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Adult Opinions on Mathematics

SECIL EDA KARTAL and SULTAN BASAK DEMIR

Abstract

Adapting to changing life conditions, interpreting events that take place and increasing life quality are possible through enhanced knowledge, skills and competences. This study aims at examining; adult perceptions on mathematics, mathematics and mathematical competences, and transferring mathematical knowledge and skills to daily life. Qualitative research approach was used in the study, conducted through the screening model. The study group consists of 20 adults above the age of 25. A semi-structured interview form was used as the data collection instrument of the study. Perceptions of the participants on mathematics were aimed at being determined, what individuals gain through mathematics and their losses due to mathematical incompetency were examined. They were asked whether or not they wanted to enhance their mathematical competence and their reasons questioned. According to the study results, it was observed that adults relate mathematics to daily life, that they like mathematics, they are successful at it, and have fun while dealing with mathematics. In addition to believing that mathematics contributes to their daily life, they also stated that they will experience big losses in cases of mathematical incompetency. The participants stated that they want to enhance their mathematical competence and that lifelong learning would continue this way.

Keywords: mathematics, competence, daily life, adult, lifelong learning.

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Introduction

Mathematics is the common definition for sciences like arithmetic, algebra and geometry that are based on number and measurement (Matematik, 2017). The development process of mathematics gained pace through commerce, went beyond daily life and the science of mathematics was introduced as a result of the curiosity for mathematics. Early societies used it in counting and measuring during daily life. For example; the Egyptians used geometry, calendar and astronomy so as to identify field borders after floods and to be able to use them due to their fertility (Erdem, Gürbüz, & Duran, 2011). It is necessary to learn mathematics in order to respond to increased social demands and to attain the required information and skills. In addition to enhancing problem solving, thinking, discussion and reasoning skills, mathematics fulfils and ensures the needs of both society and the individual. People find it necessary to learn mathematics in order to increase their knowledge and culture and to shape their own future (Altun, 2006). Mathematics education equips individuals with broad knowledge and skills that will assist them in the physical world and during social interaction. It furnishes them with a language that they can analyze, explain, predict and solve the problems concerning their experiences. It facilitates creative thinking, enables aesthetic development and accelerates reasoning skills (Millî Eğitim Bakanliği [Ministry of National Education], 2009). Mathematical skills that educational activities aim to furnish individuals with are; knowing basic skills and problems, understanding mathematical concepts and principles, applying mathematics in real life situations, communicating about mathematics and mathematical reasoning (Eurydice, 2011). The main skills are; predicting skills, mental operations skills, number heuristics, expressing mathematical knowledge, interpreting tables and graphics, using measurement-drawing tools, using calculators, accessing information, organizing and presenting, mathematical communication and problem solving (Ersoy, 2003). Individuals should use their mathematical skills in their daily life, their houses and offices and facilitate their lives through their problem solving and reasoning skills (Ulutaş & Ubuz, 2008). Individuals should increase their mathematical capacities and gain mathematical thinking skills during childhood because mathematics is an important part of life. Mathematical thinking enables a strong perspective in solving all kinds of problems, offers an objective approach, the result is significant and unlike other trends it requires certainty (Umay, 2002).

An individual in adulthood must adapt to the developments and changes happening and complete his or her informational gaps. The purpose of adult education is to furnish them with this knowledge (Aziz, 1981). This is necessary for education to be lifelong and continue even after school. In the global world where knowledge and skills are becoming insufficient, everyone should refresh and improve themselves (Miser, 2002). The EU recognized 1996 as “European Year of Lifelong Learning” and emphasized that lifelong learning is not a fundamental right, but rather a chance for everyone and perceived it as a key for accessing knowledge and acquiring vocational education in the 21st century (Kaya, 2014). Because Turkey set becoming a European Union full member as a goal after the 1960’s, it commenced reorganization in many fields along with the field of education (Bağcı, 2011). The renovated new education system should be an education system which furnishes adults with new knowledge and skills; is sustained throughout life; is not limited within the school; is embraced in all areas of life; and where learning is sustained without any barriers and without considering age, social-economic-educational status (Millî Eğitim Bakanliği [Ministry of National Education], 2014).

