face and content validity of the package by scrutinizing the: visual appearance, operating system, tenses,

readability, and clarity of the package.

Graphics Organiser Achievement Test (GOAT) was pilot tested on some selected sample that shared the same characteristics with the final sample used for this study and it was found positive. GOAT contained 50-item multiple choice objective questions with five options (A - E) drawn from the collection of past question papers of Common Entrance into Secondary School.

Experimental Procedure

The objectives and modalities of the experiments were well specified and operational manual guide were adequately provided for the teachers and students. The students were exposed to graphic organizer instruction. The graphic organizer instructional package was projected via projection screen for the experimental groups. The students were instructed to be mindful and take notices of instruction provided on the graphic organizer package. The treatment for the group lasted for six weeks. After six week treatment, GOAT was administered as posttest.

Results

$H0_1$: There is no significant difference in the mean performance score of students in public and private junior secondary school students taught using graphic organizer.

This hypothesis was tested using t-test statistic to compare the mean scores of public and private junior secondary school students' taught with graphic organizer. The result is shown in Table 1.

Table 1: t-test comparisons of the mean scores of public and private junior secondary school students taught using graphic organizer

Variables	N	Mean	SD	df	t-value	p-value
Public Junior secondary School	30	4.00	12.10			
				58	.781	.381
Private Junior secondary School	30	15.10	2.50			

Table 1 presents the t-test comparison of the mean scores of public and private junior secondary school students taught using graphic organizer. The mean scores for the public secondary school were 4.00 with standard deviation of 12.10. The mean scores for the private secondary school were 15.10 with standard deviation of 2.50. The t-value of .781 was not significant at the .381 alpha value ($t = .781$, $df = 58$, $p > 0.05$). This indicates that there was no significant difference between the public and private junior secondary schools taught using graphic organizer. Hence, hypothesis one was not rejected.

$H0_2$: There is no significant difference in the mean performance score of male and female junior secondary school students taught with graphic organizer.

This hypothesis was tested using the t-test statistic to compare the mean scores of male and female junior secondary school students taught with graphic organizer. The result is shown in Table 2.

Table 2 presents the t-test comparison of the mean scores of male and female junior secondary school students taught using graphic organizer. The mean scores for the male junior secondary students were 15.10 with standard deviation of 2.45.

Table 2: t-test comparisons of the mean scores of male and female junior secondary school students taught using graphic organizer

Variables	N	Mean	SD	df	t-value	p-value
Male Students	31	15.10	2.45			
				58	.385	.537
Female Students	29	14.00	2.09			

The mean scores for the female junior secondary school students were 14.00 with standard deviation of 2.09. The t-value of .385 was not significant at the .537 alpha value ($t = .385$, $df = 58$, $p > 0.05$). This indicates that there was no significant difference between the male and female junior secondary school students taught using graphic organizer. Hence, hypothesis two was not rejected.

Discussion of findings

The findings revealed that there was no significant difference between the public and private junior secondary school students taught with graphic organizer. Similarly, there was no significant difference between the performance of male and female students taught with graphic organizer. This finding is in line with that of Levasseur and Sawyer (2006), Jones (2009), Michelle (2013) and Nsofor and Momoh (2013), Alabi, Emmanuel and Falode (2015) that students attention are more captured through slides, projected visual image, motion pictures and developed electronic instructions irrespective of gender. The finding agrees with the findings of Clark (2007) which revealed that graphic organizers helps students to understand difficult concepts generate thoughts, and ideas.

The finding is also in congruence with that of Karsbaek (2011) who reported that graphic organizers enhance students understanding during their early scribbling, inscription and life-long writings. However, the finding disagreed with that of Egan (1999) and Baxendell (2003) who stated that graphic organizers will cause students to become confused and disorganized in their understanding. It also agreed with that of Robinson and Molina (2002) who stated that, students who studied graphic organizers performed worse on the visual task and auditory task.

