# The Level of Utilization of Conceptual Change Approach by Classroom Teachers in Science Classes[1]

Güliz AYDIN[2]

**ABSTRACT**

In order to remove the misconceptions of students about a subject and to ensure meaningful learning, it is necessary to revise the existing knowledge and change misinformation in order to adapt to the new information; which is possible through the use of conceptual change approach by the teachers. This study is a descriptive study carried out to identify to what extent classroom teachers use conceptual change approach in Science classes. It was conducted with the participation of 40 teachers of fourth grade classes working in Ordu province city center during the 2012-2013 academic year. An assessment tool including open-ended questions related to conceptual change approach and regarding their use of this approach in Science classes was administered to the teachers. In line with the data collected from the assessment tool, semi-structured interviews were conducted with eight teachers. The data collected from the open-ended questions and interviews were analyzed qualitatively. The result of the study revealed that most of the teachers did not know how to identify and remove misconceptions as well as the steps of conceptual change approach.

*Key Words*: Classroom teacher, Conceptual change, Science education

crossref DOI Number: http://dx.doi.org/10.12973/jesr. 2015.51.4

[1] This study was presented as an oral presentation at XII. National Classroom Teaching Education Symposium organized in Kuşadası on 23-25 May 2013.

[2] Yrd. Doç. Dr.- Muğla Sıtkı Koçman University, Faculty of Education, Department of Elementary Science Education - gulizaydin@mu.edu.tr

## INTRODUCTION

In order to ensure meaningful learning among students, it is important that they express the concepts as scientifically correct. Science subjects include many concepts and the relationships between these concepts; and internalizing the ideas that these concepts represent and using these concepts with their correct meaning is necessary in order to reach the upper levels of Science teaching. Misconceptions in students could cause future problems in their Science education.

Using their existing knowledge and experiences, students actively construct new information individuals. Constructivist approach aims to combine existing knowledge of the students with new knowledge and ensure meaning through learning of the concepts. Many teaching methods are insufficient in ensuring conceptual change in students; forcing them to memorize cannot prevent misconceptions in subjects that require making definition, explanation and estimation (Geban & Ertepınar, 2001). Therefore, methods developed to remove misconceptions and studies carried out are highly important in Science teaching. Conceptual change is defined as changing an existing wrong conception with the right one (Ayas, Çepni & Ayvacı, 2005). Conceptual change approach is a model explaining that existing knowledge of the students can be changed with scientific concepts (Alkhawaldeh, 2007). According to the conceptual change model developed by Posner, Strike, Hewson and Gertzog (1982), first of all, there should be dissatisfaction with the existing concepts; secondly, a new concept must be intelligible; thirdly, a new concept must appear initially plausible; and finally, a new concept should be fruitful (useful). If the new concept entails all these four features, it is easily learned. Yet, if the new concept is in contradiction with existing concepts, it is acceptable and meaningful (Chiu, Chou & Liu, 2002; Duit & Treagust, 2003). Before a student accommodates a new concept, s/he should be aware of the fact that the existing concepts are insufficient. This mostly occurs when the new concept does not fit with the pre-existing knowledge in a students' mind. Students should be made to feel that in order to remove this contradiction; there should be changes in their existing concepts. In order to change misconceptions with new and correct knowledge, the new concepts should be easy to understand. In addition, to be fruitful, the new concept should be plausible and remove the problems caused by the previous concepts in the student's mind, and should be able to bring a new perspective to the student (Canpolat & Pınarbaşı, 2002). Enabling students to do various activities and find their results, teachers should guide students and ensure that they construct the new information meaningfully (Martin, 1997). Students' misconceptions in a subject make it difficult to learn new concepts on the same subject.

That the use of some Science concepts in daily language that differs to their scientific use creates differences between the ideas that student's state and their scientific concepts (Rincke, 2011). For instance, students might express the dissolving of sugar in water, which is a scientific expression, as the melting of sugar in water. Skelly and Hall (1993) divided misconceptions into two categories, as experiential and instructional. The experiential misconceptions are based on people's everyday experiences and they are also referred to as alternative, intuitive or native conceptions. Instructional misconceptions, on the other hand, occur as a result of instructional activities in the classroom or outside the classroom that entails self-learning (Nakiboğlu, 2006). For conceptual change to occur, it is necessary to define the misconceptions which students bring into the classroom and contradicts with how the subject is stated scientifically; and then the instruction can be planned accordingly (Efe,

Hevedanlı & Yetişir, 2005). When the relevant literature is reviewed, it is seen that there are many studies on determining misconceptions in various Science subjects (Aydoğan, Güneş & Gülçiçek, 2003; Bozkurt, Salman-Akın & Uşak, 2004; Özdemir, 2005; Tatar & Cangünsü-Koray, 2005; Aydın & Balım, 2009). Yet, for meaningful learning it is important that teachers not only identify misconceptions and such utilizations but also organize activities towards removing these misconceptions. The importance of using methods and techniques that will ensure the meaningful construction of concepts in students' minds has been illustrated with studies on teaching concepts. In their studies, Kabapınar (2005), Ekici, Ekici and Aydın (2007) found that using concept cartoons was efficient in removing misconceptions; whilst Özyılmaz-Akamca and Hamurcu (2009) found that using analogies and concept cartoons was efficient in removing misconceptions; Tekkaya (2003) found that using conceptual change texts and concept maps together was efficient; Glynn and Takahashi (1998) and Pabuçcu and Geban (2006) found that using analogies within conceptual change texts was efficient in removing misconceptions. Therefore, it is believed that identifying misconceptions and organizing activities to remove these misconceptions is important in terms of meaningful learning.

It is seen in the studies carried out that meaningful learning of science concepts made it easy for students to learn future subjects (Geban & Ertepınar, 2001; Ölmez & Geban, 2001; Hewson & Hewson, 2003; Bacanak, Küçük & Çepni, 2004). The grounds of science subjects and concepts are laid by classroom teachers during the activities and studies carried out in Science classes during primary school years. Therefore, it will make teaching Science in the future easier if classroom teachers identify misconceptions of students related to Science subjects during Science classes and try to remove these misconceptions and thus, make conceptual changes. The aim of this study is to reveal to what extent classroom teachers use conceptual change approach during Science classes. This study is different from other studies in terms of revealing the opinions of teachers, who will do the work to identify and remove misconceptions and in terms of revealing to what extent they use this approach in Science classes. Whether or not teachers identify students' misconceptions during Science classes; if they do, what kind of studies they do to remove these misconceptions were explained and their level of using conceptual change approach was indicated. This study is significant in terms of building a substructure for future studies in this area and in terms of contributing to the literature.

## METHOD

The study is designed as a survey research.

*Participants*

This study was conducted with 40 fourth grade classroom teachers working at Turkish state primary schools in Ordu province city center during the 2012-2013 academic year. There were 116 fourth grade classroom teachers working in the relevant primary schools. Using criterion sampling, one of the purposeful sampling techniques, particularly teachers from the school where the number of teachers were higher were especially included; and the distribution by gender was attempted to be equal. Information about the 40 fourth grade classroom teachers are presented in Table 1 below.

Table 1. *Information on the participants of the study*

| *Seniority (years)* | *Gender* | | *Number of teachers* |
|---|---|---|---|
| | *Female* | *Male* | |
| 10-20 | 7 | 6 | 13 |
| 21-30 | 10 | 8 | 18 |
| 31 years or above | 4 | 5 | 9 |
| Total | 21 | 19 | 40 |

Teachers (n=8) with whom semi-structured interviews were conducted were chosen on a voluntary basis among those who answered the open-ended questions reasonably well, who answered the questions at a moderate level and those who could not give satisfactory answers to the questions or did not answer the questions; and the information about them are given in Table 2.

