National and Universal Values Specific to Mathematics Education from the Perspective of Prospective Mathematics Teachers

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ABSTRACT

The purpose of this study is to reveal opinions of prospective teachers about national and universal values specific to mathematics education. 230 prospective teachers attending 1st, 2nd, 3rd and 4th year Mathematics Teaching Program, Faculty of Education, Giresun University during fall semester of 2015-2016 academic year. The study utilizes the qualitative research approach. The data were analyzed via the descriptive and content analysis methods. Themes were obtained as a result of the data analysis: love and value, righteousness, protecting cultural heritage, placing importance on aesthetics, fairness, patriotism, humility, leadership, creativity and success, sharing, independent and free thinking. It was found as a result of the study that prospective teachers sufficiently internalized national and universal values specific to mathematics education. In conclusion, it is expected that prospective teachers, who will be implementers of the curriculum in near future, possess values specific to mathematics education.

Keywords: *Mathematics education, national and universal values, prospective mathematics teacher.*

INTRODUCTION

The notion of value, a concept that all humans consciously or unconsciously live with, lies behind the principles and beliefs, which direct an individual's behaviour and determine whether an individual's behaviours are acceptable (Halstead & Taylor, 2000). Values also include the development of social, cultural, attitudinal and individual characteristics (Matthews & Smith, 1995; Seah, 2002). Maslovaty (2003), defined values as national values (state, nation, homeland, language, traditions, army and national anthem, national flag, national symbols created by national festivals), and universal values (democracy, human rights and freedoms, peace, tolerance, love, respect, independence, science, equality and environmental sensitivity). Factors such as the country, its cultural structure and the individual value preferences of the teacher all affect decisions regarding how each value will be thought of in 'values education' (Halstead & Taylor, 2000; Veugelers & Vadder, 2003). Teachers have classified national values as values specific to a nation and universal values as values belonging to the whole world (Yasar, Kasa & Gurdogan-Bayir, 2015). From this standpoint, it can be said that the national values may differ from country to country, but there is no difference in terms of field or discipline. Values are found in almost every area, such as a teacher's preparation of the learning environment (Powell, 2010), implementation of activities, instructional strategy, in her/his content selection, behaviour in the classroom, and attitude towards the student (Veugelers & Vedder, 2003).

It is known that the Ministry of National Education (2006) defines the qualifications of a teacher as including their individual and professional values, teaching-learning process, monitoring and evaluating learning and development, school, family and community relations, program and content knowledge. Individual values, which are one of these qualifications (MEB, 2010) are integrative conditions accepted by society individuals, criteria believed to meet the social needs of the society and to function for the well-being of the individuals, judgments concerning emotions as well as conscious thoughts and motives that direct behaviour. Values education in Turkey has been included in different courses (with the exception of mathematics) including the life sciences, social studies, religious culture and moral knowledge from the 1924 primary school curriculum to the programme updating studies in 2017. However, it has been thought that it would be useful to integrate values into the contents of all the courses taught in schools instead of the contents of the courses specific to social sciences. Matthews (2001), stated that values have an influence on learning behaviours and that the learners who benefit from the upper level of values education are equipped with a strong strategy/method. From this point of view, it seems obvious that values education will directly reflect on the teacher's in-class practices. For this reason, it is regarded as significant for the participants to be aware of related values before they start to work as a teacher and to reflect values in their courses regardless of the field. Within this scope, it is also a known fact that pre-service training and in-service training will contribute to the professional development of the teacher (Villegas, 2003).

It has been seen that, in addition to teachers, parents, mathematicians, and even ordinary individuals describe mathematics as a "value-free" subject in values education (Clarkson, FitzSimons, Bishop & Seah; 2000; Bishop, Clarkson, FitzSimons, & Seah, 2000). Moreover, it can be also propounded that values education is not warmly accepted because Maths classes in schools are focused on academic achievements (Bishop, Clarkson, FitzSimons & Seah, 2000; Seah & Bishop, 2000; Jurdak, 1999). However, mathematics has a value, which can be encountered at any moment in everyday life and leads us to the solution of real life problems quite apart from the scientific, technological and academic worlds. In another sense, mathematics involves skills related to calculations, concepts, and problems; real mathematical problems can be solved by reasoning rather than by mathematical rules learned at school (Seah, 2001). In particular, beyond being a lesson, mathematics is a way of life, and we use it daily without even realizing (Hacisalihoglu Karadeniz, 2013). As is known, Maths classes are available at every level and in every discipline, from pre-school, primary and secondary education even up to higher education programmes (Baykul, 2014). This subject, which is encountered in every period of human life, is a universal language and culture that enables us to systematically convey our abstract thoughts as well as being a science that examines the properties of abstract entities such as numbers, geometric shapes, functions, space and their relations (Hacısalihoglu, Mirasyedioglu & Akpinar, 2004). Thus, in these terms, mathematics, like all the social sciences, contains many values common to the human being, who is a socio-cultural being (Bishop, 2002b; Seah & Bishop, 2000). From this standpoint, it becomes important to investigate the values specific to mathematics education.

Teaching values in mathematics education, expecting students to be honest, to be respectful to others, and to make logical decisions during the studies they conduct are outcomes that must be achieved in all lessons, not just in Maths classes (Bishop, 2002a; Seah & Bishop, 2003). The educational values of mathematics inferred by mathematicians who have lived in different civilizations include accuracy, clarity, conjecture, consistency, creativity, effective organization, enjoyment, flexibility, open-mindedness, persistence and systematic working (Bishop, 2004). In mathematics education, regarding values, most mathematics teachers have difficulties in associating values with mathematics topics and teaching them to students (Seah, 2002). The mathematical knowledge of individuals with different thinking skills in society encounters obstacles in terms of language, geometric concepts, algorithms, symbolic representations, reasoning, attitude, purpose and cognitive preferences, value and belief (Bishop, 2004). Therefore, in the present study, the aim is that the participants who will eventually start working and teaching mathematics realize what the

values specific to mathematics education might be in the process and do not have any difficulties adapting them to their lessons in the future.

The participants have a significant role to play in countering many problems that we experience in both global and local dimensions, such as racism, gender discrimination, violence, intolerance, hatred and hate speech. Their role is necessary to ensure the learner internalizes specific values and attitudes because, in values education, the internal participation of the learner, and her/his ability to come to her/his own internal view of events happening is necessary (Silcock & Duncan, 2001). Students who acquire a viewpoint through their own free will without any constraint can direct their thoughts and behaviours in the desired direction (Crick, 2000). For this reason, it is crucial that values education becomes one of the cornerstones of the education system and is no specific to certain courses but is associated with all disciplines. Therefore, since studies that examine the perceptions of the participants regarding the values they can acquire in mathematics education will provide important information and perspectives to educators, this issue has been investigated in the study. Furthermore, studies on mathematics educational values in the literature have been examined (Dede, 2007; Durmus, 2004; Durmus & Bicak, 2006; Durmus, Bicak & Cakir, 2008; Doruk, 2012) and it can be seen that the number of studies specifically discussing mathematics educational values is limited. In this respect, the study aims to fill the gap in the literature by determining the thoughts of prospective teachers regarding the national and universal values specific to the mathematics education that they are acquiring.

METHOD

Research Design

In this study, the qualitative case study was used because the aim was to present the opinions, perceptions and experiences of prospective teachers related to the values specific to mathematics education in holistic, deep and flexible ways (Baxter & Jack, 2008; Yin, 2009). The reason why the qualitative method was used in the study is because for the researchers, it provides a deep understanding of the phenomenon they are examining (Patton, 2002).

