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The Conceptual Perceptions of Classroom Teacher Trainees about the Boiling Subject

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Abstract

The purpose of this study is to identify the conceptual perceptions of prospective classroom teachers towards boiling subject. Case study model which is one of the qualitative research models is used for the research. The study group was determined by the criterion sampling method. The sample of the study is comprised of 153 prospective classroom teachers. A semi-structured instrument was used for gathering the data. The data were analysed by using the content analysis. Suggestions were made according to the result of the study.

1. Introduction

Concepts are the forms of information which represent the changeable common traits of objects and phenomena which gain meaning in human mind (Ülgen, 2004). They are mental instruments which provide human understand the physical and social world, create meaningful communication and thinking (Senemoğlu, 2011). Concepts constitute building blocks of information and the relations between concepts constitute scientific norms (Çepni, Ayas, Johnson and Turgut, 1997). The structure that is constituted in human mind can be taken into consideration to understand how well the subject is understood. Learning the concepts correctly and creating meaningful hierarchal relations leads to a reliable information construction. It can be said that gained information which are the products of this process, which is described as meaningful or conceptual learning, will be both more functional and permanent (Canpolat and Pınarbaşı, 2012). Current teaching approaches accepts that permanent learning is not operational but conceptual (Çepni et all,1997). A number of approaches have been put forward and tested which are intended to explain how learning occurs and as a result of what kind of structure it takes place. One of these approaches is constructivist approach which also took place in our country's curriculum (Evrekli, İnel, Balım and Keserciğolu, 2009). The concepts which constitute the building blocks of cognitive structure of human has a key role in actualizing effective and permanent learning based upon constructivist approach (Malatyalı and Yılmaz, 2010).

The importance of teaching concepts in sciences are well-known. Because of this importance, science educators gave weight to conceptual aspect of teaching science subjects to students in recent years (Coştu, Ayas and Ünal, 2007). Making students gain the science culture which is needed in every phase of life is directly related to the quality of conceptual teaching to be applied in science courses (Akgün, Gönen and Yılmaz,2005). An individual who learn conceptually owns these information to be used when needed as he/she constructed these information himself/herself (Canpolat, Pınarbaşı, 2012). Because of this reason it shouldn't be ignored that the current fallacies of teachers can affect students' conceptual progress (Akgün et al. 2005). When the fact that the education of primary level students will be done by the classroom teachers is considered, during education teaching of these concepts with not letting any fallacies to happen (Konur and Ayas, 2008) and by specifying perceptions related to concepts, setting forth the current conceptual fallacies is gaining importance. Boiling is a subject that is encountered in many education levels from primary school to bachelor's degree. When the literature is reviewed various studies about this field is encountered. In their study Yeşilyurt (2006), Kırıkkaya and Güllü (2008), Aydoğan, Güneş and Gülçiçek, 2003 specified the students' perceptions and Konur and Ayas (2008), H. Değirmencioğlu, G.Değirmencioğlu and Ayas (2004), Canpolat and Pınarbaşı, (2012) teacher trainees' perceptions related to the concept of boiling are specified. In the studies of Çostu, Ayas and Ünal (2007) the possible reasons of fallacies about boiling concept. When the

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results of studies are considered it is seen that both students and teacher trainees have various fallacies related to boiling subject.

2. Aim of the Research

The aim of this research is to reveal the conceptual perceptions of teacher trainees. By this research;

- Answer to the question of "What are the conceptual perceptions of teacher trainees about boiling subject" is sought.

3. Method

In this research case study model is used. It is used as a dioristic approach for answering the scientific questions. It is also defined as a method which investigates an event or more, the environment, program, social group or connected systems (Büyüköztürk et al., 2008).

In this study the study group was determined by the criterion sampling method. The main understanding in the criterion sampling method is the study of the whole situation which meets a series of criterum (Yıldırım and Şimşek, 2008)

3.1. Study Group

The research was carried out with 153 teacher trainees from Kırıkkale University, Faculty of Education, Primary Classroom Teaching, who are in their third year of education. The distribution of the teacher trainees according to their gender are given below in Table 1.