Conclusion

The graphic organizer enhanced the performance of public and private junior secondary school students' taught with graphic organizers in creative writing. Similarly, male and female junior secondary school students taught graphic organizer in creative arts performed equally better. This implies that, graphic organizer is gender friendly. This study proved that teaching students with technological tools like graphic organizer improved students' performance in creative arts irrespective of school type and gender.

The implication is that graphic organizer (GO) offers an individual technology-based pedagogical strategy to learner, which provides an efficient and effective teaching that facilitate the learning acquisition skill in various cognitive aspect of knowledge. Creative writing can be better taught and learned through the utilization of the graphic organizer within the Nigerian junior secondary primary school context.

Recommendations

The following recommendations were proffered based on the findings:

1. Secondary school teachers should be encouraged and trained to use Graphic organizers in teaching Creative Arts. Instructional process and activities should be designed to accommodate the use of Graphic organizers in the classrooms. Also, teachers should be able to integrate Graphic organizers into their lesson.

2. Government should create more awareness through seminar and workshop on the use of Graphic organizers in schools. There should also be a production unit in the Ministry of Education or Educational Resources Centre across the country where Graphic Organizers would be produced.

References

Alabi, T. O., Emmanuel, O., & Falode, C. O. (2015). Effects of videodisc mediated and computer assisted instructional packages on achievement of junior secondary school mathematics students in geometry in Minna, Nigeria. *Journal of Science, Technology, Mathematics and Education (JOSTMED),* 11(3)240 -251.

Alshatti, S. A. (2012). Embedding graphic organisers in the teaching and learning of family and consumer science (Home Economics). Unpublished PhD thesis, Centre for Learning Innovation Faculty of Education Queensland University of Technology.

Ayuerdi, L., Nakiboslu, C., & Ozayin, S. (2014). Usage of graphic organizers in science and technology lessons. *Procedia - Social and Behavioral Sciences,* 116, 4264 – 4269.

Babalola, I. (2007). Effectiveness of video as an instructional medium in teaching rural children agricultural and environmental sciences. *International Journal of Education and Development using Information and Communication Technology. (IJEDICT),*3 (3),105-114.

Chohan, S. (2011). Any letter for me? Relationships between an elementary school letter writing program and student attitudes, literacy achievement, and friendship culture. *Early Childhood Education,* 39(1), 39-50.

Clark, A. (2007). GOs and the school library program. University of Alberta Department of Elementary Education.

Cleveland, M. (2005). *Content area graphic organizers social studies.* Portland, Maine: Walch Publishing.

Dexter, D. D., & Hughes, C. A. (2011). Graphic organizers and students with learning disabilities: A meta-analysis. *Learning Disability Quarterly,* 34(1), 51-72.

Egan, M. (1999). Reflections on effective use of graphic organizer's. *Journal of Adolescent & Adult Literacy, 42* (8), 641-645.

Ellis, E. (2004). *What's the big deal about GO*? Retrieved on January 23rd, 2010, from http://graphicorganizer.com

Githua, B., & Nyabwa, R. A. (2008). Effects of graphic organiser strategy during instruction on secondary school student's mathematics achievement in Kenya's Nakuru District. *International Journal of Science and Mathematics Education,* (6), 439-457.

Hall, T., & Strangman, N. (2008). *National center on accessing the general curriculum at cast*. Walch Education.

Jasmine, J., & Weiner, W. (2007a). *Using graphic organizers to teach writing 1 an examination of using graphic organizers to teach writing:* A case study Katie Lancaster Eastern Illinois University. ELE 5900 Spring 2013

Jasmine, J., & Weiner, W. (2007b). The effects of writing workshop in abilities of first grade students to become confident and independent writers. *Early Childhood Education Journal,* 53(2), 131-139.

Josiah, O., & Adaramati, T. F. (2015). Effects of graphic organiser on students' achievement in algebraic word problems. *Journal of Education,* 6, (5), 122 – 222.