Research Group

The study was conducted with 230 prospective teachers who were first, second, third and fourth-year students studying in the Mathematics Education Department of the Faculty of Education at Giresun University during the fall semester of 2015-2016 academic year. The names of the participants were kept confidential within the scope of the ethical rules of the research. Following these research ethics, first-year students of the mathematics education department with whom the questionnaire was conducted, were coded as P11,…, P168; second-year students as P21,..., P250; third-year students as P31,…, P343; fourth year students as P41,…, P469.

Data Collection Tool

The research data were collected through an open-ended "*Mathematics Educational Values Questionnaire Form*" that was developed and the created by the researcher for this purpose because the study is a case study and the original answers to the questionnaire were needed for it to achieve its goal. One way to achieve this was to use an open-ended questionnaire. As the form was being developed, questions were formulated regarding the thoughts of prospective teachers about national and universal values specific to mathematics education from their perspectives. After the completion of the development phase of the questionnaire, participants in the sample were given three days to complete them so that they could freely write their views. Following this, the questionnaires were collected.

Data Analysis

The data within the scope of this study were analysed using both descriptive and content analysis methods. First, the collected data were recorded as a word document, then the answers given by the participants to the questions were subjected to descriptive analysis. Afterwards, themes and codes were deduced from the data with the help of content analysis. Finally, the frequencies of the codes were calculated. In the qualitative data analysis, participants were asked to read the answers they had given; thus participants identity was verified, and, if there were any misunderstandings, they were corrected to increase the reliability and validity of the research results (Yanow & Schwartz-Shea, 2006). Similar data were gathered within the framework of specific themes, and associations and encodings were made using the data. In presenting the study results, limits privacy was respected, and the raw data obtained was only quoted from the questionnaire responses after personal identifying information of the participants had been removed and numbers given to the participants. It was promised that their answers to the questionnaire would only be used to provide data for the research, and not be shared with anyone (Patton, 2002).

FINDINGS

Findings Related to the Research Question: "Do you like maths? What do you think about this topic as a maths teacher?"

Because of the analysis of the answers given by the participants to the question *"Do you like maths?"* the theme of *Love and Value* emerged. 17 different codes were created and are presented in the diagram below. Among these 17 codes, the most frequently found code is *Being Enjoyable*. The findings related to this code and the other 16 codes are given in Diagram 1.

When Diagram 1 is examined, it is seen that under the *Love and Value* theme participants made statements relating mathematics to enjoyment, daily life, abstract thinking skills, games, cognitive thinking skills, infinity, reflecting oneself, variability depending on teacher's behaviours and attitudes, logic, being boring, being irreplaceable, being a guiding method and the basis of all sciences, being universal, and being an art. It is also seen that 98 of the participants stated that they enjoy dealing with mathematics; f=44 stated that mathematics starts the moment we get up, f=12 stated that mathematics develops abstract thinking skills, and f=10 stated that mathematics is a game. Some of the participants' statements regarding the *Love and Value* theme which are prominent on the diagram are given below, along with their subcodes:

> *"I like maths because I enjoy finding answers to problems, understanding subjects and dealing with numbers. I realize that I value more if I am more successful. I think that my teachers are also contributing to my love for this subject.* (P413) - Being Enjoyable". "*Yes, I love it, because the moment we get up, mathematics starts. There is mathematics in everything and everywhere.* (P128) - Being Daily Life". *Yes, I love it because mathematics develops abstract thinking skills in people. In this way, we become familiar with 3D objects.* (P112) - Developing Abstract Thinking Skills".

Findings Related to the Research Question: "Can mathematical knowledge be falsified over time? What do you think about this issue as a maths teacher?"

As a result of the analysis of the answers given by the participants to the question *"Can mathematical knowledge be falsified over time?"* the theme of *Accuracy* emerged, and 6 different codes were created under this theme and are presented in the diagram below. Among these 6 codes, the most frequent code is *Being Changeable*. Findings regarding this code and the other 5 codes are given in Diagram 2. When Diagram 2 is analysed, it is seen that, under the *Accuracy* theme, the participants made statements related to changeability, objectivity, falsifiability, comprehensiveness, development and integrity. 95 of the participants stated that mathematics cannot be falsified but can change, f=35 participants stated that mathematical knowledge builds on itself, so that it develops

over time and that it has become comprehensive in this way. Some of the participants' statements regarding the *Accuracy* theme and the sub-codes for this theme are given below:

> *"Mathematics cannot be proven false but it can change. For example, in contrast to Euclidean geometry (the sum of the interior angles of a triangle is 180 degrees) introduced by Euclid 2000 years ago, non-Euclidean geometry (the sum of the interior angles of a triangle is different from 180 degrees) started to be used.* (P443) - Being Changeable". "*Yes, it can be falsified. According to Popper, a claim that cannot be falsified cannot be a scientific theory (a hypothesis). An explanation has to be falsifiable in order to be scientific. According to this, of course mathematics can also be falsified in time. Mathematics is successive and accumulative; it builds on itself. It develops over time and becomes comprehensive.* (P118) - Being Comprehensive".

Findings related to the Research Question: *"It is said that Mimar Sinan solved an equation with 13 unknowns creating a 5th operation that was different from the 4 known main mathematics operations in order to successfully make Selimiye Mosque's dome the width it is. What do you think about this issue as a mathematics teacher? "*

As a result of the analysis of the answers given by the participants to this question, the theme of *Preservation of Cultural Heritage* emerged. Under this theme, 15 different codes were created and are presented in the following diagram. Among these 15 codes, the most frequent code, referring to Selimiye Mosque, is *Being the Masterpiece of his Creative Intelligence*. Findings related to this code and the other 14 codes are given in Diagram 3. When Diagram 3 is examined, it is seen that, under the *Preservation of Cultural Heritage* theme the participants made statements related to creativity, culture, intelligence, versatility, using maths in all areas of life, thinking skills, innovation, being the source of pride, authenticity, achieving an extremely difficult objective, modelling, aesthetics, the golden ratio, not using a fifth operation and that mathematical knowledge not being theorized yet. 47 of the participants stated that Mimar Sinan drew in a distinctive and different way; f=31 stated that Mimar Sinan reflected the culture of that time in his works, and f=14 participants stated that he built his masterpiece using his versatile thinking skills. Some of the participants' statements regarding the *Preservation of Cultural Heritage* theme and the sub-codes for this theme are given below:

> *"Mimar Sinan solved the problem by drawing in a distinctive and different way, thinking mathematically. In other words, he used conceptual learning. Also, in this work, he built a masterpiece using his creativity. I think that it is possible for everyone to develop their own distinctive solutions to the problems around us.* (P46) - Being the Masterpiece of his Creative Intelligence". "*It is true because we are talking about a great architect, an artist. A fifth operation can be created with a different mindset. The architect does not just draw, but he reflects the culture of his time in his works, and Mimar Sinan did this by integrating it with mathematics in the best way.* (P218) - Blending with Ottoman Culture". "*At first we saw Mimar Sinan only as an architect, but in his works we see that he is a mathematical scholar. In order to make the big dome, he first built small domes; in fact, he built his masterpiece by using his versatile thinking skills. This shows that he was a genius. I am as proud as if I were a grandson of such a genius, and we can continue to develop mathematics by following in his footsteps.* (P39) - Having Versatile Thinking Skills".