Table 2. *Information on the interviewed teachers*

| *Seniority (years)* | *Gender* | | *Number of teachers* |
|---|---|---|---|
| | *Female* | *Male* | |
| 10-20 (S1) | 1 | 1 | 2 |
| 21-30 (S2) | 3 | 2 | 5 |
| 31 years or more (S3) | 1 | - | 1 |
| Total | 5 | 3 | 8 |

*Data Collection*

An assessment tool consisting of eight open-ended questions were asked to the teachers in order to find out how they identify students' misconceptions, and to what extent they used conceptual change approach. During the preparation to establish the questions, the literature was reviewed, analyzed and questions were then prerared. The study areas reviewed included; identifying misconceptions and the negative effects of misconceptions on meaningful learning (Dove, 1998; Palmer, 2001; Bacanak et al., 2004; Buluş-Kırıkkaya & Güllü, 2008); and the importance of conceptual change strategies and removing misconceptions by ensuring conceptual change (Posner et al., 1982; Carey, 2000; Duit & Treagust, 2003; Zacharia, 2007). Expert opinions were taken from two academicians; one from Science education and one from assessment and evaluation. According to their feedbacks, relevant revisions were applied to ensure the content validity. This assessment tool, revised according to the expert opinions, was implemented with five teachers in order to finalize it.

Semi-structured interviews were conducted with eight of the 40 teachers in order to obtain in-depth information. While preparing the semi-structured interview form, the data collected from the 40 teachers was analyzed and eight interview questions were prepared. Six questions in the interview were chosen among the open-ended questions in the assessment tool and two questions were newly created. Once again, expert opinions were sought from two academicians (from Science education, and from assessment and evaluation) and suggested revisions were applied.

The concepts of validity and reliability in the interviews, which is a data collection technique in qualitative research, is used related to the researcher (Türnüklü, 2000). Asking the same question in the same manner to all the participants was taken into account. Pilot interviews were conducted with two of the 40 teachers in order to determine the interview

period and to ensure that the questions were both clear and understandable. As a result of the pilot interviews, the interview form was then finalized and it was estimated that the interviews would each take around ten minutes. The semi-structured interview form included eight questions; and while the longest interview was 12 minutes duration, the shortest was seven minutes. The interview questions are given as follows:

1. How do you decide whether or not an expression you see in your students during Science classes is a misconception?
2. What do you prefer to do to determine whether students have misconceptions on a certain Science subject?
3. What do you do to remove the misconceptions of your students?
4. Do you think that it is necessary to make conceptual change in order to remove misconceptions? Why?
5. What do you think is meant by "conceptual change"?
6. Which techniques do you prefer to use to make conceptual change among students during Science classes, and how often do you use these techniques?
7. Are the techniques that you use to make conceptual change in Science classes useful? Why?
8. Are the techniques that you use in Science classes to make conceptual change in your students practical? Why?

*Data Analysis*

The answers of the teachers to the open-ended questions were descriptively analyzed; the data was reduced and categorized, put into tables and presented. The data from the open-ended questions answered by the 40 teachers were analyzed by an independent academician working in the field of Science education, and to ensure reliability, the coherence between the two analyses was checked. The reliability was found to be 89%.

As per Miles and Huberman (1994), the analysis of the data collected from an interview follows three consecutive steps, each affected by another; data reduction, data display and conclusion drawing and verification. In order to reduce the data, raw data are coded based on certain categories (Patton, 1990). Within the framework of these categories, the data is coded, the essential parts extracted, and the remaining parts discarded. The decoding of the semi-structured interviews, recorded using a voice recorder, was controlled by the independent academician, as well as the researcher to ensure the correctness of the decoding. The data from the interviews were examined by one more Science academician and themes and codes of interviews were formed by two experts; and the reliability between the two was found to be 92%. The data collected from the descriptive analysis of the interviews were summarized and interpreted according to the pre-set themes. Besides, in order to reflect the opinions of the individuals interviewed, direct quotations were included. The data collected through the interviews were analyzed in three steps: data reduction, data display and conclusion drawing and verification. Themes formed for semi-structured interviews in this study are: "Deciding on misconceptions", "Identifying misconceptions", "Removing misconceptions", "Conceptual change", "Conceptual change techniques used", "The frequency of using conceptual change techniques" and "Usefulness- Utility".

## FINDINGS

The purpose of the study is to reveal the opinions of classroom teachers on conceptual change as well as to what extent they use conceptual change approach in Science classes. The descriptive analysis of the open-ended questions and themes from the interviews conducted with eight of the 40 participating teachers of the study are presented together.

39 teachers indicated that they came across misconceptions in Science classes and one teacher stated that s/he did found no misconceptions. Teachers were asked how they decided whether or not students' expressions included misconceptions. The findings related to their answers are shown in Table 3.

Table 3. *Themes, codes and frequencies related to the question, "How do you decide whether or not student expressions include misconceptions?"*

| *Deciding on misconceptions* | **f** |
|---|---|
| From the sentences they make | 13 |
| From the examples they give | 6 |
| From their answers to questions | 6 |
| When they could not explain what the concept means | 5 |
| From written examinations | 2 |

13 teachers stated that they understood that student expressions included misconceptions from the sentences the students made; whilst six of them said they understood it from the answers students gave to questions, five of them said they understood it when students cannot explain the concept and two of the teachers said they understood it from written examinations. Examples of the teachers' answers are as follows:

> *That there is a misconception is clearly seen most of the time in the answers students give to the questions I ask them* (5th teacher).
>
> *That there is a misconception is clearly seen in the examples students give and in the sentences they make* (8th teacher).

Regarding "deciding on the misconception" theme, all the interviewed teachers (n=8) indicated that they understood students had misconceptions from student expressions and the answers students give to the questions they asked. Examples of the teachers' statements on this theme are as follows:

> *The student uses the concept in the wrong place. For instance, s/he cannot distinguish heat from temperature. When you ask, s/he delivers an explanation. And that way you understand that s/he has a misconception* (5th teacher-S1).
>
> *When students answer a question, I see that they cannot clearly express the concept but say something close to it. In such cases, I compare students' concepts with the program in terms of their compatibility and try to determine how close they are. I check to what extent they are close to the concepts in the books and in the program* (8th teacher-S2).

Teachers were asked whether or not they had identified misconceptions of students in Science classes; and 39 teachers stated that they had identified misconceptions, and subsequently removed these misconceptions; and one of them said s/he did not identify any

misconceptions. Findings on what teachers do to identify the misconceptions of students are shown in Table 4.

Table 4. *Themes, codes and frequencies related to the question, "What do you do to identify the misconceptions of your students?"*

| *Ways to identify misconceptions* | | **f** |
|---|---|---|
| Through question-answers | | 9 |
| By making students form sentences and tell events to explain the concept | | 7 |
| Through examples from the environment/ life | | 3 |
| Through tests | Multiple choice tests | 3 |
| | Matching | 1 |
| | True-False questions | 1 |
| | Fill-in-the-blank questions | 1 |
| Through brain-storming | | 2 |
| Through activities | | 2 |
| By creating texts and including the concepts within the text | | 2 |
| By making students form concept maps | | 1 |
| By making students form mind maps | | 1 |

When Table 4 is examined, it is seen that most of the teachers identify misconceptions through question-answers (f=9), by making students form sentences and state an event to explain the concept (f=7) and through tests (f=6); and that the number of teachers who identify misconceptions by making students form concept maps (f=1) and by making students form concept maps (f=1) is very low. Examples of teachers' answers are as follows:

> *Before I start each unit, I write down the concepts to be taught on the board. I make students form sentences and tell events to explain these concepts. I make them give examples from the environment and from their lives* (2nd teacher).

