Determining the Understanding Levels of Class Teacher Candidates on Matter and the Structure (Properties) of Matter

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Abstract

The purpose of this study is to determine the understanding levels of teacher candidates studying at the class teacher's department on Matter and the Structure (Structure) of Matter, which are among the basic science topics. For this purpose, the understanding levels of students who were studying at Class Teachers Department and who studied Science and Technology Teaching I-II classes were determined on the above mentioned subject. The study was designed in Review Model. The Study Group consisted of 84 teacher candidates who were studying at Inonu University, Class Teachers Program, grade 3 at Inonu University, Faculty of Education, and Class Teachers Department in Spring Term. The data of the study were analyzed with the SPSS 24 Statistical Package Program. According to the data, it was determined that the teacher candidates did not have adequate knowledge on matter, could answer the questions on the subject when reminding knowledge was provided, and determine whether the knowledge given was correct or not.

Keywords: Science, Matter, Class teachers, Concept Learning, Understanding Level

1.Introduction

In today's world, the target of all societies is raising active individuals that may criticize, participative, adapt to innovations, convert thoughts into actions, and may solve the problems. The key to this is not related with how much knowledge individuals are loaded, but with how much individuals are active in the reaching in the knowledge process. In this context, it is necessary to raise teachers who have similar thoughts for science education. The targets on this topic were stated in the Primary Education, Science and Technology Classes Curriculum (for 4^{th} and 5^{th} grades) that was released in 2005 by the Mo NE, Turkish Education Board. In this context, one of the science and technology education in primary education is to make students, in other words, the individuals who will govern the society in the future, acquire science and technological literacy. In this context, science and technological literacy is an important element ensuring that individuals become aware of the present world in which we live in scientific terms and examine events, and help them see how life is facilitated by science and how it covers the need of people (Sağır, Tekin, & Karamustafaoğlu, 2012). As a result of this, science education at schools have an extremely important place and science classes are included in basic classes in our country as it is the case in the whole world (Türkmen, 2002).

The purpose of science education in primary education is ensuring that the reasoning skills of students are developed at a logical or scientific level, and bring their problem solving skills to upper levels (Demircioğlu, Demircioğlu & Ayas, 2004).

The innovations and inventions in the field of science that contribute to the development of countries also constitute the basis of scientific and technological developments. For this reason, the importance of science and its education is increasing with each passing day, and the issue of training the teachers who will apply and teach science are furnished with modern knowledge, skills and attitudes is having great importance (Özmen, 2004).

In addition, it was reported in previous studies that learning science concepts in a more understanding and more permanent manner will ensure that students will not have difficulties in further years in learning other subjects (Geban & Ertepınar, 2001; Briggs, & Holding, 1986; narrated by: Ayas, Özmen, & Coştu, 2002; Hewson, & Hewson, 2003; Uyanık, 2015, Uyanık & Serin, 2016).

The widespread viewpoint on science and technology education is that the individual makes use of the experiences in concept development processes and improved himself/herself. In this process, even if teachers use different teaching techniques, they must help students to enable them experience learning situations. Brunne, Goodnow, Austin (1956) reported that there are five important elements in teaching and developing concepts, which are; noun, definition, examples, properties and importance (Sağır, et.al., 2012). Students generally use macro level when they are learning the chemical topics in science classes; however, for a deeper and more meaningful learning, students have to understand and make sense of concepts at a micro level.

The topics of chemistry classes mostly consist of abstract concepts, and require an upper-level effort in terms of learning-teaching skills, which makes it difficult to perform education both for students and teachers. For this reason, in order to ensure a permanent, accurate and meaningful learning in chemical concepts, the concept must be defined in macro micro and symbol level (Kaptan, & Korkmaz, 2001; Ayvacı & Durmuş, 2016). While the events at macro level are learnt by students by observing, the ones at micro level are made to become understandable by concretizing with models; and the concepts defined at symbolic level must be taught by using symbols, numbers, formula, equations and structures. With such an education, it will be possible to understand chemical concepts at an adequate level (Okumuş, Öztürk, Çavdar, Karadeniz, & Doymuş, 2016).