Findings related to the Research Question: *"In the Selimiye Mosque, which is Mimar Sinan's masterpiece, marble and calligraphy are also important. The interior of the building is decorated with Iznik tiles. What do you think about this issue? "*

As a result of the analysis of the answers given by the participants to this question, the theme of *Placing Emphasis on Aesthetic Feelings* emerged. Under this theme, 11 different codes were

created and are presented in the following diagram. Among these 11 codes, the most frequent code is *Placing Emphasis on Aesthetics*. The findings related to this code and the other 10 codes are given in Diagram 4. When Diagram 4 is analysed, it is seen that, under the *Placing Emphasis on Aesthetic Feelings* theme the participants made statements related to aesthetics, using mathematics in every detail, pattern, art, multiple intelligence, visuality, creativity, working very hard, culture, traditional understanding and probability. While 71 of the participants stated that Selimiye Mosque is the most artistic architectural work in the world, it is seen that f=55 stated that mathematics is used in every detail of it. Some of the participants' statements regarding the *Placing Emphasis on Aesthetic Feelings* theme most frequently found in the diagram, and the sub-codes for this theme are given below:

> *"Sinan the Architect is not just a person but also a scholar. With his knowledge and the research he did during the Ottoman period, he created an unprecedented work. Selimiye Mosque is the most artistic architectural work in the world. This shows the emphasis that Mimar Sinan placed on aesthetics.* (P110) - Placing Emphasis on Aesthetics". "*In the marble and workmanship of the masterpieces as well as in the ornamentation made with tiles, there is also the influence of mathematics. There is a certain measure, angle and connection between the harmony in the ornamentation and the successive structures. In short, I think there is mathematics in every detail.* (P116) - Using Mathematics in Every Detail".

Findings related to the Research Question: *"Making its faces smooth, breaking its corners, or changing the weight of the interior changes possible dice combinations. What do you think about this issue as a mathematics educator?"*

As a result of the analysis of the answers given by the participants to this question, the theme of *Being Fair* emerged. Under this theme, 13 different codes were created and are presented in the following diagram. Among these 13 codes, the most frequent code is *Being Fair*. Findings related to this code and the other 12 codes are given in Diagram 5. When Diagram 5 is analyzed, it is seen that, under the *Being Fair* theme, the participants made statements related to variability, fairness, being different of each field for per number, being a human construct, objectivity, self-improvement, creativity, the importance of probabilities, the abilities provided by mathematics, ratio, mathematics' relation to other sciences and the necessity to be sceptical. It is also seen that 76 of the participants stated that probabilities always vary and f=52 stated that one should be unbiased in every case involving a probability. Some of the participants' statements which are most frequent in the diagram for the *Being Fair* theme and the sub-codes for this theme are given below:

> *"Changing the shape, weight and size of an object means changing the centre of gravity. If you diminish a dice and make it a dice of 7 grams when it should be 10 grams, you cause the centre of gravity of this dice to change. For example, umbrellas at a market have been produced using a specific centre of gravity. Changing this centre of gravity means destroying the umbrella's function, so probability changes constantly in this case.* (P337) - Being Variable". "*Mathematics is like a thin line. Its position should not be played with. The slightest change to the dice changes all possibilities. The important thing is that even if the mathematician knows that he is going to fail at a task, he should always be fair and accept the result of everything.* (P225) - Thinking that a Mathematician Should Be Fair".

Findings related to the Research Question*: "According to Article 3 of the 1982 Constitution, the flag of the Turkish Republic is a red flag with a moon and a star on it. The red colour is designated as Pantone 186 and RGB (227, 10, 23), as mentioned in the law. As a mathematics educator, what do you think about drawing the flag?"*

As a result of the analysis of the answers given by the participants to this question, the *Patriotism* theme emerged. Under the *Patriotism* theme, 16 different codes were created and presented in the diagram below. Among these 16 codes, the most frequent code is *Using Some Mathematics*. Findings related to this code and the other 15 codes are given in Diagram 6. When

Diagram 6 is examined, it is seen that, under the *Patriotism* theme, the participants made statements relating the flag to the use of mathematics, being important, not accepting mistakes, skills required, expressing the 5 pillars of Islam, the golden ratio, holiness, independence, general its validity, different meanings of the points of the stars, patriotism, becoming meaningful during war, reflecting history, following the law, and not being related to mathematics. It is also seen that 115 of the participants stated that mathematical calculations should be made while drawing the locations of the moon and a star in relation to each other, f=21 stated that we should place importance on the drawing of our flag, which is the symbol of our independence. Some of the participants' statements which are most frequently found in the diagram regarding the *Patriotism* theme, and the sub-codes for this theme are given below:

> *"There are rules that must be followed while drawing our flag, which is the symbol of our independence. These rules are mathematical. Regardless of the size of the flag, the width is taken as the main source of all measurements. Measures are obtained with reference to the width. Someone who does not know mathematics cannot even draw the symbol of our flag.* (P432) - Using Some Mathematics". "*I remember, during the middle school period, when I was drawing the stars and the moon, there were certain mathematical rules for the slope of the moon and the spaces between them. A flag is very important for a nation and must be drawn, sewn and hung everywhere. Therefore, the use of these mathematical rules is always important.* (P214) - Giving Importance to Flag Drawing".

Findings related to the Research Question: *"When a wise person is promoted to a higher rank, his nobleness (modesty) increases (Hz. Idris A.S). What do you think about this issue as a mathematics educator?"*

Because of the analysis of the answers given by the participants' to this question the theme of *Modesty* theme emerged. Codes were created under this theme and are presented in the diagram below. Among these 18 codes, the most frequent code is *Thinking that a Scientist Is Modest*. Findings related to this code and the other 17 codes are given in Diagram 7. When Diagram 7 is analysed, it is seen that, under the *Modesty* theme, participants' made statements related to the modesty of a scientist, self-improvement, thinking more and speaking less, not needing to prove oneself, acting depending on the situation, maths not having a relation to modesty, being loved, virtue, responsibility, eternity, intelligence, personality, being proportionate to the rank or the title, tolerance, imagination, and being similar to each other. It was seen that 50 of the participants stated that it is not a 'rank' or 'title', as mentioned in the question that indicates modesty, but tagwa (piousness) or virtue, f=47 stated that a modest mathematician improves himself. Some of the participants' statements which are frequently found in the diagram regarding the *Modesty* theme and the sub-codes for this theme are given below:

> *"First I want to state that it is not the rank here, but tagwa. The closer a human gets to Allah, the more valuable he is. A scientist is modest. Mathematics is also a science. For this reason, as mathematicians we should give the impression that we do not know anything, even though we do know.* (P323) - Thinking That a Scientist is Modest". "*Being promoted to a higher rank means that his knowledge and experience increases. My opinion on this subject is the saying that, "The only true wisdom is to know that you know nothing.* (P24) - Self-Improvement".