With the updated education system, the importance of adult education has increased, projects for adults have been introduced and new programs have been prepared. Thus, providing adults of all age with mathematical skills should become the objectives of the updated education system. Although equipping adults with the basic mathematical skills is individually and socially important, it is also an issue that has long been ignored (Yıldız, 2010). According to the Trends in International Mathematics and Science Study (TIMSS), a screening study evaluating primary and secondary school students' knowledge, skills and attitudes in the fields of mathematics and sciences, Turkey has performed below the average of participating countries (Yıldırım, Özgürlük, Parlak, Gönen, & Polat, 2016). The Programme for International Student Assessment (PISA), conducted by the Organization for Economic Cooperation and Development (OECD), evaluates to what extent children under the age 15 adapt their mathematical knowledge to daily life (Eurydice, 2011). PISA measures student skills through the term "literacy" which refers to using knowledge and skills during a problem, analyzing, making logical reasoning and achieving effective communication. According to the study results, similar to TIMSS, Turkey performs below average in mathematics literacy (Taş, Arıcı, Özarkan, & Özgürlük, 2016). The adherent of PISA in mathematics education Programme for the International Assessment of Adult Competencies (PIAAC); is a survey that measures adults' skills and competences. The main purpose is to measure adults' competences and knowledge, make adult educational programs more effective, show the level of applying the education that adults receive and measure to what extent they use their knowledge and skills in their daily lives. According to the study conducted in Turkey based on PIAAC, among the other participant countries, Turkey is placed at the bottom for adult mathematics competence (Aydemir, 2016).

The number of studies concerning adult knowledge and skills on mathematics in Turkey are very low. According to a study conducted by Yıldız (2010) on the mathematics skills of adults who participated in beginner-level reading-writing courses; it was observed that students preferred reading-writing lessons to mathematics, and that their mathematics skills were lower. Younger adults, employed adults and adults continuing primary education were observed to be more successful than other adults. According to a study conducted on pre-service classroom teachers, the themes "mathematics as an exciting lesson," "mathematics as a difficult and boring lesson" and "mathematics consisting of many subjects" was underlined concerning the term mathematics. In addition to these; it was underlined that mathematics consists of mental processes and is used throughout life (Güveli, İpek, Atasoy, & Güveli, 2011). Because of the very few studies in Turkey on mathematics knowledge, skills and attitudes and because the level of mathematics achievement in international studies like PISA, TIMMS and PIAAC is insufficient, the current study is aimed at identifying mathematics attitudes of adults and their state of transferring mathematics to their daily lives.

Methodology

Data were accessed in the study through the qualitative research method. Qualitative study is a type of research which focuses on the quality of an event or fact rather than its frequency of occurrence. The analyses were conducted through the content analysis method. Content analysis is a systematic and replicable technique in which various text are summarized in small content categories through codes based on certain rules (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2016).

This study was conducted during the 2016-2017 academic year fall term in Bartın, Turkey. A total of 20 adults, 12 females and eight males, participated in the study. Six of the participants are primary school graduates, whilst three graduates from high schools and 11 are university graduates. The convenience sampling method was preferred while determining the participants. In the convenience sampling method, the researcher sets the sample by starting from the most accessible candidates, and thereby saves time, money and labor (Büyüköztürk et al., 2016).

A semi-structured interview form with questions at the end was used as the data collection instrument. The form questions were prepared after a literature review and by resorting to the opinions of experts in the field of mathematics, educational sciences and lifelong learning-adult education. Interviews performed with the participants were audio-recorded with the permission of the participants. The questions contained in the interview form which were directed to the participants were:

1. What do you think mathematics is? Explain.
2. How do you perceive mathematics? Explain (like, hate, easy, difficult, fun...)
3. Does knowing mathematics have any contributions for you? How?
4. Does knowing mathematics make you lose anything? How?
5. Do you use mathematics in your daily life; which areas do you use it in?
6. Do you want to enhance your mathematics knowledge? Why?

The interviews held with the participants were audio-recorded. These recordings were transcribed by the researchers. Buffer questions were asked during the interviews with the participants so as to clarify questions that were not understood. The transcribed forms were evaluated one-by-one for each question. Categories and themes were determined concerning the answers and analyzed through the NVivo 8.0 program.