Matter, the structure and nature of the matter are the basic concepts of chemistry are constantly faced by students from primary education to higher education level. In this process, if students have some misconceptions, this will affect negatively their knowledge acquisition at upper levels in further years. A similar situation is also valid for class teacher candidates who are studying at educational faculties. The superficial understanding level of class teacher candidates in this context or their misunderstanding affects negatively the students' training processes (Konur & Ayas, 2008). These subjects pose the bases for all chemistry subjects, and must be emphasized again to make sure that student and a teacher candidates from any level understands without any misconceptions.

It is possible to claim that the superficial understanding of the structure of the matter will make it more problematic to construct other chemical subjects at macro level.

The concepts are knowledge structures that constitute the contents of physical sciences and are extremely important. According to Kaptan (1999), concept is the common name given to the group of events, ideas and objects that have properties close to each other. Ayas (Edt: Çepni , 2005, p. 67) defined concepts as the associations occurring in the human mind when some entities or objects are being mentioned. In addition, concepts are the contents of knowledge that is revealed as a result of the events happening in the nature, and for this reason, they must be expressed accurately and permanently (Uyanık & Serin, 2016).

The most important role of concepts is that they are the elements used in obtaining knowledge. According to Griffith's, Thomey, Cooke and Normore (1988, p.711) individuals make use of pre-knowledge that is formed in their minds when they are learning concepts. Teaching concepts during learning process must be in the form of constructing the concepts that are scientifically accepted and valid. For example, if the concepts in the preschool period of students are constructed in an incorrect manner, more importantly, if they are acquired in formal education, the majority of the concepts are stored as misconceptions when knowledge is organized in the mind. In this process, the most basic reason is the way that is followed in teaching concepts. Science concepts constitute the first step to reach the information on natural events and laws throughout life. In their lives, children start science classes with concepts that are not constructed accurately and that are not formal, in other words, non-scientific concepts. The initial first concepts that are acquired in this way are converted into misconceptions. For a student that has misconceptions, the prejudices make it extremely difficult to correct misconceptions (Fellows, 1994, p. 985; Pines & West, 1986, p. 593).

In order to conduct an efficient science teaching, an education that is far from misconceptions is needed (Coştu, Çepni, & Yeşilyurt, 2002). For this reason, teacher candidates must have accurate knowledge on concepts (Konur & Ayas, 2008; Gökulu, 2015). Since teachers who have misconceptions will transfer them to their students, teacher candidates must have accurate, permanent, and scientific knowledge about basic science concepts (Uyanık & Serin, 2016).

In addition, aside from the science teachers having accurate knowledge on concepts away from misconceptions, teachers must use different methods and techniques in their classes to make students acquire science concepts (Demiriz & Ulutaş, 2001; Sürücü, Özdemir, & Baştürk, 2013)

2. Method

2.1. The Study Design

In the present study, the General Review Model, which is one of the non-empirical qualitative research methods, was used. The review method is used in studies that aim to depict an existing situation as is. In this study model, the existing situation is observed in a proper manner without changing it in any way (Karasar, 2002).

2.2. The Sampling of the Study

For the purpose of determining the knowledge levels of 3rd grade students of İnönü University, Education Faculty, Class Teachers department on matter. In this respect, the questionnaire "Determination Scale for the Knowledge Level on Matter", which consisted of 52 questions collected from the sources approved by the Ministry of Education. The scale was prepared by four academicians working in Inönü University, Faculty of Education, Science Teachers Department. The scale consisted of 6 sub-groups. 84 students participated in the study (Table 1).