Findings related to the Research Question: *"Ataturk, the leader and the founder of the Republic of Turkey, used his mathematical intelligence successfully in every part of his life. Do you think that this contributed to his leadership?"*

Because of the analysis of the answers given by the participants to this question, the theme of *Leadership* emerged. Under this theme, 15 different codes were created and are presented in the

following diagram. Among these 15 codes, the most frequent code is *Being a Leader in Every Field*. Findings related to 14 codes are given in Diagram 8. When Figure 8 is examined, it is seen that, under the *Leadership* theme, participants made statements related to being a leader in every area, mathematical intelligence, farsightedness, problem- solving skills, success, objectivity, translating geometric terms into Turkish, having a different perspective, innovativeness, multiple intelligence, cognitive thinking skills and the importance given to details. It is also seen that 74 of the participants stated that Ataturk achieved victories in many fields and became a leader using his mathematical intelligence and f=41 stated that he used his mathematical intelligence in every area and reflected this in his everyday life. Some of the participants' statements regarding the *Leadership* theme which are most frequently found in the diagram and the sub-codes for this theme are given below:

> *"Yes, I think it contributed. Thanks to the support his maths teacher gave him, he took his first steps as an intelligent child, and this made him a respected, farsighted individual in the future. Together with mathematics, he started to place emphasis on education and won many victories using his mathematical intelligence in every area. He showed qualities of leadership in all fields. (P114) - Becoming a Leader in Every Field". "Events, people, in short, everything in the whole universe is related to mathematics. For this reason, Ataturk shaped his mathematical intelligence by using it in every area and practicing it in his life in order to perform his duties in the best way. (P327) - Mathematical Intelligence".*

Findings related to the Research Question: *"How does being creative affect success in mathematics education? What do you think about this issue as a mathematics educator?"*

As a result of the analysis of the answers given by the participants to the question "*How does being creative affect success in mathematics education?"* the theme *Creativity and Success* emerged. Under this theme 20 different codes were created under the *Creativity and Success* theme and are presented in the diagram below. Among these 20 codes, the most frequent code is *Increasing Success through Different Perspectives*. Findings related to this code and the other 19 codes are given in Diagram 9. When Diagram 9 is examined, it is seen that, under the *Creativity and Success* theme, prospective teachers made statements related to increasing success, authenticity, expanding horizons, problem*solving strategies, creativity, abstract thinking, effective solutions, imagination, convenience, productivity, nature, practicality, drawing, not affecting success, mathematics' relationship to itself and other fields, being the foundation of mathematics, and being a gift given by God. It is also seen that 40 of the participants stated that different perspectives increase success, f=35 stated that original methods could be found instead of applying a uniform method to solving a problem, and f=31 stated that creativity increases success by expanding horizons. Some of the statements by the prospective teachers theme found in the diagram regarding the *Creativity and Success*, and the sub codes for this theme are given below:

> *"If we are creative, we can find different solutions by using our creative thinking skills when we cannot solve a problem. For example, we use real objects in situations where abstract thinking does not work. If real objects are not available, we use other materials. In this way, we materialize the abstract data.* (P216) - Increasing Success through Different Perspectives"*. "While solving a problem, we can use original methods instead of applying a uniform method. Instead of looking at the question as just a question that is presented to us, we need to understand and interpret its meanings from a different perspective. This increases success*. (P45) – Authenticity"*. "It has a positive effect. Being creative not only allows us to master the equations, problems, methods, but also other theories that are waiting to be discovered on the other side of the horizon. This also affects success positively.* (P155) – Expanding Horizons".

Findings related to the Research Question: *"In mathematics education, researching a subject by creating small groups, preparing an activity, studying towards a common goal to solve a problem, and carrying out tasks bring individual success. What do you think about this issue?"*

As a result of the analysis of the answers given by the participants to this question, the *Being a Sharer* theme emerged. Under this theme, 17 different codes were created and are presented in the following diagram. Among these 17 codes, the most frequent code is *Thinking That Collaboration Increases Success*. Findings related to this code and the other 16 codes are given in Diagram 10. When Diagram 10 is examined, it is seen that, under the *Being a Sharer* theme, prospective teachers made statements related to success, expanding horizons, sharing, responsibility, self- confidence, different perspectives, peer education, variability depending on group characteristics, from part to whole relationship, mathematical thinking, cooperation, brain-storming, permanence, validity of ideas, performing tasks equally and seeing oneself as a mathematics educator. It is also seen that 48 of the participants stated that working cooperatively increases individual success, and f=27 stated that superior knowledge should be shared. Some of the statements of the prospective teachers regarding the *Being a Sharer* theme which are prominent in the diagram and the sub codes for this theme are given below:

> *"Working cooperatively in mathematics increases individual success because mathematics is such a mythical field that individuals can develop very different ideas about any topic or question. Someone may master a subject in a quick and easy way, some through the most memorable way, others through different methods. This can help even a person who does not love and understand mathematics at all. It can help him or her like mathematics more, and increase his or her interest in mathematics. If we look at it from another angle, it can help new theorems develop and expand his or her horizons. It can contribute to the development and the improvement of mathematics.* (P111) - Thinking that Cooperation Increases Success". "*Learning different ideas and knowledge of people increases our individual success. It is selfish to put forward your superior knowledge in group work. I'd like to study in a group by sharing my superior knowledge and learning what other people in the group know. Also sharing our knowledge shows the value we give to mathematics.* (P25) - Being a Sharer".

Findings related to the Research Question: *"A mathematician who has not gained a mathematical culture remains only among books, which gives him a narrow range of action. As the field of action narrows, knowledge is presented in a stereotypical way. More generally, the mathematician develops a one-sided, prejudiced understanding. What do you think about this issue as a mathematician?"*

As a result of the analysis of the answers given by the participants to this question, the *Independent and Free Thinking* theme emerged. Under this theme, 16 different codes were created and are presented in the diagram below. Among these 16 codes, the most frequent code is *Being Free*. Findings related to this code and the other 15 codes are given in Diagram 11. When Diagram 11 is analyzed, it is seen that, under *Independent and Free Thinking* theme, prospective teachers made statements related to freedom and independence, having trouble in practice, nature, creativity, cultural interaction, different perspectives, the history of mathematics, authenticity, prejudice, modernity, group work, mathematical culture, objectivity, mathematical thinking and the testability of knowledge. 39 of the participants stated that a mathematics educator should be a free person, not a prisoner, f=30 stated that superior knowledge should be shared, and f=18 stated that a mathematician who has not gained mathematical culture, cannot put her/his knowledge into practice. Some of the statements of prospective teachers regarding the *Independent and Free Thinking* theme that is prominent in the diagram and the sub codes for this theme are given below:

> *"Mathematics does not consist just of the rules in books, and the mathematics*

educator is also not just the person who presents these rules. Mathematics' field of interest is to teach how mathematics can be taught effectively and permanently. In this case, a mathematician can be independent by internalizing her or his own knowledge, not depending on others. A mathematics educator can improve him or herself and become independent if he is interested in the nature of mathematics. (P246) - Being Independent". "*Practical mathematics is not just about x, y, z. Mathematics is a whole and everyone can learn when they are asked to or can teach as long as s/he is at a higher level than the student. Then maths is fun. That is why we should not be satisfied with only theoretical information. We have to put it into practice. The mathematician, who does not have mathematical culture, cannot put his or her knowledge into practice, and his or her knowledge stays as theoretical knowledge.* (P44) - Living Trouble in Practice".