Results and Discussion

Findings of the study are given below according to the study questions and study themes.

How Adults Define Mathematics

The question on the interview form related to this sub-problem is; “What is Mathematics?” and the data are presented in a thematic structure. According to the analysis of the answers, sub-themes such as daily life, number, shopping, story problems, science, difficult lesson, and reasoning skill were defined. When these themes are considered, the point most emphasized by the adults was daily life and secondly the number definition. In addition, some participants expressed it as shopping, story problems and science; problem solving and reasoning skills of mathematics were not mentioned, and only one participant defined it as the skill of reasoning.

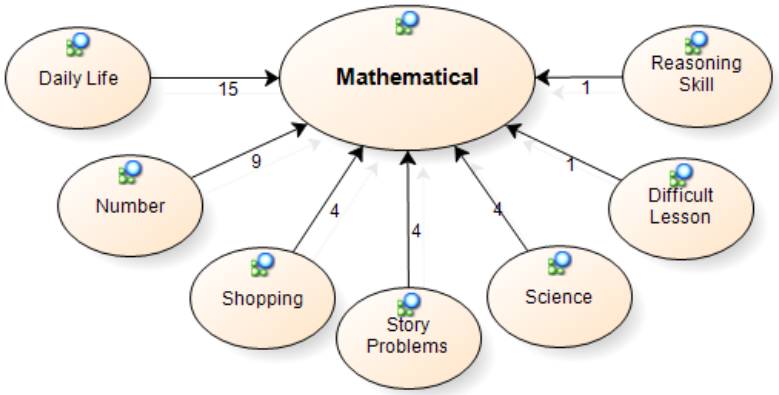

Figure 1. Mathematical definitions

The participant who defined it as daily life stated that, *"Mathematics is really important in my daily life, it is important while solving story problems and explaining something to my children. It is very important for me to help them with their lessons but I am also a bit sad that I can't help them"* (P-19). Another participant stated that, *"It is life itself. How can life be possible without mathematics? Mathematics has to exist in markets and bazaars"* (P-5). One other participant defined mathematics as, *"Everything in life is related to mathematics. We arrange our eating, drinking, our future, everything, shopping, calculations, numbers with it..."* (P-7).

Mathematical Perceptions of Adults

In the question aimed at defining adult perceptions on mathematics, the majority of the participants stated they like mathematics, they are successful in it and have fun while dealing with mathematics. Some participants also stated that the teacher has a major effect in mathematics education.

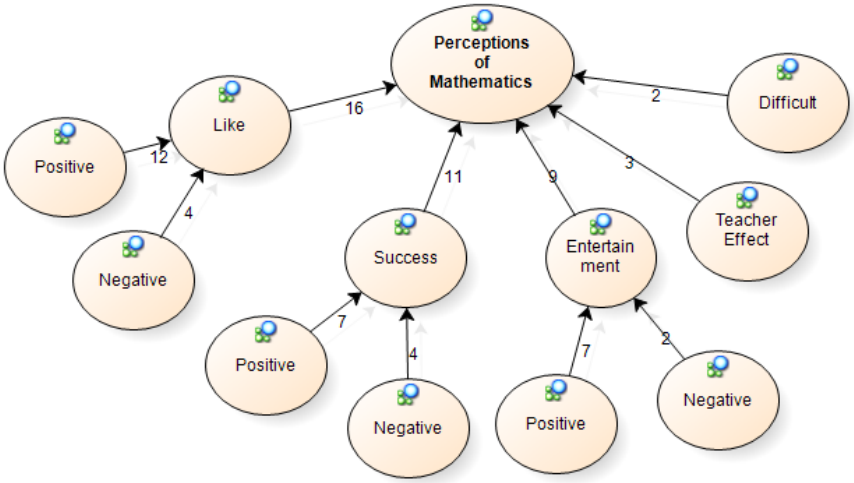

Figure 2. Perceptions of Mathematics

One participant who likes mathematics stated that, *"I loved it a lot, I was good at some subjects, I was happy dealing with it. I used to have fun with subjects I was good at, but I didn't have fun with other subjects"* (P-5). Another participant stated that;