> *By asking multiple-choice, fill-in-the-blank, true-false questions and tests* (21st teacher).

Findings on "Identifying misconceptions" theme are as follows: one teacher stated that s/he identified misconceptions by making students prepare concept maps; whilst four teachers stated that they made students make explanations; and one of them said that s/he identified misconceptions through true-false and fill-in-the-blank questions. Examples of teachers' expressions relating to this theme are as follows:

> *I write the concept down on the board and ask students what they know about it. I ask them to give examples and make explanations. I write everything they say without judging or stating that it is true or false. Later we talk about them and students then understand their own mistakes* (2nd teacher-S1).

> *I make exams. True-false and fill-in-the-blank questions* (21st teacher-S3).

Findings on what teachers do to remove misconceptions of students in Science classes are shown in Table 5.

Table 5. *Themes, codes and frequencies related to the question, "What do you do to remove the misconceptions of your students?"*

| *Ways to remove misconceptions* | **f** |
|---|---|
| Experiments | 14 |
| Observations | 6 |
| Giving examples from everyday life | 6 |
| Question-answers | 5 |
| Visual presentations | 5 |
| Brain-storming | 4 |
| Using concepts in a sentence | 4 |
| Group work/activities | 4 |
| Using dictionaries | 4 |
| Researching | 3 |
| Course/excursions | 2 |
| Drawing diagrams | 2 |
| Using course materials | 2 |
| Instant correction of mistakes | 1 |
| Making repetition | 1 |

According to Table 5, it is seen that teachers remove misconceptions mostly through experiments (f=14) and observations (f=6), by making students give examples from everyday life (f=6), through question-answers (f=5) and making students watch visual presentations (f=5). Examples of teachers' answers are given as follows:

> *I ask students to make research* (5th teacher).
>
> *We give examples from everyday life in order to materialize intangible concepts* (9th teacher).

Findings collected from interviews about "removing misconceptions" theme are as follows: Of the teachers interviewed, three of them said they make students perform experiments, one of them said s/he asked students to brainstorm and using visuals, two of them said they asked students to check the concepts in a dictionary and one said s/he asked students to give examples from everyday life to remove misconceptions. In addition, seven of the teachers said that conceptual change is necessary to remove misconceptions. Examples of teachers' statements relating to the removing misconceptions are given as follows:

> *Making students find the meaning of the concept in a dictionary. We make students read the lines in the book where the concept is given and make them use visuals related to the concept* (5th teacher-S1).
>
> *We make experiments in the classroom to remove misconceptions through material examples. In misconceptions about heat and temperature, we perform experiments to remove the misconception* (9th teacher-S2).

The teachers were asked whether or not ensuring conceptual change was necessary to remove misconceptions; and of the 40 teachers, 37 of them said that ensuring conceptual change was necessary to remove misconceptions, whilst three of them said it was not necessary.

Teachers were asked why they thought that ensuring conceptual change was necessary to remove misconceptions; and the findings relating to their answers are shown in Table 6.

Table 6. *Themes, codes and frequencies related to the question, "Why do you think ensuring conceptual change is necessary to remove misconceptions?"*

| *The necessity of conceptual change* | **f** |
|---|---|
| To ensure meaningful learning | 8 |
| To make scientific explanation | 4 |
| To ensure easy learning | 3 |
| To prevent other misconceptions | 2 |
| To be more successful | 2 |
| To learn in a shorter time | 1 |

When Table 6 is examined, it is seen that eight teachers said that ensuring conceptual change is necessary for meaningful learning, four of them said it is necessary to make scientific explanations, and three of them said it is necessary to ensure easy learning. Examples of teachers' statements are as follows:

> *I don't believe that meaningful learning is possible before removing misconceptions* (3rd teacher).
>
> *I need conceptual change to make students find out what is right and to help them make scientific explanations* (32nd teacher).

Teachers were asked what was meant with the "conceptual change" expression and the findings relating to their answers are shown in Table 7.

Table 7. *Themes, codes and frequencies related to the question, "What do you think is meant with "conceptual change?"*

| *Conceptual change* | **f** |
|---|---|
| Changing an existing wrong conception with the right one | 7 |
| Perception of the meanings of the concepts | 4 |
| Using the concepts in the right place with the right meaning | 3 |
| New technological development | 2 |
| Questioning existing concepts | 1 |
| Design of an idea in the mind | 1 |
| Changing of a concept depending on where it is used | 1 |
| Using a concept wrong, not using a concept in the right place | 1 |
| Confusing concepts with close meanings | 1 |

According to Table 7, seven of the teachers stated that conceptual change was the changing of an existing wrong conception with the right one; whilst four of them said it was perceiving the meanings of the concepts; and three of them said it was using the concepts in the right place with the right meaning. It was seen that one teacher used conceptual change to mean misconceptions by indicating that conceptual change was the using a concept wrongly or not using a concept in the right place, and one teacher used conceptual change to mean incomprehensibility by indicating that conceptual change was confusing concepts with

close meanings. One of the teachers could not explain what conceptual change was and indicated that it was a new technological development. And one teacher said conceptual change was the change of a concept depending on where it is used. Examples of teachers' statements are as follows:

*The conceptual change expression makes you think of removing concepts that students learned wrongly or concepts that they do not know properly* (8th teacher).

*The change of the concept depending on where it is used* (27th teacher).

When the findings related to the conceptual change theme are looked into, the expressions that teachers used for conceptual change are as follows:

*Wrong utilization of the concept apart from its real meaning* (f=3)

*Correcting a concept that is used in the wrong way* (f=2)

*Learning the real meaning of the concept* (f=1)

*Stating a complex concept simply* (f=1)

*To me, conceptual change is…* (f=1)

Table 8 includes findings based on the answers of the teachers to the question regarding what kind of features the new concept should have for conceptual change to occur.

Table 8. *Themes, codes and frequencies related to the question, "What kind of features, do you think, should the new concept have for conceptual change to occur?"*

| *The features that the concept should have for conceptual change to occur* | **f** |
|---|---|
| It should be used in everyday life | 9 |
| It should be interesting | 8 |
| It should be easy to understand | 5 |
| It should be at students' level | 5 |
| It should be tangible | 4 |
| It should be plausible | 2 |
| It should be memorable | 1 |
| It should fit the needs | 1 |
| It should be visual | 1 |

When Table 8 is examined, it is seen that nine of the teachers stated that for a concept to be learned by the student, it should be used in everyday life; whilst eight of the teachers said it should be interesting, five of them said it should be plausible, five of them said it should be at the students' level, four of them said it should be tangible, two of them said it should be plausible, one said it should be memorable, one said it should fit the needs and one said it should be visual. Examples of the teachers' statements are as follows:

*The new concept should be meaningful and plausible* (21st teacher).

*It should be understandable and clear* (27th teacher).

Teachers were asked which techniques they used to make conceptual change in Science classes and the findings based on this question are shown in Table 9.

Table 9. *Themes, codes and frequencies related to the question, "Which techniques do you prefer to use to make conceptual change in your Science classes?"*

| *Methods and techniques to ensure conceptual change* | **f** |
|---|---|
| Experiment | 17 |
| Observation | 12 |
| Trip | 6 |
| Research | 6 |
| Question-answer | 5 |
| Brain storming | 3 |
| Drama | 3 |
| Demonstration | 3 |
| Telling | 2 |
| Concept maps | 1 |

When Table 9 is examined, it is seen that teachers prefer experiments (f=17), observation (f=12), research (f=6), and question and answer (f=5) as mays that most make conceptual change; and only one teacher prefers to use concept map technique.