Table 1. The distribution of teacher trainees according to gender.

Sex	f	%
Female	126	82.4
Male	27	17.6
Total	153	100.0

126 of 153 (%82.4) teacher trainees are constituted female, 27 of 153 (%27) teacher trainees are constituted from male.

3.2. Data Gathering Instrument

In order to specify the perceptions of teacher trainees about boiling, a measurement instrument was developed which has content validity with expert opinions and it consists of 2 semi-structured questions. This developed instrument is named as "Kaynama Konusu Algılama Testi (KKAT)".

The themes created by the researchers were broached to qualitative research professionalist academicians and asked to give opinions about the appropriacy of created structure in order to provide reliability for the research datum. The categories which are created by researchers and specialists are compared and the number of agreement of opinions and split in opinions are specified. Their reliability was measured by means of Miles and Huberma's formula (Reliability = agreement of opinions / agreement of opinions + split in opinions). In descriptive studies, desirable reliability is provided when the accordance between specialist's and researcher's assessment is %90 and more (Saban 2009). In two themes opinion split was detected between specialists and researchers. The reliability was measured as Reliability=36/36+2= 0,94).

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3.3. Data Gathering Duration

The datum of the research was gathered in September, 2012 by applying KKAT to teacher trainees. The answers were gathered in written way.

3.4. Data Analysis

The datum gathered from the research was analyzed with content analysis. Content analysis can be defined as a technique which is systematical and iterable technique that summarizes some words of a text with smaller content categories with specified rules and codes (Büyüköztürk ve diğ. 2008). Primarily the datum collected from teacher trainees were separated into meaningful sections and the conceptual meaning of each section were specified. During this process the sections which constituted a meaningful whole were coded, the similarities and differences between codes were assessed and interrelated codes are gathered and themed. Afterwards, the specified themes were supported with the citations taken directly from the teacher trainees. In citations teacher trainees are coded as Ö1, Ö2, Ö3, ….

4. Findings

In the research two questions asked in order to reveal the perceptions of teacher trainees about boiling. The analysis of the questions and answers given by teacher trainees are given below.

> ***1st Question*** *Explain boiling.* With this question the meaning that the teacher trainees attributed to the concept of boiling was tried to be specified. The answers and finding are analyzed below in table 2 whereas 7 of teacher trainees didn't answer the question.

Table 2. *The meanings that teacher trainees attributed to the concept of boiling*

Themes	F
1. The gasification of the liquid and change of state	40
2. The reach of the liquid to the highest heat	15
3. The liquid's duration of evaporation	14
4. The reaching of the liquid to the boiling point	12
5. The movement of molecules with the effect of heat	11
6. The change with the increase of the heat	10
7. The equation of liquid vapor pressure with open air pressure	7
8. The intense moment during which evaporation is seen in every part of the liquid	6
9. The situation observed before the phase of evaporation	4
10. The phase of liquids when they reach to 100 C	4
11.The occurrence of bubbles on the surface of the liquid	3
12. The liquid's beginning to create bubble noise	3
13. The heat in which the liquid evaporates	3
14. The reaching of kinetic energy to the highest point.	2
15. The condensation of the liquid	2
16. The action of liquid molecules become loose	2
17. The transformation of molecular energy to kinetic energy	1
18.The liquid molecules' approach to each other	1
19.The rise of the liquid molecules to the surface	1
20.The dilation of the liquid molecules	1
21. The separation of air molecules with the help of heat	1
22. The decondensation of liquid	1
23. The reach of the liquid to specific heat	1
24.The movement of the substance through itself	1

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Total	146

The meanings that teacher trainees attributed to the concept of boiling can be gathered in 4 groups. The first one is about the fact that the boiling is a change of state. A great deal of teacher trainees stated boiling as the change in the state of liquid to the gas by getting heat. This statement shows the confusion with boiling and evaporation. Entering the process of evaporation, the state of evaporation in every part of the liquid, the state which is seen before evaporation phase, the condensation of the liquid, the losing density are other prominent themes.