> *I was successful, one gets results when he or she works on something. Working on mathematics helped me recognize my own characteristics. It was through mathematics that I saw that I can overcome a hardship by working hard on a system that I have difficulty in, by reasoning it, solving problems and trying to solve it, that I progress when I work on it. I like it and have fun. Because the rules are clear and certain, they are not interpretable. You can access the truth clearly, that's why I like mathematics.* (P-8)

Contributions of Mathematics to Adults

According to the answers given to the interview form question, *"Does knowing mathematics have any contributions for you? How?"* the majority of participants believe that mathematics contributes to them and their lives. They stated that they use mathematics in daily life especially while shopping, in time management and budget planning. Some participants stated they find mathematics necessary in their professional life, for their reasoning skills and when helping their children with their homework.

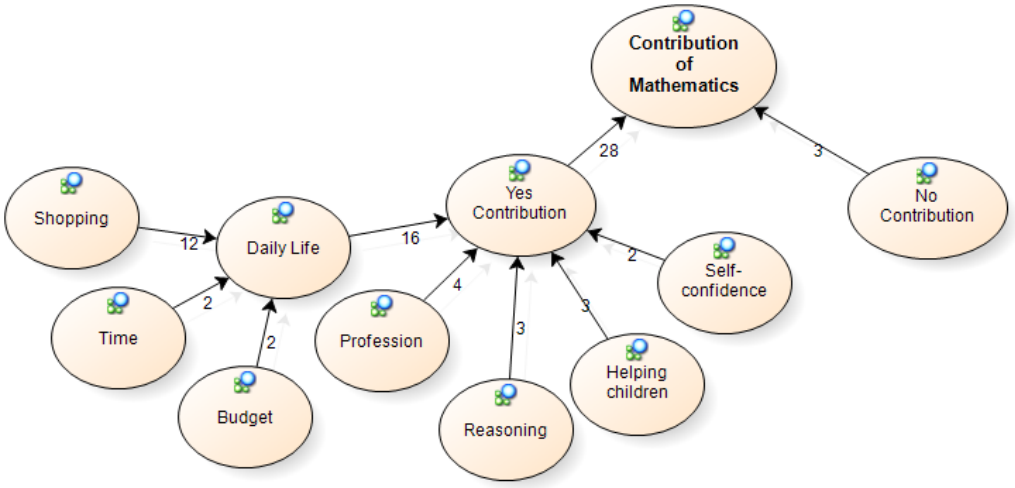

Figure 3. Contribution of Mathematics

While one of the participants stated that, *"Of course, either positive or negative, everything in our life is related to mathematics. The cashier made mistakes many times, she gave me too much change, I gave back money many times"* (P-7); another participant stated that;

> *I don't think mathematics was that effective in my life apart from in the exam I took while getting my profession. We don't use mathematics that much during daily life, we use basic mathematics. Almost everyone has that knowledge, what it actually furnishes us with is not a direct but an indirect system; when I think of it as a whole, it helps learning to adapt to a new system and seeing the deficiencies and feasibilities of that system, it directs you as a way of thinking. It provides you with the skill of adapting to a newly established system.* (P-8)

A participant who believed that mathematics does not have a contribution stated that *"No, I don't live with mathematics. I live in a world where there is no mathematics, money is a number, time is a number. But literally I don't live with mathematics, that's why it doesn't*

have any contributions" (P-2). With the following opinion, one participant expressed the contributions of mathematics to their life as;

> *It provides us with many things, how many kilometers has this vehicle gone, how many kilometers later will I reach a place, how long will it take, I drive a car but how many kilometers? We definitely need mathematics, we need it at the bazaar, everyone does shopping, mathematics is necessary.* (P-13)

Losses due to Mathematical Competency

The participants believe that they will experience losses due to cases of mathematical incompetency. While the majority of participants stated they will have difficulties in daily life; some participants stated that their self-respect will become damaged and that they will have difficulties in their professional life.