RESULTS AND DISCUSSION

To provide a better future for the Turkish people, instead of teaching stereotypical mathematics full of rules, mathematics could begin to be taught to students in a way they feel is strong and valuable and which makes them internalize the value of mathematics. Dede (2007) has emphasized the necessity of giving importance to the values education dimension in mathematics education so that students can also discover the values inherent in mathematics. A prospective teacher who has gained these values will have taken the most basic and necessary step for a good mathematics education because, according to Umay (2007), for the problems adapted from the real world, mathematics can be a part of life, sometimes a key skill, sometimes even a game for *the learner* who sees patterns, establishes relationships, knows what he or she is finding and why and how make his/her own decisions. Therefore, mathematical values are closely related to mathematics educational values and general educational values (Seah & Bishop, 2000). However, the effort of making learners do lots of exercises to consolidate a topic that might be encountered in exams, or providing techniques that are quickly forgotten to use in difficult problems, prevents the aesthetic aspect of mathematics from being experienced (King, 2004). Thus, learning mathematics is not limited to the acquisition of basic concepts and skills. To learn mathematics includes notion of mathematical thinking (Arslan & Yildiz, 2010; Yildiz, 2016), reasoning (MEB, 2013), comprehending problem-solving strategies (Altun, 2015) and realizing that mathematics is used in real life. For this reason, it is important to implement practices that make students see mathematics as *sensible, worthwhile and important*, and make them study *with attention and patience* (MEB, 2013). Thus, it will be easier for the students to find their own solutions to problems that grab their attention and belonging to their own world, to enjoy the activities, and to learn values through mathematics.

In the education faculties of the universities, there are no courses related to the values education. This situation can lead to the lack of awareness in prospective teachers regarding values education. Moreover, most of the values that prospective mathematics teachers are expected to have are the kind that can be gained in Maths lessons. For this reason, this study has tried to determine what prospective teachers think about national and universal values specific to mathematics education. When the findings of the present study are examined, it is seen that the code most frequently used by the participants under *Love and Value* theme is *Being Enjoyable*. Within this context, it is concluded that prospective teachers enjoy dealing with mathematics. In the studies of Chin & Lin (2001) and Clarkson et al. (2000), they defined the value of enjoyment as feeling pleasure when engaged in mathematics and learning mathematics by having fun. This result is quite similar to the value that *mathematics is enjoyable* which has emerged in the study. It has been determined that the *Being Part of Daily Life* code is also a frequently used code, and within this frame, participants stated that mathematics starts as soon as one goes out into the world. It is seen that the code most frequently used by the participants under *Being Accurate* theme is *Being Changeable*. Apart from the fact that something is either true or false in mathematics (Seah, 2001); regarding this

code, participants pointed out that mathematical knowledge cannot be falsified but can change. While traditional behaviourists argue that mathematics cannot be falsified, constructivists suggest that mathematical accuracy is contextual (Ernest, 1991; Golafshani, 2002). It is seen that the code most frequently used by the participants under the *Preservation of Cultural Inheritance* theme is *Being the Masterpiece of His Creative Intelligence*. Within the scope of this code, participants stated that Mimar Sinan forged an authentic and distinctive path for himself. The *Blending with Ottoman Culture* code is also a frequently used code. Mathematics is the foundations of the domes and minarets of Selimiye Mosque. Therefore, it is obvious that Mimar Sinan's has solved 13 unknown equations to fit the dome of the mosque to the desired width, and this is done with unique mathematical intelligence (Duru & İşleyen, 2005). The views of the participants show that Mimar Sinan reflected the culture of his time in his works. Participants used the code *Having Versatile Thinking Skills*, though not to a great extent, and within this code they stated that Mimar Sinan built his masterpiece thanks to his versatile thinking skills.

> *"It is possible to see examples of Mimar Sinan's golden ratios in Turkish architecture and art. In the minarets of the Suleymaniye and Selimiye Mosques built by Sinan. In the crowned gate of the Ince Minaret Medrese built by the Seljuks in Konya, in the Davut Pasa Mosque in Istanbul, In the Divrigi Great Mosque inherited from Menguçogulları in Sivas, the golden ratio is observed (Duru & İşleyen, 2005)."*

It has been determined that the code most frequently used by the participants under the *Placing Emphasis on Aesthetic Feelings* theme is *Placing Emphasis on Aesthetics*. For this code, participants stated that Selimiye Mosque is the most artistic architectural work in the world. The *Using Mathematics in Every Detail* code is also a frequently used code. Within the scope of this code, the views of prospective teachers are based on the use of mathematics in every detail.

> *"Mimar Sinan showed one of the most beautiful applications of the helix curve in the three-stair minarets of the Selimiye Mosque in Edirne. The minarets would be with three balconies, at the same time as thin as possible, and those using separate stairs would not see each other. This could only be done by Big Sinan, who could combine great mathematical knowledge with architectural prowess. Even daring to think about such a project would be daring. That's the difference between Sinan and ordinary people (Sertöz, 2000)."*

It has been found that the code most frequently used by the participants under the *Being Fair* theme is *Being Variable*. Within this context, the participants expressed opinions about the continuous change in situations involving probability. Regarding the *Thinking That a Mathematician Should Be Fair* code, participants stated that *one should be unbiased in all cases where there is probability involved*. Within the scope of this, it can be expected that students will become aware of their rights and responsibilities, improve their communication and questioning skills and the skills of being able to participate in social activities and act responsibly (Davies, Gorrard & McGuinn, 2005). Gokcek & Baran-Kaya (2016) stated that prospective teachers wanted to have various values such as love, respect, justice and understanding (Gallavan, Peace & Thomason, 2009; Altunay & Yalcinkaya, 2011). Considering that teachers' value judgments influence students' learning and school performances (Reimen & Peace, 2002), it can be considered as a positive situation that prospective teachers attach importance to mathematics educational values. It has been determined that the code most frequently used by the participants under *Patriotism* theme is *The Use of Mathematics in Flag Drawing*. Within the context of this code, participants stated that mathematical calculations are made when drawing the locations of the moon and star on the flag in relation to each other. The *Placing Emphasis on Flag Drawing* code is also a frequently used code by the participants. In the primary school mathematics curriculum, in the "Measurement of Angles" sub-learning topic of 7th grade "Measuring and Learning", there was an educational objective that *"students draw a Turkish flag according to the measures stated in the Flag Law and make a Turkish flag using paper"* (Ministry

of National Education [MEB], 2009). Regarding *Placing Emphasis on Flag Drawing*, participants stated that importance should be attached to drawing of our flag, which is the symbol of our independence. For this reason, it seems very important to put the mentioned educational objective back into the updated curriculum. It has been found that the code most frequently used by the participants under the *Modesty* theme is that *a Scientist is Modest*. Within this code, participants argued that it is not the rank or the title that is in question but *tagwa*, or virtue. For the *Self-Improvement* code, participants stated that a mathematician who is modest will improve himself.

It has been determined that the code most frequently used by the prospective teachers under *Leadership* theme is *Being a Leader in Every Field*. Within this code, participants stated that Ataturk gained many victories in many fields using his mathematical intelligence and became a leader. For the *Mathematical Intelligence* code, participants stated that Ataturk used his mathematical intelligence in all fields and reflected this in his daily life. The first edition of the book "Geometry Guide" written by Atatürk was made in 1937 by the Ministry of Culture. On the inside cover of the book, which doesn't have the author's name, there is a note saying "published by the Ministry of Culture as a guide to those who teach geometry and to those who write books on this subject". Agop Dilacar wrote in the preface to the book Geometry, which was newly published by the Turkish Language Institution in 1971:

> *"Atatürk, a year and a half before his death, wrote in his own hand at the Dolmabahçe Palace in the winter months of 1936-1937 immediately after the III. Turkish Language Congress. One day in the autumn of 1936, Ataturk sent me to the Haşet Kitabevi in Beyoğlu beside his Executive Assistant, Sureyya Anderiman, to get one of the books of French geometry we deemed appropriate. After these books were reviewed together with Atatürk, the general design of the geometry book was created. After a while, I left and Ataturk worked on this work in the winter months. The booklet in your hand is the product of this effort (URL-1, 2017)."*

It has been indicated that the code most frequently used by the participants under the *Creativity and Success* theme is *Increasing Success through Different Perspectives* and within this frame, participants stated that different point of views increase success. For the *Being Authentic* and *Expanding the Horizon* codes, participants also stated that original means and methods can be generated instead of applying a uniform method for solving a problem and that creativity increases success by expanding horizons. It is known that problem solving is one of the basic skills in teaching mathematics (MEB, 2013; NCTM, 1989; Silver, 1994). This is parallel to the "ability to produce original paths when solving problems", which is achieved through "boosting success through different perspectives" of the study. It has been determined that the code most frequently used by the participants under the *Being a Sharer* theme is *Thinking That Cooperation Increases Success* and they stated that working cooperatively increases individual success. It is seen that regarding the *Thinking That One Should Sharer Mathematics* code, the participants stated that superior knowledge should be shared. In this context, Cumhur & Elmas Baydar's (2017) studies have shown that the teaching the GCD-LCM subject, which is one of the most important subjects of mathematics, by using peer learning method, increases the mathematics success of the students.