Jones, J. B. (2009, November). Challenging the presentation paradigm (in 6 minutes, 40 seconds): Pecha Kucha. *The Chronicle of Higher Education*. Retrieved from http://chronicle.com on the 6th August 2014.

Kalilu, R. O. (2013). Art from art for art conceptualising existence in the space of the visual arts. Inaugural Lecture Series 10, delivered at Ladoke Akintola University of Technology, Ogbomoso. Lagos, SOF & Co. Press.

Katayama, A. D., & Crooks, S. M. (2003). Online notes: Differential effects of studying complete or partial graphically organised notes. *Journal of Experimental Education,* 71 (4), 293 - 312.

Karsbaek, B. (2011). Writer's workshop: Does it improve the skills of young writers? *Illinois Reading Council Journal, 39*(2), 3-11.

Kim, A. H., Vaughan, S., Wanzek, J., & Wei, S. (2004). Graphic organizer and their effects on the reading comprehension of students with LD: A Synthesis of Research. Hammill Institute on Disabilities (37, 105).

Kools, M., van de Wiel. W. J., Ruiter, A. C., Cruts, A., & Kok, G. (2006). *The effect of graphic organizers on subjective and objective comprehension of a health education text.* Health Education Behaviour Onlinefirst.

Kristina, C. (2010). *The usefulness of graphic organizers in enhancing science.* UK: Learning Fisher Digital Publications.

Levasseur, D. G., & Sawyer, J. K. (2006). Pedagogy meets PowerPoint: A research review of the effects of computer-generated slides in the classroom. *The Review of Communication*, (6), 101-123.

Lovitt, S. (1994). Strategies for adapting science textbooks for youth with learning disabilities. *Remedial and Special Education*, 15(2), 105-116.

McElroy, L. T., & Coughlin, C. N. (2009). The other side of the story: Using graphic organizer as cognitive learning tools to teach students to construct effective counter-analysis. Unpublished Thesis University of Baltimore Law Review.

Meera, P., & Aiswarya, K. (2014). A study on the effectiveness of graphic organizers in the writing skill of English among secondary school students. https://www.scholarworld.net, 2, (IV), 72-82.

Mercer, C., & Miller, M. D. (2003). Teaching Algebra to students with learning difficulties: An investigation of an explicit instruction model. *Learning Disabilities Research & Practice*, 18(2), 121- 131.

Michelle, J., & Marie, P. (2013). *Effects of visual media on achievement and attitude in a secondary biology classroom*. Unpublished Master Thesis submitted to Faculty of the Education and Human Services, Ohio University.

Miller, S. (2011). *Using graphic organizers to increase writing performance.* Unpublished MA thesis. State University of New York at Fredonia.

Nsofor, C. C., & Momoh, G. D. (2013). Effects of developed electronic instructional medium on students' achievement in biology. *Journal of Education and Learning*, 2 (2).

Robinson, D. H., & Molina, E. (2002). The relative involvement of visual and auditory working memory when studying adjunct displays. *Contemporary Educational Psychology*, (27), 118-131.

Sewidan, K., & Al-Jazar, B. (2007). Education technology for people with special needs. Amman: Dar Al-Fikr Publishers & Distributors.

Sundeen, T. (2007). So what's the big idea? Using graphic organizers to guide writing for secondary students with learning and behavioural issues. *Beyond Behaviour*, 16(3), 29-33.

Usman, A., Odewumi, O., Obotuke, E., Apolola, O., & Ogunyinka, C. O. (2014). *Cultural and creative arts book one for junior secondary schools*. Ibadan: Spectrum Books Limited.

Zaini, S. H., Mokhtar, S. Z., & Nawawi, M. (2010). The effect of graphic organizer on students' learning in school. *Malaysian Journal of Educational Technology*, 10(1), 17-23.