One participant expressed that, *"I think it's a loss; I have difficulty in making calculations, especially when giving larger amounts of change"* (K-1), while another participant stated;

> *We will not be financially successful in life if we don't know how to calculate. We won't be successful if we don't know where we spend the money in our pocket, our life will become a dead end. At least story problems are necessary in every area of life, field measurement, square... Although we don't use them much in life; division, multiplication, subtraction – we at least have to know these.* (K-18)

A participant who believes that people will encounter big losses in their professional life stated that,

> *I would have had big losses, you would have a lower chance of working, would be paid less, experience trouble with building measurements, the height of stairs etc. These are all are related to mathematics. It would have been a bit difficult without mathematics.* (K-6)

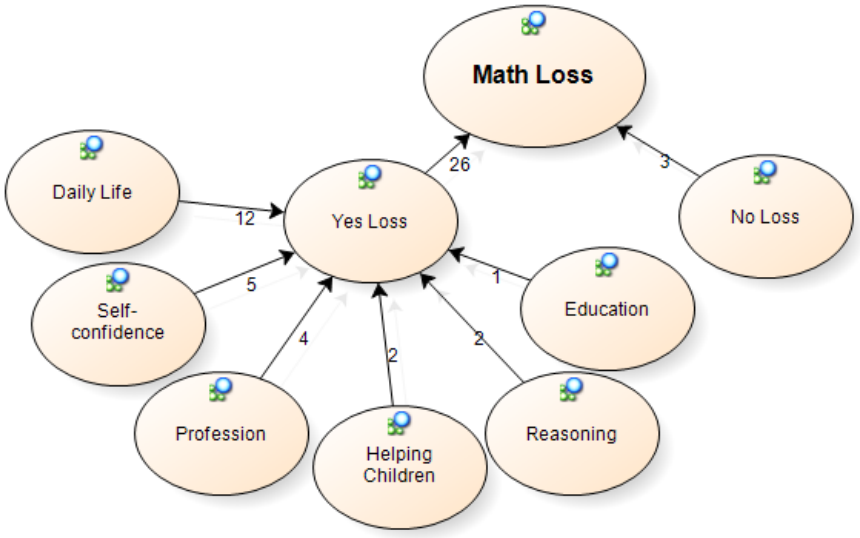

Figure 4. Losses due to Mathematical Incompetency

Mathematics Used in Daily Life

The participants gave positive answers to the question, "*Do you use mathematics in your daily life, which areas do you use it in?"* from the interview form. They underlined that they use mathematics especially when shopping, in the kitchen, for time, in budget management and in their professional lives. While one participant who uses mathematics in daily life stated that, *"Yes, I plan my cooking through like a glass, during shopping and on a journey and when paying for shopping you calculate, you calculate how many kilos you will buy and how much you will pay for them"* (P-3); another participant stated that;

> *We use it in everything we plan; for example when we plan a journey we calculate the time, distance, costs, and also when we go shopping. We use story problem in money and budget planning and also in business life. There should be a certain proportion when you want a building or a piece of work to look good, we use it as a proportion.* (P-8)

Another participant stated that;

> *I usually use it during shopping, when my children ask me something about mathematics, when I explain a problem to them, when cooking, I measure grams when baking a cake. You use it in recipe measures, you measure in meters too. When I am going to change rooms I change it according to meter measurements, I do painting according to square meter measures.* (P-19)

One of the participants stated the advantages of mathematics in budget management as;

> *I use it during my lessons, in family budgeting, when purchasing something, I don't find it necessary to buy things that are above our income level, I follow interest ratios, I delay buying something for two years, it is more profitable. I am going to get 10,000 liras bank loan and pay it back with interest in two years, so it will be better to wait, I don't fall into trouble.* (P-15)