It has been found that the code most frequently used by the participants under the *Independent and Free Thinking* theme is *Being Free* and they stated that a mathematician should be a free person not a prisoner. With regard to the *Being Independent* code, participants stated that the mathematics does not only consist of the rules in books, and that the mathematician is not just the person who presents these rules. They also stated that *mathematics' field of interest is to teach how mathematics can be taught effectively and permanently* and they believed that a mathematician can be independent by internalizing his own knowledge, not depending on others. According to the themes obtained, it has been determined that the participants' national and universal values which relate specifically to mathematics education are *love and value, accuracy, preservation of cultural*

heritage, placing emphasis on aesthetic feelings, being fair, patriotism, modesty, leadership, creativity and success, being a sharer, independent and free thinking. It is concluded from this that prospective teachers are sufficiently aware of the values specific to mathematics education. Therefore, it is expected that the prospective teachers who, in a short period of time, will themselves be teaching the programme, will graduate with values specific to mathematics education and will be aware of these values. In conclusion, as a result of this research on the perspectives of prospective mathematics teachers, it is hoped that *"National and Universal Values"* will be considered in studies conducted to increase the quality and development of the education addressed in teacher training policies and in initiatives taken by the Ministry of National Education and Council of Higher Education officials.

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DIAGRAMS

Diagram 1. Findings related to the love and value theme

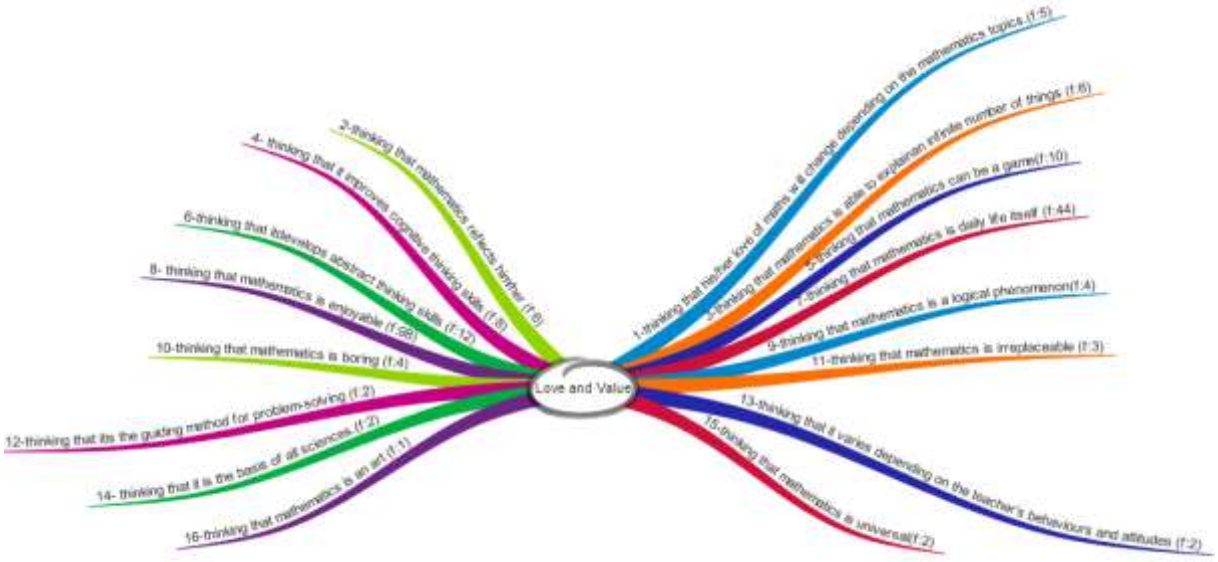


Diagram 2. Findings related to the *accuracy* theme

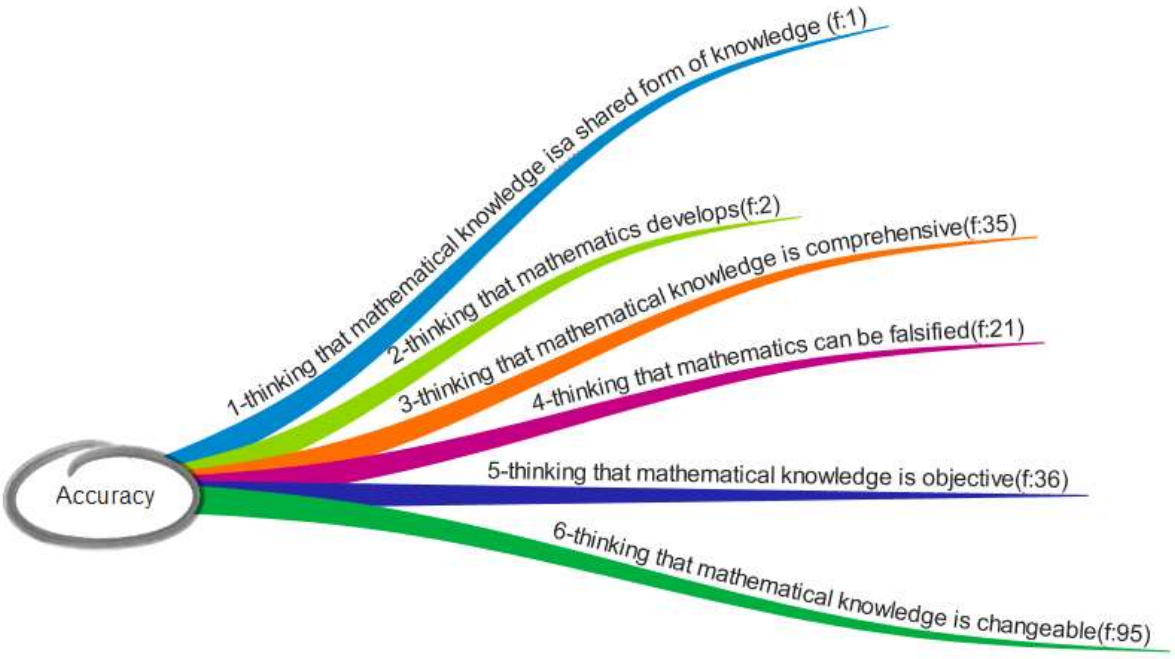


Diagram 3. Findings related to the preservation of cultural heritage theme

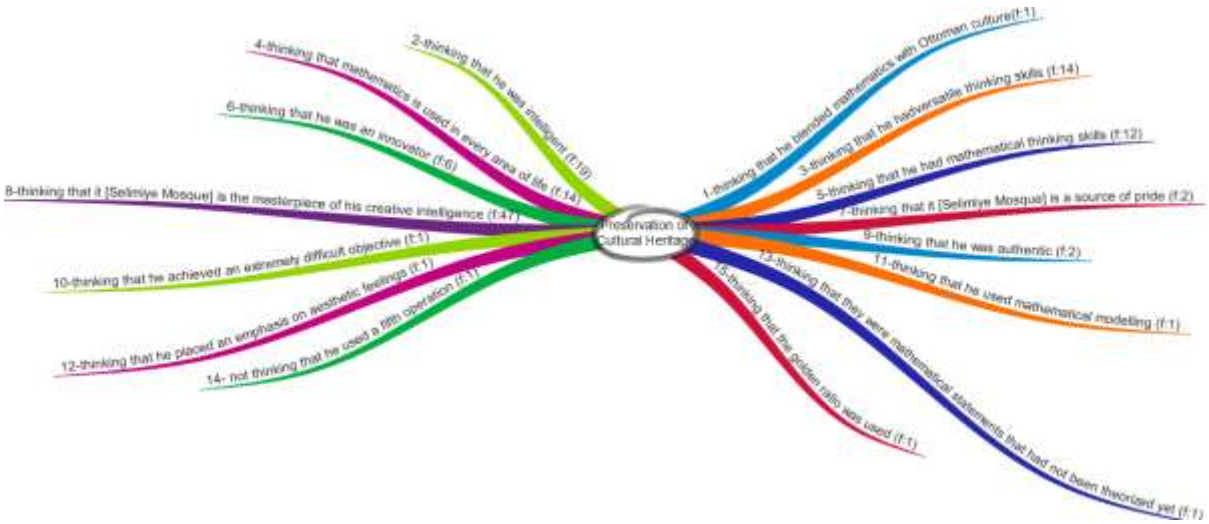


Diagram 4. Findings related to the placing emphasis on aesthetic feelings theme

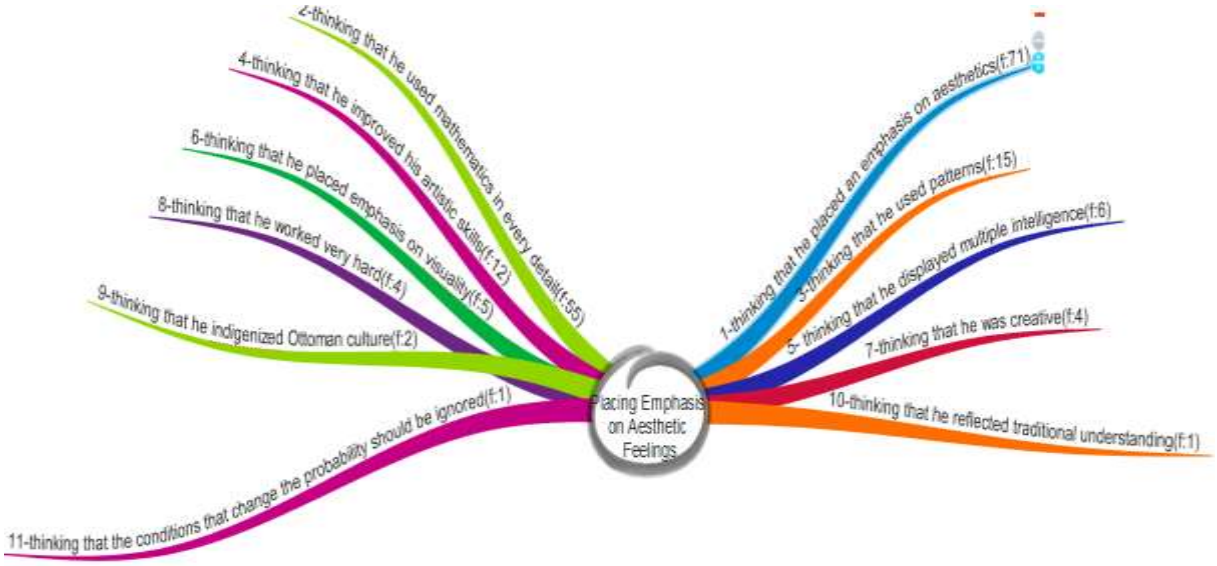


Diagram 5. Findings related to the being fair theme

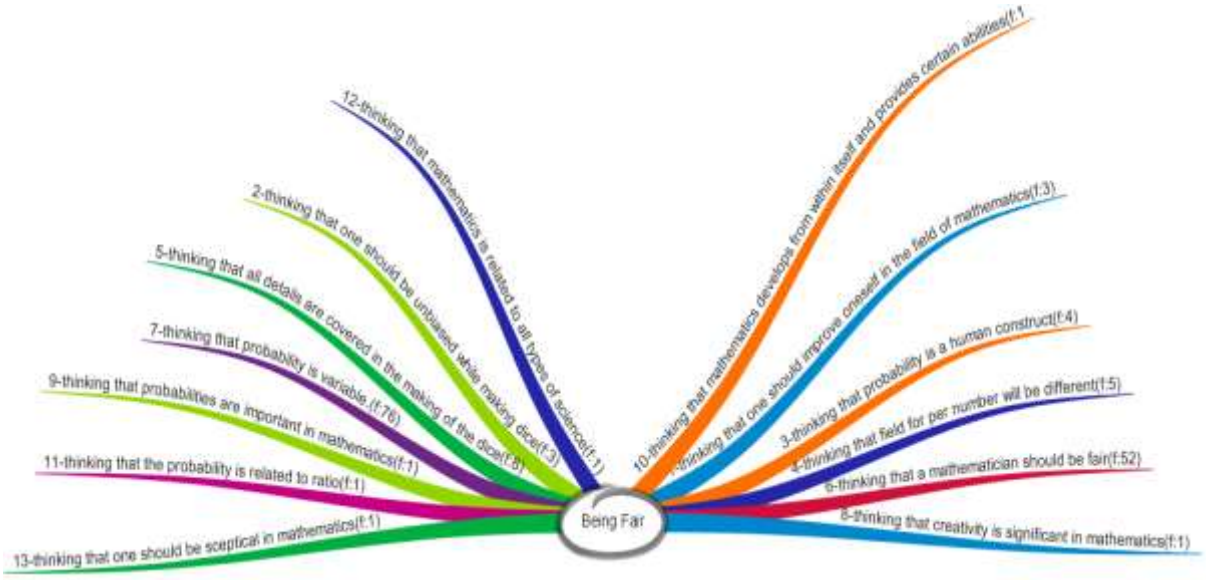
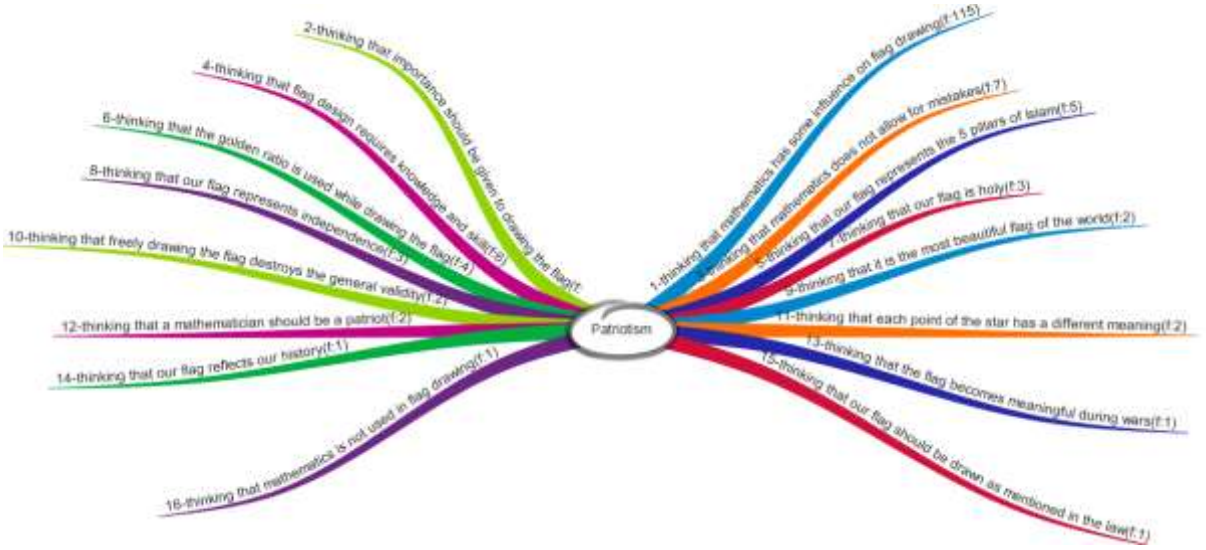