Ö61 Boiling is gasifying a liquid by giving heat, it is right the opposite of condensation. Ö31 it is a change in the state of a substance in a specific heat. Ö96 it is a method to prove the specialty of a liquid's changing state with a substance which has higher temperature than room temperature. Ö71 …… is a process of evaporation of a liquid by getting a specific heat. Ö94 It is a phase of a liquid substance before evaporation.

The second group of opinions is about molecular movements and change. While some teacher trainees associated boiling with movement of liquid molecules with the effect of heat, become free, getting closer to each other, rise to the surface, dilatation, the conversion of potential energy to kinetic energy some others accepted boiling as the change that occurs with the increase of heat, the movement of the substance itself, beginning of gurgitation and occurrence of bubbles on the liquid surface.

Ö65 boiling occurs by the movement of whole molecules of water when it reaches a certain heat. Ö6 It is the movement of particles in a substance when specific amount of heat is applied. Ö131 It is the dilatation of molecules with the heat. Ö45 It is a conversion of some particles from potential energy to kinetic energy as a result of increasing the heat of liquid substances.

Opinions of third group are about the pressure association. A small number of teacher trainees stated boiling as an equality of liquid evaporation pressure with open air pressure.

Ö50 It is an instance that occurs when the pressure of a liquid at highest heat with external pressure. Ö127 When heat is applied to a liquid and if the open air pressure and evaporation pressure are equal it is called boiling. Ö27 Internal pressure raises if heat is applied to a liquid, as the external pressure is static boiling occurs (In order to equalize external pressure with internal pressure).

Opinions of the fourth group is consisted of liquid's reaching to a certain degree of heat and the state occurs afterwards. In this section, liquid's reaching of the highest heat, liquid's reaching to boiling point, the state of the liquids in 100 C are the themes that represent the meanings that teacher trainees attributed about boiling.

Ö116 Boiling is the liquid's reaching to the maximum amount of heat it could have. Ö150 It is the heat in which the substance is gasified. Ö142 It is the saturation of heat of a liquid. Ö13 It is the liquid's reaching to boiling point in a specific heat. Ö2 It is the state of liquids in 100 C.

2nd Question: *Is it possible to boil a glass of water in room temperature (25 C) without addition of heat?* With this question the opinions about the circumstances needed for boiling are gathered. 8 of teacher trainees didn't answer the question. The answers from the rest of the group are gathered in 2 titles under table 3.

Table 3. *Categories related to 2nd question*

Categories	f
1. Boiling water is not possible	99
2. Boiling water is possible	46
Total	145

A large number of teacher trainees think that it is not possible to boil the water without additional heat, whereas 46 of them are on the opinion that it is possible. 8 of teacher trainees who stated that it is not possible

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didn't give any reason. The answers from the rest are analyzed and the findings gathered are seen in table 4 below.

Table 4 . *The reasons of impossibility of boiling the water without additional heat*

Themes	f
1. The need for heat for boiling	45
2. Room temperature is not enough for boiling process	31
3.Tha fact that the water needs to reach 100 C in order to boil	8
4.The lack of an instrument which changes the heat of the water	5
5.The fact that water has density	1
6.Nonfulfillment of condensation	1
Total	91

The reasons of unfeasibility of boiling water without the addition of heat can be gathered in two groups. The first one is about the fact that without gaining heat, boiling is not possible to occur. The need for heat for boiling and the lack of instruments to change the heat of the water are the themes that consists of this section.

Ö2 ….. because of the lack of additional heat, boiling is not observable.Ö23 Room temperature is 25C, the water can't be boiled. Ö21 Without a heater we can't boil.

The second group of opinions is about the specific heat that boiling occurs, the density of the water and it's incapability of condensing.

Ö81 the boiling of water occurs only in 100 C. Ö12 We can't boil the water because the water has density. Ö20 It doesn't boil because the water has an amount of condensation. In the same degree of heat condensation doesn't occur and water can't be boiled.

3 of 46 teacher trainees who think that boiling can be boiled without additional heat didn't make any explanation for this statement. The analysis for the answers of others is in table 5 below.