Table 1. Subgroups of the "Determination Scale for the Knowledge Level on Matter"

	Total Number of Questions	**Points**
Open-ended (A GROUP)	4	12
True-False (B GROUP)	7	14
Fill in The Blanks (C GROUP)	15	30
Yes-No (D GROUP)	14	28
Closed-ended (E GROUP)	8	8
Multiple-Choice (F GROUP)	4	8
Total		100

3. Findings

In the analyses which were made by evaluating the answers of the teacher candidates given to the scale, the average scores and standard deviation values of the students in each sub-group are given in Table 2.

Table 2. Average and Standard Deviation Values of the Groups

	A GROUP	**B GROUP**	**C GROUP**	**D GROUP**	**E GROUP**	**F GROUP**
N	84	84	84	84	84	84
Ave.	1,821	7,857	15,857	22,095	5,179	2,357
SD	2,329	1,831	5,491	5,240	1,798	1,867

When Table 2 is analyzed, it is observed that the students answered the questions in A GROUP with the lowest accuracy level, and to the questions in D GROUP with the highest accuracy level.

Table 3. A GROUP Frequency and Percentage Values

	Frequency	**Percentage**
0,00	47	56,0
3,00	24	28,6
6,00	12	14,3
9,00	1	1,2
12,00	0	0,00
Total	84	100,0

When Table 3 is analyzed it is observed that none of the students received full points from the questions in A GROUP, and 47 (56,0%) of the students could not give accurate answers to none of the questions.

When Table 4 is analyzed it is observed that none of the students (14,00) could receive full points, and 55 students could receive passing points.

Table 4. B GROUP Frequency and Percentage Values

	Frequency	Percentage
4,00	2	2,4
6,00	27	32,1
8,00	35	41,7
10,00	15	17,9
12,00	5	6,0
14,00	0	0,0
Total	84	100,0

When Table 5 is analyzed, it is observed that there are no students who received full points from the questions in C GROUP, only 1 student could not give accurate answer to none of the questions, and only 47 students had passing points (56,1%).

Table 5. C GROUP Frequency and Percentage Values

	Frequency	Percentage
0,00	1	1,2
2,00	1	1,2
4,00	1	1,2
8,00	6	7,1
10,00	8	9,5
12,00	11	13,1
14,00	9	10,7
16,00	5	6,0
18,00	12	14,3
20,00	14	16,7
22,00	11	13,1
24,00	4	4,8
26,00	1	1,2
30,00	0	0
Total	84	100,0

In Table 6, it is observed that 8 students (9,5%) answered all the questions accurately and received full points, and 79 students received passing points (94%).

Table 6. D GROUP Frequency and Percentage Values

	Frequency	Percentage
6,00	2	2,4
8,00	3	3,6
14,00	4	4,8
16,00	6	7,1
18,00	2	2,4
20,00	3	3,6
22,00	16	19,0
24,00	22	26,2
26,00	18	21,4
28,00	8	9,5
Total	84	100,0

When Table 7 is analyzed it is observed that 2 students (2,4%) could not give answers to none of the questions, 3 students (3,6) received full points and 70 students (83,4%) received passing points.

Table 7. E GROUP Frequency and Percentage Values

	Frequency	**Percentage**
0,00	2	2,4
1,00	1	1,2
2,00	5	6,0
3,00	6	7,1
4,00	10	11,9
5,00	21	25,0
6,00	15	17,9
7,00	21	25,0
8,00	3	3,6
Total	84	100,0

When Table 8 is analyzed it is observed that 20 students (23,8%) could not give accurate answers to any of the questions, none of the students could receive full points, and only 25 students (29,8%) could give accurate answers to half of the questions and receive passing points.

Table 8. F GROUP Frequency and Percentage Values

	Frequency	**Percentage**
0,00	20	23,8
2,00	39	46,4
4,00	15	17,9
6,00	10	11,9
8,00	0	0,0
Total	84	100,0

In Table 9, the average and standard deviation values of the total points received by students from the measurement scale are given. The average point received by the students, who participated in the study, from the scale is 55,167 over 100 full points.