Examples of teachers' statements are as follows:

*It is more efficient when we make experiments* (3rd teacher).

*Observation* (32nd teacher).

Of the teachers interviewed relating to the conceptual change techniques theme, five of them said they asked students to perform experiments to instigate conceptual change, two of them said that they made observations and presentations and three of them said they asked students to make explanations on the concepts and to give examples. Examples of teachers' statements are as follows:

*Experiments and asking students to give examples. These ensure materializing* (3rd teacher-S2).

*Presentations using projections and observations* (32nd teacher-S1).

Teachers were asked how often they used the techniques towards making conceptual change in students during Science classes and the findings relating to their answers are shown in Table 10.

Table 10. *Themes, codes and frequencies related to the question, "How often do you use techniques towards making conceptual change in students during Science classes?"*

| *Use of techniques towards making conceptual change* | **f** |
|---|---|
| Always | 6 |
| Often | 6 |
| When there is time | 4 |
| When necessary | 9 |
| Depending on the frequency of the concepts in the program | 8 |
| Within the bounds of possibility | 5 |
| Never | 2 |

When Table 10 is examined, it is seen that of the 40 teachers, six of them said they always used the techniques towards making conceptual change, whilst six of them said they used these techniques often, four said they used the techniques when there is time, nine said they used these techniques when necessary, eight said that they used these techniques depending on the frequency of the concepts in the program, five said they used the techniques within the bounds of possibility, and two teachers said that they never used the techniques to make conceptual change. Examples of teachers' statements are as follows:

> *I determine this depending on the frequency of the concepts in the program* (3rd teacher).
>
> *I use it when necessary during the class* (21st teacher).

Teachers interviewed on the frequency of using conceptual change techniques stated that they used it when they come across the concept during the class. Examples of teachers' statements on this theme are as follows:

> *I use it when we it comes up in the curriculum* (3rd teacher-S2).
>
> *I use it when necessary. I can't use it very often. For instance, we cannot perform experiments most of the time. We do not even have a thermometer or ethyl alcohol* (21st teacher-S3).

Of the 40 participating teachers, 34 of them said techniques used to create conceptual change was useful. Six teachers, on the other hand, said that for these techniques to be useful, the number of students in each class should be smaller.

Findings on usefulness-utility theme are as follows: All the teachers interviewed said that the techniques they used during Science classes in order to make conceptual change were useful. Six of them said these techniques were practical, and one of those six stated that these techniques were practical for upper and average level students in terms of success. Among the interviewed teachers, two of them stated that they could not use the techniques to ensure conceptual change because of the high number of students in the classrooms. Examples of teachers' expressions on usefulness-utility theme are as follows:

> *The technique that each student uses is different. The number of students should be less. It is useful for upper and average level students, but not for unsuccessful students* (8th teacher-S2).
>
> *It is useful when it is based on experiment and observation. Practical. It is forgotten if not repeated* (28th teacher-S2).

## RESULT, DISCUSSION AND SUGGESTIONS

The purpose of this study was to find out whether or not classroom teachers identified their students' misconceptions in Science classes. If they did, what they did to remove these misconceptions and their level of using conceptual change approach in their classes. The descriptive analysis of the data collected from open-ended questions in the assessment tool administered to the teachers indicated that most of the teachers did not precisely know conceptual change approach, or how to identify misconceptions. Teachers should be sure that the concepts that students will learn are easy to understand, acceptable and fruitful, and this is only possible by taking the prior knowledge of the students into

consideration. Therefore, teachers should play an active role particularly in revealing concepts learned earlier, as well as in finding out inadequacies and differences related to these concepts and in making students discuss these concepts (Koray & Bal, 2002). Recognizing that students have misconceptions and knowing the ways to remove these misconceptions is the first step taken towards meaningful and permanent learning (Chiu, Guo & Treagust, 2007). The Science Teaching Program is a helical program; and those subjects or concepts that are not learned meaningfully will make it more difficult to learn other concepts and subjects in the following years. Therefore, it is important that classroom teachers identify the misconceptions of their students relating to Science subjects and use conceptual change approach towards removing these misconceptions for meaningful and permanent learning. Learning Science concepts clearly will make it easier to learn future subjects (Hewson & Hewson, 2003). Learning basic concepts in a wrong way will only cause wrong learning of the knowledge to be constructed (Bayram, Sökmen & Savcı, 1997).

It was seen that the interviewed teachers could not properly explain the conceptual change, which means the process whereby students existing concepts are replaced with scientific concepts. Although teachers stated that conceptual change was necessary and that the techniques used to do this were useful, two of the eight teachers interviewed said that they did not achieve the techniques towards ensuring conceptual change useful because of the high number of students in the classrooms. Three teachers said that they identified misconceptions during Science classes and made conceptual changes; and that they used such techniques as experiments and brainstorming to remove misconceptions; made students watch presentations, asked them to look for the meanings of the concepts in a dictionary and to give examples from everyday life. Yet, using techniques based on conceptual change strategies, the efficiency of which has been proven in studies (Şahin, 2002; Holland, Holland & Davies, 2004; Sağırlı & Macaroğlu-Akgül, 2004; Öner & Arslan, 2005; Candan, Türkmen & Çardak, 2006; Yaşar, 2006; Şaşmaz-Ören, Ormancı, Babacan, Çiçek & Koparan, 2010), will be more effective in removing misconceptions. Conceptual change strategies ensure meaningful learning and replacement of misconceptions through scientifically-accepted concepts (Geban & Ertepınar, 2001). Using concept maps and conceptual change texts in teaching Science is among the leading techniques in removing misconceptions (Ölmez & Geban, 2001). Analogies, mind maps, concepts cartoons and models could also be used to remove misconceptions. Identifying students' misconceptions in Science classes and using methods and techniques based on conceptual change strategies to remove these misconceptions (conceptual change texts, concept maps, mind maps, concept cartoons, analogies, models etc.) will ensure meaningful learning. Identifying student misconceptions on a subject by undertaking a literature review, implementing concept tests on students, asking open-ended questions and semi-structured interview questions or by making them prepare concept maps; and organizing activities towards removing students' misconceptions are all necessary for meaningful learning. Activities based on conceptual change strategies during Science classes will, to a large extent, prevent misconceptions.

The following suggestions can be made towards using conceptual change approach in Science classes: Classroom teachers could be provided with in-service trainings related to teaching concepts. Such in-service training could include workshops on how to determine and remove misconceptions or in other words, how to create conceptual change in students'

minds. Thus, it will be possible for students to meaningfully learn Science subjects and concepts, which are important to everyday life.

Activities based on conceptual change strategies could be included in Science course boks in order to make learning subjects easier and more fun for students. Informing classroom teachers and prospective teachers on identifying misconceptions and on the strategies that could be used to remove misconceptions; and preparing sample activities on this topic will ensure that the students they teach will learn meaningfully.

Further studies on how teachers identify misconceptions in Science classes at different grades and how they ensured conceptual change and removed misconceptions could be made.

## REFERENCES

Alkhawaldeh, S.A. (2007). Facilitating conceptual change in ninth grade students' understanding of human circulatory system concepts. *Research in Science and Technological Education*, *25* (3), 371-385.

Ayas, A., Çepni, S. & Ayvacı, H. Ş. (2005). Fen ve teknoloji derslerinde öğrencileri aktif kılan yöntem, teknik ve modellemeler. *Kuramdan uygulamaya fen ve teknoloji öğretimi*. (Edt: S. Çepni). Ankara: Pegem A Publishing. pp.116-134.