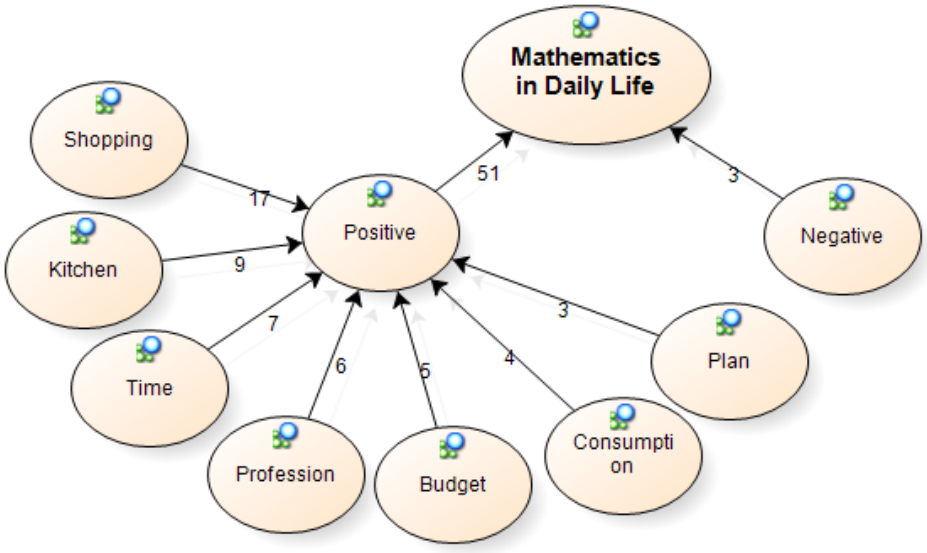

Figure 5. Mathematics Used in Daily Life

Enhancing Mathematical Competence

The participants gave different answers to the question, *"Do you want to enhance your mathematical knowledge? Why?"* While the majority wanted to enhance their mathematical knowledge and skills due to the idea that there is no age limit to learning; some participants stated they cannot learn and so they did not want to enhance it.

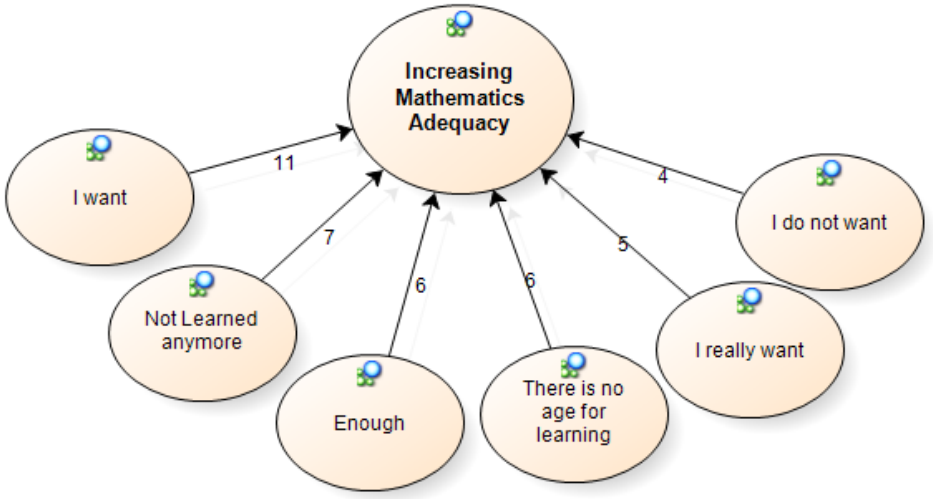

Figure 6. Enhancing Mathematical Competence

One participant stated, *"I do but it is hard after this age. I can't understand, I forget things but it would be more practical if I learned. I would have self-confidence and do calculations faster, I can't manage it though"* (P-1). While one participant stated, *"I believe I have learned enough. I don't think it will contribute to me that much now, I have aged, you learn when you are young. Mathematics is not possible after a certain time"* (P-4); another participant stated that;

> *I'd love to. I would love to go back to the start again and repeat it. I didn't used to like geometry. I would have wanted to learn geometry from the beginning right now. But I would want to be able to help my children with their lessons the most. I would like to enter the ALES* [Academic Personnel and Graduate Education] *exam, if there is a course and if the schedule suits, I would like to attend it. My children are very young, they are going to start school.* (P-9)

Conclusion and Recommendations

The following results were obtained in the study, which aimed at determining the opinions of adults on mathematics:

How adults define mathematics: Adults emphasized that mathematics is related to daily life, it consists of numbers and requires story problems, and that it is a science used while shopping. Mathematical skills such as considering, problem solving and reasoning were not underlined.

Mathematical perceptions of adults: The majority of the participants were observed to like mathematics, are successful in it and have fun while dealing with mathematics. In

addition, it is considered that the attitudes and behaviors of teachers affects whether or not one likes mathematics and believed that it is a difficult field of science.