Table 9. Evaluation of the Total Points Received by Students

	Total
N	84
Ave.	55,167
SD	9,962

When Table 10 is analyzed, it is observed that 54,4% of the students who participated in the study received passing grades from the scale, and there are no students who could receive full points.

Table 10. Frequency and Percentage Values of the Total Points Received by the Students

	Frequency	**Percentage**
0,00-25,00	0	0
26,00-54,00	38	45,6
55,00-82,00	46	54,4
Total	84	100,0

4. Discussion and Result

In the science curriculum, the subject of matter has been included as one of the major topics in education from primary school to secondary and university education; and is extremely important because it is the basis for many other subjects and is interconnected with them (Erdem, Yılmaz, Atav & Gücüm, 2004). Science education must ensure that individuals make their lives better by using science, and cope with the world that is becoming more technological with each day (Konur, F., http://www.google.com.tr//fikretkorur.guncelfizik.com/wp-content/uploads/fen_egitiminin_amaclari.pdf). The purpose of the primary education science classes is to develop the logical and scientific reasoning skills of students, and make them become skillful problem-solvers (Demircioğlu et.al., 2004). The teachers, who will develop these behaviors in students, must also be equipped with similar skills (Ginns & Watters, 1995).

It was observed that the matter subject which is included in the 4th grade science course books is not undertook adequately by students. We believe that the reason for this situation is inadequate knowledge and equipment of teachers. When the literature was reviewed, it was observed that the investigated topics are the basic concepts like the granulose structure of the matter, its states, boiling, vaporizing and melting, or the misconceptions are investigated (Novick & Nussbaum, 1978; Erdem, Yılmaz, Atav, & Gücüm, 2004). However, no studies were detected investigating the basic knowledge levels of class teacher candidates on matter. In this study which was conducted by us for the purpose of covering this gap, it was observed that the majority of the students could not give any answers to Open-ended questions (56%) and receive zero points, and there was no student who received full points. The fact that students could not give answers to Open-ended questions show that they do not have full knowledge on this subject. True-False questions evaluate whether students can test whether the knowledge given to them is accurate or not. When the answers given by students are analyzed, it was observed that none of the students could receive full points over 14 points, and more than half of the students could receive passing points (55). In order to answer the Fill in The Blanks questions by students, they must have knowledge on the topic. When the answers given to these questions were analyzed it was observed that there were no students who received full points, 1 student could not answer accurate answers to any of the questions, and 47 students (56,1%) received passing points. When the answers given by students to the Yes-No questions were analyzed it was observed that 8 students gave accurate answers to all of the questions and received full points, and 94% had passing points. When the answers given to the Closed-ended questions were analyzed it was observed that 2 students could not give answers to any of the questions; however, 83,4% of them had passing points. To be able to answer the Multiple-Choice questions in our scale, students must have more detailed knowledge on matter. When the answer given by the students to Multiple-Choice questions were amazed it was observed that 20 students could not give answers to any of the questions, and 29,8% of them could give accurate answers to half of the questions and received passing points.

In this context, teachers, who will raise future generations, must construct and associate macro, micro and symbol level concepts in an accurate manner without allowing any misconceptions. For this reason, the misconceptions of the teacher candidates in chemistry topics and the superficial understanding levels will affect negatively both themselves and the students they will raise. In this respect, the aim of the present study is to determine how teacher candidates studying at class teachers department express the concepts about the matter and its structure, and determine the understanding levels of them on matter (Ginns & Watters, 1995). In was determined that students gave accurate answers to Open-ended questions with the lowest level, and to the Yes-No questions with the highest level. When these data were evaluated it was observed that the students who participated in the study did not have a full knowledge on matter, more than half of them gave answers to the questions when reminding knowledge was given on the topic, and determine whether the knowledge given was accurate or not.

Based on the results of our study, we believe that the topic matter must be taught better by using different teaching methods.

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