Aydın, G. & Balım, A. G. (2009). Students' misconceptions about the subjects in the unit: The Systems in Our Body. *Procedia-Social and Behavioral Sciences*, 1, 2258-2263.

Aydoğan, S., Güneş, B. & Gülçiçek, Ç. (2003). The misconceptions about heat and temperature. *Gazi University Journal of Gazi Educational Faculty*, *23* (2), 111-124.

Bacanak, A., Küçük, M. & Çepni, S. (2004). Primary school students misconceptions about photosynthesis and respiration subjects: a case for Trabzon. *Ondokuz Mayıs University Journal of Educational Faculty*, 17, 67-80.

Bayram, H., Sökmen, N. & Savcı, H. (1997). Temel fen kavramlarının anlaşılma düzeyinin saptanması. *Marmara University Journal of Educational Sciences*, 9, 89-100.

Bozkurt, O., Salman-Akın, B. & Uşak, M. (2004). Identifying of grade 6, 7. and 8. students' pre-informations and misconceptions about the erosion. *Gazi University Journal of Kırşehir Educational Faculty*, *5* (2), 277-285.

Buluş-Kırıkkaya, E. & Güllü, D. (2008). İlköğretim beşinci sınıf öğrencilerinin ısı-sıcaklık ve buharlaşma-kaynama konularındaki kavram yanılgıları. *Elementary Education Online*, *7* (1), 15-27.

Carey, S. (2000). Science education as conceptual change. *Journal of Applied Developmental Psychology*, 21 (1), 13-19.

Chiu, M. H., Chou, C. C. & Liu, C. J. (2002). Dynamic processes of conceptual change: analysis of constructing mental models of chemical equilibrium. *Journal of Research in Science Teaching*, *39* (8), 688-712.

Chiu, M. H., Guo, C. J. & Treagust, D. F. (2007). Assessing students' conceptual understanding in science: an introduction about a national project in Taiwan. *International Journal of Science Education*, *29* (4), 379-390.

Candan, A., Türkmen, L. & Çardak, O. (2006). Kavram haritalamanın ilköğretim öğrencilerinin hareket ve kuvvet kavramalarını anlamalarına etkisi. *Journal of Turkish Science Education*, *3* (1), 66-75.

Canpolat, N. & Pınarbaşı, T. (2002). Conceptual change approach in science education-I: theoretical basis. *Kastamonu Education Journal*, *10* (1), 59-66.

Dove, J. E. (1998). Students' alternative conceptions in Earth science: a review of research and implications for teaching and learning, *Research Papers in Education*, *13* (2), 183-201.

Duit, R. & Treagust, D. (2003). Conceptual change: a powerful framework for improving science teaching and learning. *International Journal of Science Education*, 25, 671-681.

Efe, R., Hevedanlı, M. & Yetişir, İ. (2005). Fen ve teknoloji eğitiminde temel kavram hataları. *İlköğretimde fen ve teknoloji öğretimi*. (Edt: M. Aydoğdu & T. Kesercioğlu). Ankara: Anı Publishing. pp.280-298

Ekici, F., Ekici, E. & Aydın, F. (2007). Utility of concept cartoons in diagnosing and overcoming misconceptions related to photosynthesis. *International Journal of Environmental & Science Education*, *2* (4), 111-124.

Geban, Ö. & Ertepınar, H. (2001). Altıncı sınıf öğrencilerinin elektrik konusundaki kavramları anlamalarında kavramsal değişim yaklaşımının etkisi. *Bilimde Çağdaş, Düşüncede Özgür Yeni Binyılın Başında Türkiye'de Fen Bilimleri Eğitimi Sempozyumu*. Maltepe University. September 7-8, 2001. İstanbul. pp. 35-38.

Glynn, S. M. & Takahashi, T. (1998). Learning from analogy-enhanced science text. *Journal of Research in Science Teaching*, 22, 53-62.

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.

Holland, B., Holland, L. & Davies. J. (2004). An investigation into the concept of mind mapping and the use of mind mapping software to support and improve student academic performance. *Learning and Teaching Projects 2003/2004* (Edt: H. Gale).

Kabapınar, F. (2005). Effectiveness of teaching via concept cartoons from the point of view of constructivist approach. *Educational Sciences: Theory & Practice*, *5* (1), 103-146.

Koray, Ö. C. & Bal, Ş. (2002). Misconception in science teaching and conceptual change strategy . *Kastamonu Education Journal*, *10* (1), 83-90.

Martin, D. J. (1997). *Elementary science methods. a constructivist approach*. Kennesaw State College. Delmar Publishers.

Miles, M. B. & Huberman, A. M. (1994). *An expanded sourcebook qualitative data analysis*. United States of America: Sage Publications.

Nakiboğlu, C. (2006). Fen ve teknoloji öğretiminde yanlış kavramalar. *Fen ve teknoloji öğretimi*. (Edt: M. Bahar). Ankara: Pegem A Publishing. pp. 191-217.

Ölmez, O. & Geban, Ö. (2001). Dördüncü sınıf öğrencilerinin dünya ve gökyüzü konularındaki kavramları anlamalarında kavramsal değişim yaklaşımının etkisi. *Bilimde Çağdaş, Düşüncede Özgür Yeni Binyılın Başında Türkiye'de Fen Bilimleri Eğitimi Sempozyumu*. Maltepe University. September 7-8, 2001. İstanbul. pp.172-175.

Öner, F. & Arslan, M. (2005). İlköğretim 6. sınıf fen bilgisi dersi elektrik ünitesinde kavram haritaları ile öğretimin öğrenme düzeyine etkisi. *The Turkish Online Journal of Educational Technology*, *4* (4), 19, 163-169.

Özdemir, O. (2005). The misconception of primary 8th grade students concerning genetics and biotechnology . *Ondokuz Mayıs University Journal of Educational Faculty*, 20, 49-62.

Özyılmaz-Akamca, G. & Hamurcu, H. (2009). Science and technology education based on analogies, concept cartoons and predict-observe-explain techniques. *E-Journal of New World Sciences Academy*, *4* (4), 1186-1206.

Pabuçcu, A. & Geban, Ö. (2006). Remediating misconceptions concerning chemical bonding through conceptual change text. *Hacettepe University Journal of Education*, 30, 184-192.

Palmer, D. (2001). Students' alternative conceptions and scientifically acceptable conceptions about gravity. *International Journal of Science Education*, *23* (7), 691-706.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. (2nd Edition). United States of America: Sage Publications.

Posner, G., Strike, K., Hewson, P. & Gertzog, W. (1982). Accommodation of a scientific conception: toward a theory of conceptual change. *Science Education*, 66, 211-227.

Rincke, K. (2011). It's rather like learning a language: development of talk and conceptual understanding in mechanics lessons. *International Journal of Science Education*, *33* (2), 229-258.

Sağırlı, S. & Macaroğlu-Akgül, E. (2004). Fen bilgisi dersinde analoji kullanımının kavramaya etkisi. *VI. National Science and Mathematics Education Congress*. Marmara University Atatürk Faculty of Education. September 9-11, 2004. İstanbul. pp. 171-178.

Şahin, F. (2002). Kavram haritalarının değerlendirme aracı olarak kullanılması ile ilgili bir araştırma. *Pamukkale University Journal of Education*, 11, 18-33.