Contributions of mathematics to adults: Adults observe the effects of mathematics, not only in their personal developments but also within their lives. They use mathematics in their daily life when going shopping, in time-budget management, in their professional life, for their reasoning skills and when helping their children with their homework.

Losses due to mathematical incompetency: Participants stated that they will encounter a loss in the case of mathematical incompetency. They will face difficulties in daily life, their self-respect will become damaged and they will have difficulties in their professional life.

Mathematics used in daily life: Adults use mathematics in their daily life, especially when shopping, in the kitchen, in time and budgetary planning and in their professional lives.

Enhancing mathematical competence: While the majority of the adults wanted to enhance their mathematical knowledge and skills due to the idea that there is no age for learning; it was observed that some participants did not want to enhance their mathematical competence because they believed their knowledge and skills to be lacking.

In Şahin's (2013) study that examined pre-service teachers' metaphoric perceptions on mathematics, pre-service teachers related the term mathematics with intelligence, entertainment, requirement, talent, difficulty and success metaphors.

The adults did not mention mathematical skills concerning reasoning, problem solving or creative thinking. Educational activities in which adults can improve their knowledge and skills should be prepared and they should be informed about lifelong learning activities. Thus, adults who believe they can no longer learn will make future plans more effectively. A daily life without mathematics is impossible. In order to free students from the negative bias towards mathematics, it should be emphasized that mathematics is a part of daily life. Books should be printed on how to use mathematics in the course of daily life and lessons on this issue should be included in the curriculum (İlgar & Gülten, 2013). When today's students are considered as tomorrow's adults, daily life and mathematics should be engaged when presenting to students so as to end the bias towards mathematics. Students see mathematics as only a lesson and do not know how to use it in daily life. In order to overcome this problem, examples of daily life should be concrete and an educational environment lacking rote learning should be provided (Civelek, Meder, Tüzen, & Aycan, 2003).

Mathematics is used by the farmer in the field for measuring, by a mason in measuring whether or not the wall built is straight and in the commercial business of artisans. Such daily life examples should be included in school mathematics and homework should be given so as to prove that mathematics is not limited to symbols and formulas; in addition, the researcher characteristics of students can be developed (Erdem et al., 2011). Necessary investment should be made with adults who have completed their school years so that they can obtain mathematical skills and in this respect, formal and extensive education regulations should be developed and applied. New programs and tools should be established for individuals to become literate in mathematics; thus the aim should be to increase Turkey's reputation in science and industry (Ersoy, 2003).

Many studies are being carried out in Turkey on mathematics education. According to PISA, an example for an international study and survey, Turkey is below the general average but has demonstrated significant progress in the past ten years. These studies are conducted to a high degree during pre-school, primary school, secondary school, undergraduate and post-graduate education levels (Taş et al., 2016). However, there is a need to develop an understanding for adults; who have completed their formal education, but who have not developed positive attitudes towards mathematics for various reasons, who have mathematical anxiety, lack mathematical skills, and who do not resort to mathematics during daily life. The aim should be to facilitate adult lives by providing a positive attitude, ending their mathematical concerns, and furnishing them with the necessary skills. The principle of lifelong learning through educational activities without setting an age limit can be valid for mathematics education too. Every individual deserves a second chance and everyone can learn mathematics. Yıldız (2010) underlined that there are no studies in Turkey directly examining mathematical skills of adults and stated that the majority of the studies examining basic adult education focus on literacy. Mathematics education should not only embrace students but should be extended so as to include adults as well. Studies on this subject can be focused on. Koç, Taş, Özkan, and Yılmaz (2009) suggested a graduate program for expert educators to make adult education more effective and productive in Turkey. The aim of this program is to raise experts who will carry out projects related to the interests and needs of adults in educational activities organized for adults. Adult education can be carried out by competent and expert people by taking these suggestions into consideration.

Adults in Turkey showed lower performance than the other OECD member countries in general mathematical skills such as working and problem solving (Aydemir, 2016). Searching for the reasons as to why adults show low performance in general skills, especially in mathematical skills and seeking solutions for these problems is necessary. The current study is limited to the knowledge and experiences of the participants. A more comprehensive study can be conducted by increasing the number of participants. In addition, the research can be widened by conducting studies that measure mathematical knowledge and skills of adults.

Notes

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