Table 5. *The states of boiling water in 25 C without additional heat*

Themes	f
1.By decreasing ambient pressure	20
2. With the occurence of evaporation	6
3. Decresing boiling point by adding another substance to the water	5
3.With the change of location	4
5. With sun energy	3
6 By increasing pressure	2
7 With the help of light sources placed around the glass	2
8.By giving electric current to the water	1
Total	43

The opinions of teacher trainees who think that without additional heat it is possible to boil the water can be gathered in 4 groups. The first is that the possibility of this action with the change in the pressure and location. The decrease, increase in the ambient pressure, change in the location are the themes under this section.

Ö46 If I decrease the pressure of the room the heat doesn't change, I decrease the boiling heat point. Ö41 As far as I know when we go down to the sea level boiling of the water would be possible. Ö40… Water can't boil at 100 C in any location for this reason we can boil the water at 25 C heat by calculating the level of height

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The second group of opinions is about vaporization. Some of the teachers assume that as vaporization occurs, boiling comes with it.

Ö123….if we consider boiling as evaporating from liquid form, as there will be evaporation in room temperature even if it isn't visible we can take it as boilable. Ö49 although it doesn't boil profusely there is invisible vaporization.

kaynamayı sıvı halden buhar haline geçiş olarak kabul edersek gözle görülebilir olmasa da oda sıcaklığında buharlaşama olacağından kaynatılabilir olarak kabul ederiz. Fokur fokur kaynamasa da gözle görülemeyecek bir buharlaşma gerçekleşir.

Third group of opinions is about adding something. Dropping the boiling point of the water by adding something else is the theme of this part. The fourth opinion group is formed with the idea of transferring energy to the water. Despite the statement of without heat addition some of the prospective teachers stated that water can be boiled with solar energy, with light sources around the glass or with electric current.

Ö90….by adding a substance boiling at a lower boiling point to the water we can lower the boiling point of the water to the room temperature. Ö112 we can boil the water by placing light sources around the water.

5. Results and Discussion

The results of the study on the conceptual perceptions of classroom teacher trainees about the boiling subject are as following.

Most of the teacher trainees do not have a clear and accurate perception about boiling. Most of them take boiling as gasifying of the liquid with heat or in other words changing states. This depicts that boiling and vaporization concepts are mixed up. The same findings are also seen in the studies of Kırıkkaya and Güllü (2008), Aydoğan et al., (2003). Furthermore, the fact that some of the teachers defined boiling as the process before the vaporization or process of vaporization supports the misunderstanding between boiling and vaporization. The studies of Kırıkkaya ve Güllü (2008) presented that a great deal of the students believe that water has to boil in order to evaporate. Some of the teacher trainees take the boiling as the mobility of molecules and a change so they define boiling as movement, freedom and getting closer, emergence, dilation of the liquid molecules, and transformation of potential energy to kinetic energy, bubbling of the water and occurring bubbles on the surface of the water with heat effect. Sometimes boiling is perceived as water's reaching a particular temperature by the teacher trainees. Usage of 100°C for the boiling of liquids demonstrates the fact that water is the only example given for boiling, so teacher trainees are tend to make a generalization about all liquids. Only few of them associate boiling with the equality of the liquid vapor pressure and open air pressure. The study of Yeşilyurt (2006) majority of the students used the expression of "applying enough heat to the liquid" but they didn't mention the relationship between boiling and pressure. On their study done with chemistry teacher candidates Canpolat and Pınarbaşı (2012) stated that the definitions of boiling point of the teacher trainees are either "the temperature where the vapor pressure of the liquid is equal to the atmosphere pressure" or "the temperature when the internal pressure of the liquid is equal to the external pressure (atmosphere pressure). These definitions are almost the same as the ones read by the teacher trainees from the textbooks or they give the exact definition they teach during classes. However, their perceptions of boiling are far away from what they defined.

Another finding of the study is that most of the teacher trainees think that heat is necessary to make liquids boil and without heat there will be no boiling. Very few teachers expressed that any change in the pressure helps boiling process.

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