Şaşmaz-Ören, F., Ormancı, Ü., Babacan, T., Çiçek, T. & Koparan, S. (2010). An application of guide materials based on analogy and inquiry-based learning approach and related student opinions. *Western Anatolia Journal of Educational Sciences*, *1* (1), 33-53.

Tatar, N. & Cangünsü-Koray, Ö. (2005). Determination of the misconceptions of the 8th grade students in primary school about "Genetics" unit. *Kastamonu Education Journal*, *13* (2), 415-426.

Tekkaya, C. (2003). Remediating high school students' misconceptions concerning diffusion and osmosis through concept mapping and conceptual change text. *Research in Science & Technological Education*, *21* (1), 5-16.

Türnüklü, A. (2000). Eğitimbilim Araştırmalarında Etkin Olarak Kullanılabilecek Nitel Bir Araştırma Tekniği: Görüşme. *Educational Administration: Theory & Practice*, *6* (24), 543-559.

Yaşar, I.Z. (2006). *Fen eğitiminde zihin haritalama tekniğiyle not tutmanın kavram öğrenmeye ve başarıya etkisi*. Unpublished Master's Thesis, Marmara University Institute of Educational Sciences, İstanbul.

Zacharia, Z.C. (2007). Comparing and combining real and virtual experimentation: an effort to enhance students' conceptual understanding of electric circuits. *Journal of Computer Assisted Learning*, *23* (2), 120-132.

# Sınıf Öğretmenlerinin Fen Derslerinde Kavramsal Değişim Yaklaşımını Kullanma Düzeyleri[3]

Güliz AYDIN[4]

## Giriş

Öğrencilerin anlamlı öğrenmeleri için, kavramları bilimsel olarak doğru ifade edebilmeleri büyük önem taşımaktadır. Fen konuları, pek çok kavram ve bunlar arasındaki ilişkileri içermekte olup; kavramların temsil ettiği düşünceleri içselleştirmek ve bu kavramları doğru anlamlarıyla kullanmak, Fen öğretiminin üst basamaklarına ulaşabilmek için gereklidir. Öğrencilerde oluşabilecek kavram yanılgıları, Fen öğretiminde ileriye dönük sorunlara sebep olabilmektedir.

Öğrencilerin yanlış bilgilerinin doğru olanlarla değiştirilmesi kavramsal değişim olarak adlandırılmaktadır (Ayas, Çepni & Ayvacı, 2005). Kavramsal değişim yaklaşımı, öğrencilerin var olan bilgileri ile bilimsel kavramların yer değiştirebileceğini açıklayan bir modeldir (Alkhawaldeh, 2007). Posner, Strike, Hewson ve Gertzog (1982) tarafından geliştirilen kavramsal değişim modeline göre, öğrencilerin öncelikle var olan kavramlarını yetersiz bulmaları (var olan bilgilerinden bir tatminsizlik duymaları), ikinci olarak yeni kavramı anlaşılır, üçüncü olarak mantıklı (kabul edilebilir) ve son olarak da faydalı (kullanışlı) bulmaları gerekmektedir. Yeni kavram sözü edilen bu dört özelliği de taşıyorsa zorluk çekilmeden öğrenilir. Aksine yeni kavram mevcut kavramlarla çelişiyorsa, kabul edilebilir ve anlamlı olamaz (Chiu, Chou & Liu, 2002; Duit & Treagust, 2003). Öğrenci, yeni bir kavramı kabullenmeden önce, mevcut kavramlarının yetersiz olduğunun farkında olmalıdır. Bu durum daha çok, yeni kavramın öğrencinin zihninde var olan bilgi yapısıyla uyuşmaması sonucunda ortaya çıkar. Öğrenciye, bu uyuşmazlığı gidermek için mevcut kavramlarında değişikliklerin olması gerektiği hissettirilmelidir. Yanlış olan kavramların, doğru olan yeni kavramlarla yer değiştirebilmesi için, yeni kavramların kolayca anlaşılabilecek nitelikte olması gerekir. Ayrıca yeni kavram mantıklı olmalı, öğrencinin kavramlarının neden olduğu sorunları giderebilmeli ve öğrenciye, yeni bir bakış açısı kazandırabilmelidir ki verimli olabilsin (Canpolat & Pınarbaşı, 2002). Öğretmen, öğrencilerin çeşitli aktiviteleri yapmalarına ve sonuçları bulmalarına olanak sağlayarak onlara rehberlik etmeli, yeni bilgiyi anlamlı bir şekilde yapılandırmalarını sağlamalıdır (Martin, 1997). Öğrencilerin bir konuda sahip oldukları kavram yanılgıları, o konuya ilişkin yeni kavramların öğrenilmesini zorlaştırmaktadır. Kavramsal değişimin sağlanabilmesi için, öğrencilerin konuya ilişkin sınıfa getirdikleri ve konunun bilimsel olarak ifade edilme biçimiyle çelişen kavram yanılgılarının tanımlanması ve ona göre öğretimin planlanması gerekir (Efe, Hevedanlı & Yetişir, 2005). İlgili alanyazın incelendiğinde, çeşitli Fen konularında kavram yanılgılarının belirlenmesine ilişkin çalışmalara sıkça rastlandığı (Aydoğan, Güneş & Gülçiçek, 2003; Bozkurt, Salman-Akın & Uşak, 2004; Özdemir, 2005; Tatar & Cangünsü-Koray, 2005; Aydın & Balım, 2009) görülmektedir. Oysa ki öğretmenlerin,

[3] Bu çalışma, 23-25 Mayıs 2013 tarihlerinde Kuşadası'nda düzenlenen XII. Ulusal Sınıf Öğretmenliği Eğitimi Sempozyumu'nda sözlü bildiri olarak sunulmuştur.

[4] Yrd. Doç. Dr.- Muğla Sıtkı Koçman Üniversitesi, Eğitim Fakültesi, İlköğretim Bölümü Fen Bilgisi Eğitimi Anabilim Dalı, gulizaydin@mu.edu.tr

kavram yanılgılarını ve bu gibi kullanımları belirlemelerinin yanı sıra gidermeye yönelik kavramsal değişim etkinlikleri düzenlemeleri, anlamlı öğrenmenin gerçekleşmesi için önemlidir. Çünkü derslerde kavramların öğrencilerin zihinlerinde anlamlı olarak yapılandırılmasını sağlayacak yöntem ve tekniklerin kullanılmasının önemi, kavram öğretimine ilişkin yapılan çalışmalarda ortaya konulmuştur. Kabapınar (2005), Ekici, Ekici ve Aydın (2007) yaptıkları çalışmalarda kavram karikatürlerinin; Özyılmaz-Akamca ve Hamurcu (2009) analojiler ve kavram karikatürlerinin; Tekkaya (2003) kavramsal değişim metinleri ile kavram haritalarını birlikte kullanmanın; Glyn ve Takahashi (1998) ile Pabuçcu ve Geban (2006), kavramsal değişim metinlerinin içinde analojilerin kullanılmasının, kavram yanılgılarını gidermede etkili olduğunu tespit etmişlerdir. Bu nedenle, öğretmenlerin kavram yanılgılarını belirlemelerinin ve gidermeye yönelik kavramsal değişim etkinlikleri düzenlemelerinin, anlamlı öğrenmenin gerçekleşmesi için önemli olduğu düşünülmektedir.

Fen kavramlarının anlaşılır bir şekilde öğrenilmesinin, öğrencilerin daha sonraki konuları öğrenebilmelerinde kolaylık sağladığı yapılan çalışmalarda görülmektedir (Geban & Ertepınar, 2001; Ölmez & Geban, 2001; Hewson & Hewson, 2003; Bacanak, Küçük & Çepni, 2004). Fen konu ve kavramlarının temeli, sınıf öğretmenleri tarafından ilkokul yıllarında Fen derslerinde yapılan etkinlik ve çalışmalarla atılmaktadır. Bu nedenle, sınıf öğretmenlerinin Fen derslerinde öğrencilerin Fen konularına ilişkin kavram yanılgılarını belirleyip gidermeye yönelik çalışmalar yapmaları ve bu sayede öğrencilerde kavramsal değişimi gerçekleştirmeleri, ilerleyen yıllarda Fen öğretimi için kolaylaştırıcı olacaktır. Bu çalışmanın amacı, sınıf öğretmenlerinin Fen derslerinde kavramsal değişim yaklaşımını ne düzeyde kullandıklarını ortaya koymaktır. Araştırma, kavram yanılgılarını belirlemeye ve gidermeye yönelik çalışmaları gerçekleştirebilecek olan öğretmenlerin kavramsal değişim yaklaşımı konusundaki düşüncelerini ve bu yaklaşımı Fen derslerinde kullanma düzeylerini ortaya koyması açısından, yapılan çalışmalardan farklıdır. Çalışmada, öğretmenlerin Fen derslerinde öğrencilerin kavram yanılgılarını belirleyip belirlemedikleri; belirliyorlarsa bu kavram yanılgılarını gidermek için nasıl çalışmalar yaptıkları açıklanmış, derslerinde kavramsal değişim yaklaşımını kullanma düzeyleri ortaya konmuştur. Araştırma, bu konudaki çalışmalara altyapı hazırlaması ve alanyazına katkı sağlaması açısından önemlidir.

## Yöntem

Araştırma, tarama modelinde desenlenmiştir. Çalışma, Ordu il merkezine bağlı ilkokullarda görev yapmakta olan 40 (21 kadın, 19 erkek) dördüncü sınıf öğretmeniyle gerçekleştirilmiştir. Söz konusu ilkokullarda görev yapmakta olan 116 dördüncü sınıf öğretmeni bulunmaktadır. Amaçlı örnekleme tekniklerinden ölçüt örnekleme tekniği kullanılarak, çalışmaya özellikle öğretmen sayısının fazla olduğu okullardaki öğretmenler dahil edilmiştir.

Çalışmada, öğrencilerin kavram yanılgılarını nasıl belirlediklerini ve giderdiklerini; kavramsal değişim yaklaşımını ne düzeyde kullandıklarını ortaya koymak için, öğretmenlere açık uçlu sorulardan oluşan ölçme aracı uygulanmıştır. Uzmanların görüşleri doğrultusunda düzenlenmiş olan bu ölçme aracı, beş öğretmene uygulanarak son şekli verilmiştir. Ölçme aracının uygulandığı 40 öğretmenden sekiziyle (beş kadın, üç erkek) daha derinlemesine bilgi elde etmek için yarı yapılandırılmış görüşmeler gerçekleştirilmiştir. Yarı yapılandırılmış görüşme formu hazırlanırken, 40 öğretmenden elde edilen veriler incelenmiş ve açık uçlu sorular çerçevesinde görüşme soruları oluşturulmuştur. Görüşme soruları için

de uzman görüşleri alınmış ve önerilen düzeltmeler yapılmıştır. 40 öğretmenden ikisiyle görüşme süresinin belirlenmesi, soruların açık ve anlaşılır olup olmadığının test edilmesi için pilot görüşmeler yapılmıştır. Pilot görüşmeler sonucunda, görüşme formuna son şekli verilmiştir.

Öğretmenlerin açık uçlu sorulara verdikleri cevapların betimsel analizi yapılmış; veriler azaltılarak kategorize edilmiş, tablolaştırılarak sunulmuştur. 40 öğretmenden elde edilen açık uçlu soru verilerinin, araştırmacı dışında Fen eğitimi alanında uzman bir akademisyen tarafından daha analizi gerçekleştirilmiş ve güvenirlik için ikisi arasındaki tutarlılığa bakılmıştır. Güvenirlik yüzdesi % 89 olarak belirlenmiştir.

Ses kayıt cihazına kaydedilmiş olan yarı yapılandırılmış görüşmelerin dökümleri araştırmacı dışındaki bir kişi tarafından da kontrol edilmiş, dökümlerin doğruluğu sağlanmıştır. Görüşmelerden elde edilen veriler, bir Fen eğitimcisi tarafından daha incelenerek iki uzman tarafından görüşme temaları ve kodları oluşturulmuş; ikisi arasındaki güvenirlik yüzdesi % 92 olarak hesaplanmıştır. Görüşmelerin betimsel analizinde elde edilen veriler önceden belirlenen temalara göre özetlenmiş ve yorumlanmıştır. Ayrıca görüşülen bireylerin görüşlerini yansıtmak amacıyla doğrudan alıntılara yer verilmiştir. Görüşme verileri, belirlenmiş olan temalar çerçevesinde verilerin azaltılması, verilerin sunumu ve sonuç çıkarma basamaklarıyla analiz edilmiştir. Bu çalışmada, yarı yapılandırılmış görüşmeler için oluşturulan temalar şu şekildedir: "Kavram yanılgısına karar verme", "Kavram yanılgılarını belirleme", "Kavram yanılgılarını giderme" "Kavramsal değişim", "Kullanılan kavramsal değişim teknikleri", Kavramsal değişim tekniklerinin kullanım sıklığı" ve "Yararlılık-kullanışlılık".

**Bulgular**

Öğretmenler, öğrencilerin kurdukları cümlelerden, verdikleri örneklerden, sorulara verdikleri cevaplardan, kavramın ne ifade ettiğini açıklayamamalarından ve yazılı sınavlardan öğrenci ifadelerinin kavram yanılgısı içerdiğini farkettiklerini belirtmişlerdir.

Öğretmenlerin daha çok soru-cevaplarla (f=9), öğrencilere kavramları anlatacak cümleler kurdurup olaylar anlattırarak (f=7), testlerle (f=6) öğrencilerin kavram yanılgılarını belirledikleri; öğrencilere kavram haritaları hazırlatarak (f=1) ve zihin haritaları hazırlatarak (f=1) kavram yanılgılarını belirleyen öğretmenlerin çok az olduğu görülmektedir.

Öğretmenlerin daha çok deneyler (f=14) ve gözlemler (f=6) yaptırarak, günlük hayattan örnekler verdirerek (f=6), soru-cevaplarla (f=5) ve görsel sunular izlettirerek (f=5) öğrencilerin kavram yanılgılarını giderdikleri anlaşılmaktadır.

Görüşme yapılan öğretmenler kavramsal değişim için, "Kavramın gerçek anlamı dışında yanlış kullanılması", "Yanlış kullanılan kavramın düzeltilmesi", "Kavramın gerçek anlamını öğrenmek" ve "Karmaşık bir kavramın basit olarak ifade edilmesi" ifadelerini kullanmışlardır.

Öğretmenlerin, yeni kavramın öğrenci tarafından öğrenilmesi için günlük hayatta kullanılması, ilgi çekici olması, anlaşılır olması, öğrenci seviyesine uygun olması, somut olması, mantıklı olması, akılda kalıcı olması, ihtiyaçlara uygun olması, görsel olması gerektiğini ifade ettikleri görülmektedir.

Öğretmenlerin Fen derslerinde öğrencilerde kavramsal değişimi gerçekleştirmek için en çok deney (f=17), gözlem (f=12), gezi (f=6), araştırma (f=6) ve soru-cevap (f=5) tekniklerini kullanmayı tercih ettikleri, sadece bir öğretmenin kavram haritası tekniğini kullandığı anlaşılmaktadır.

Öğretmenlerin altısının Fen derslerinde kavramsal değişimi gerçekleştirmeye yönelik teknikleri sürekli, altısının sık sık, dördünün zaman buldukça kullandıklarını belirttikleri; dokuzunun gerekli olduğunda, sekizinin programda yer alan kavramların sıklığına göre, beşinin imkanların elverdiği ölçüde bu tekniklere yer verdiklerini ifade ettikleri görülmektedir. Öğretmenlerin ikisi ise kavramsal değişimi gerçekleştirmeye yönelik teknikleri Fen derslerinde hiç kullanmadıklarını belirtmişlerdir.

40 öğretmenden 34'ü öğrencilerde kavramsal değişimi sağlamaya yarayan tekniklerin kullanılmasının yararlı olduğunu ifade etmiştir. Altı öğretmen ise, bu tekniklerin yararlı olması için sınıflardaki öğrenci sayısının az olması gerektiğini ifade etmiştir.

Görüşülen sekiz öğretmenin tamamı Fen derslerinde öğrencilerde kavramsal değişimi gerçekleştirmek için kullandıkları tekniklerin yararlı olduğunu söylemiş, altısı bu tekniklerin kullanışlı olduğunu belirtmiş; bunu ifade eden öğretmenlerden biri, bu tekniklerin başarı açısından üst ve orta seviyedeki öğrenciler için kullanışlı olduğunu söylemiştir. Görüşülen öğretmenlerin ikisi ise sınıfların kalabalık olması nedeniyle kavramsal değişimi sağlamaya yönelik teknikleri kullanışlı bulmadıklarını belirtmişlerdir.

## Sonuç, Tartışma ve Öneriler

Çalışmada, sınıf öğretmenlerinin Fen derslerinde öğrencilerin kavram yanılgılarını belirleyip belirlemediklerini; belirliyorlarsa bu kavram yanılgılarını gidermek için nasıl çalışmalar yaptıklarını ve derslerinde kavramsal değişim yaklaşımını kullanma düzeylerini belirlemek amaçlanmıştır. Öğretmenlere uygulanan ölçme aracındaki açık uçlu sorulardan elde edilen verilerin betimsel analizi sonucu, pek çok öğretmenin kavram yanılgılarının nasıl belirleneceğini ve kavramsal değişim yaklaşımını tam olarak bilmedikleri anlaşılmıştır. Öğretmenin, öğrencilerin yeni öğrenecekleri kavramları kolay anlaşılabilir, kabul edilebilir ve verimli bulduklarından emin olması gerekir. Bu da ancak öğrencilerin daha önceki bilgilerinin dikkate alınması ile yapılabilir. Bu nedenle öğretmenler özellikle daha önceki kavramları belirleyip açığa çıkarmada, bu kavramlarla ilgili farklı ve yetersiz noktaları işaret etmede, öğrencilerin bu kavramları tartışmaya yönelmelerinde aktif bir rol oynamalıdırlar (Koray & Bal, 2002). Öğrencilerin kavram yanılgılarına sahip olduklarını fark ederek bu yanılgıları belirleme yollarını bilmek, anlamlı ve kalıcı öğrenmenin gerçekleştirilmesi için atılan ilk adımdır (Chiu, Guo & Treagust, 2007). Fen Bilimleri Öğretim Programı, sarmal bir program olup; anlamlı öğrenilemeyen konu ve kavramlar, ilerleyen yıllardaki ilgili yeni konu ve kavramların öğrenilmesini de zorlaştırmaktadır. Bu nedenle, sınıf öğretmenlerinin öğrencilerin Fen konularına ilişkin kavram yanılgılarını belirleyerek bunlara gidermeye yönelik kavramsal değişim yaklaşımını derslerinde kullanmaları, anlamlı ve kalıcı öğrenme için önemli bir gerekliliktir. Fen kavramlarının anlaşılır bir şekilde öğrenilmesi, öğrencilerin daha sonraki konuları öğrenebilmelerinde kolaylık sağlamaktadır (Hewson & Hewson, 2003). Temel kavramların yanlış ya da eksik öğrenilmesi, yeni oluşturulacak bilginin de yanlış öğrenilmesine neden olacaktır (Bayram, Sökmen & Savcı, 1997).

Görüşme yapılan öğretmenlerin, öğrencilerin mevcut kavramları ile bilimsel kavramların yer değiştirilmesi anlamına gelen kavramsal değişimi gerektiği şekilde ifade edemedikleri görülmüştür. Öğretmenler, kavramsal değişimin gerekli ve bunu gerçekleştirmek için kullanılan tekniklerin yararlı olduğunu belirttikleri halde; görüşülen sekiz öğretmenden ikisi sınıfların kalabalık olması nedeniyle kavramsal değişimi sağlamaya yönelik teknikleri kullanışlı bulmadıklarını söylemişlerdir. Üç öğretmen Fen derslerinde öğrencilerin kavram yanılgılarını belirlediklerini ve kavramsal değişimi gerçekleştirerek kavram yanılgılarını gidermek için deney, beyin fırtınası gibi teknikleri kullandıklarını; öğrencilere görseller izleterek, kavramların sözlük anlamına baktırarak ve günlük hayattan örnekler verdirerek kavram yanılgılarını giderdiklerini ifade etmişlerdir. Oysa ki, etkililiği yapılan çalışmalarla ortaya konulmuş kavramsal değişim stratejilerine dayalı tekniklerin kullanılması (Şahin, 2002; Holland, Holland & Davies, 2004; Sağırlı & Macaroğlu-Akgül, 2004; Öner & Arslan, 2005; Candan, Türkmen & Çardak, 2006; Yaşar, 2006; Şaşmaz-Ören, Ormancı, Babacan, Çiçek & Koparan, 2010), kavram yanılgılarını gidermede daha etkili olacaktır. Sınıf öğretmenlerinin Fen derslerinde öğrencilerin kavram yanılgılarını belirlemeleri ve bu kavram yanılgılarını gidermeye yönelik kavramsal değişim stratejilerine dayalı yöntem ve teknikleri (kavramsal değişim metinleri, kavram haritaları, zihin haritaları, kavram karikatürleri, analojiler, modeller vb.) kullanmaları öğrencilerin anlamlı öğrenmelerini sağlayacaktır. Öğrencilerin yeni öğrenecekleri konuya ilişkin kavram yanılgılarının alanyazın taraması yapılarak, öğrencilere kavram testleri uygulanarak, açık uçlu sorular, yarı yapılandırılmış görüşme soruları sorularak veya kavram haritaları hazırlattırılarak belirlenmesi; derslerde öğrencilerin kavram yanılgılarını gidermeye yönelik etkinliklerin yapılması, anlamlı öğrenmenin gerçekleşmesi için önemli bir gerekliliktir. Sınıf öğretmenlerinin, Fen Bilimleri derslerinde kavramsal değişim stratejilerine dayalı etkinlikler yapmaları öğrencilerin zihinlerinde kavram yanılgılarının oluşmasına büyük ölçüde engel olacaktır.

*Anahtar Sözcükler*: Sınıf öğretmeni, Kavramsal değişim, Fen eğitimi

**Atıf için / Please cite as:**

Aydın, G. (2015). The level of utilization of conceptual change approach by classroom teachers in science classes [Sınıf öğretmenlerinin fen derslerinde kavramsal değişim yaklaşımını kullanma düzeyleri]. *Eğitim Bilimleri Araştırmaları Dergisi - Journal of Educational Sciences Research, 5* (1), 57-77. http://ebad-jesr.com/