Diagram 6. Findings related to the patriotism theme



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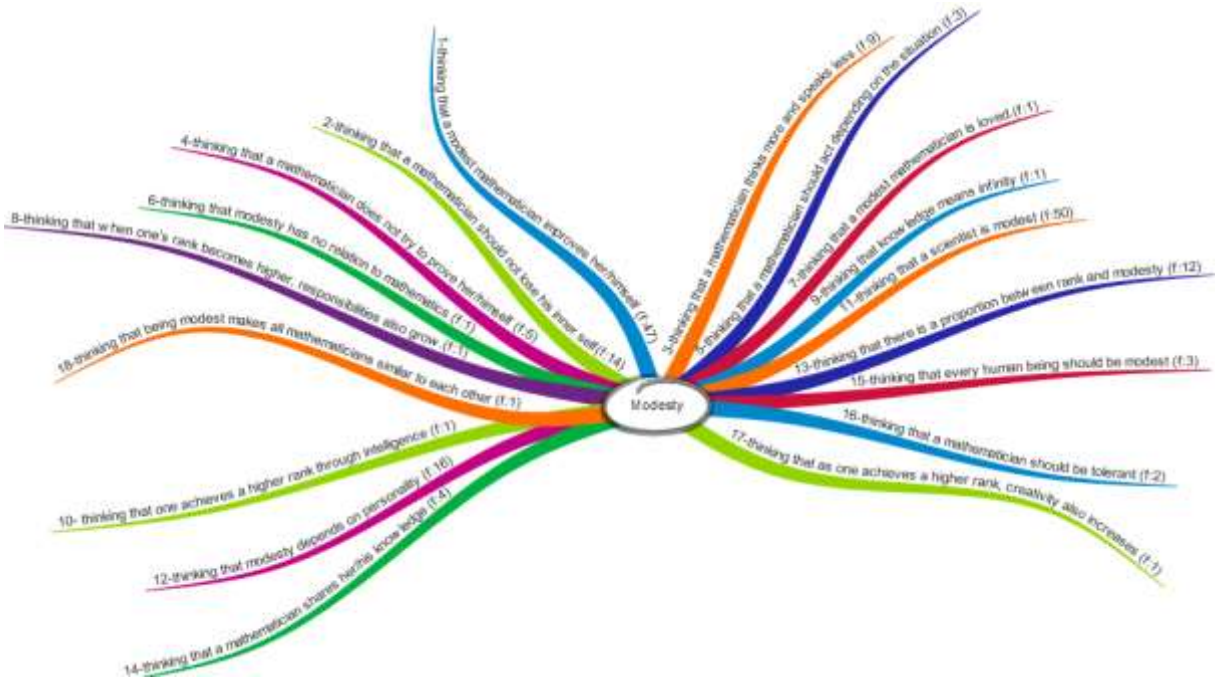

Diagram 8. Findings related to the leadership theme

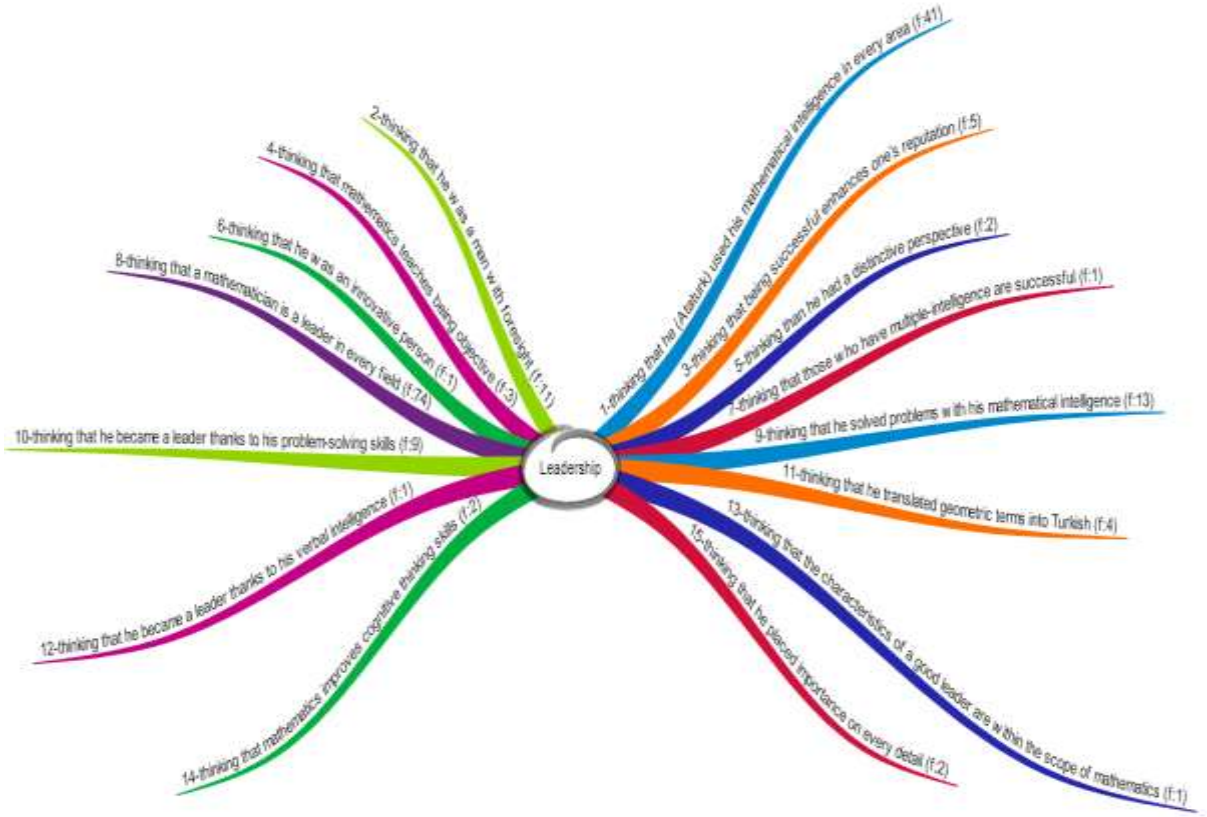

Diagram 9. Findings related to the creativity and success theme

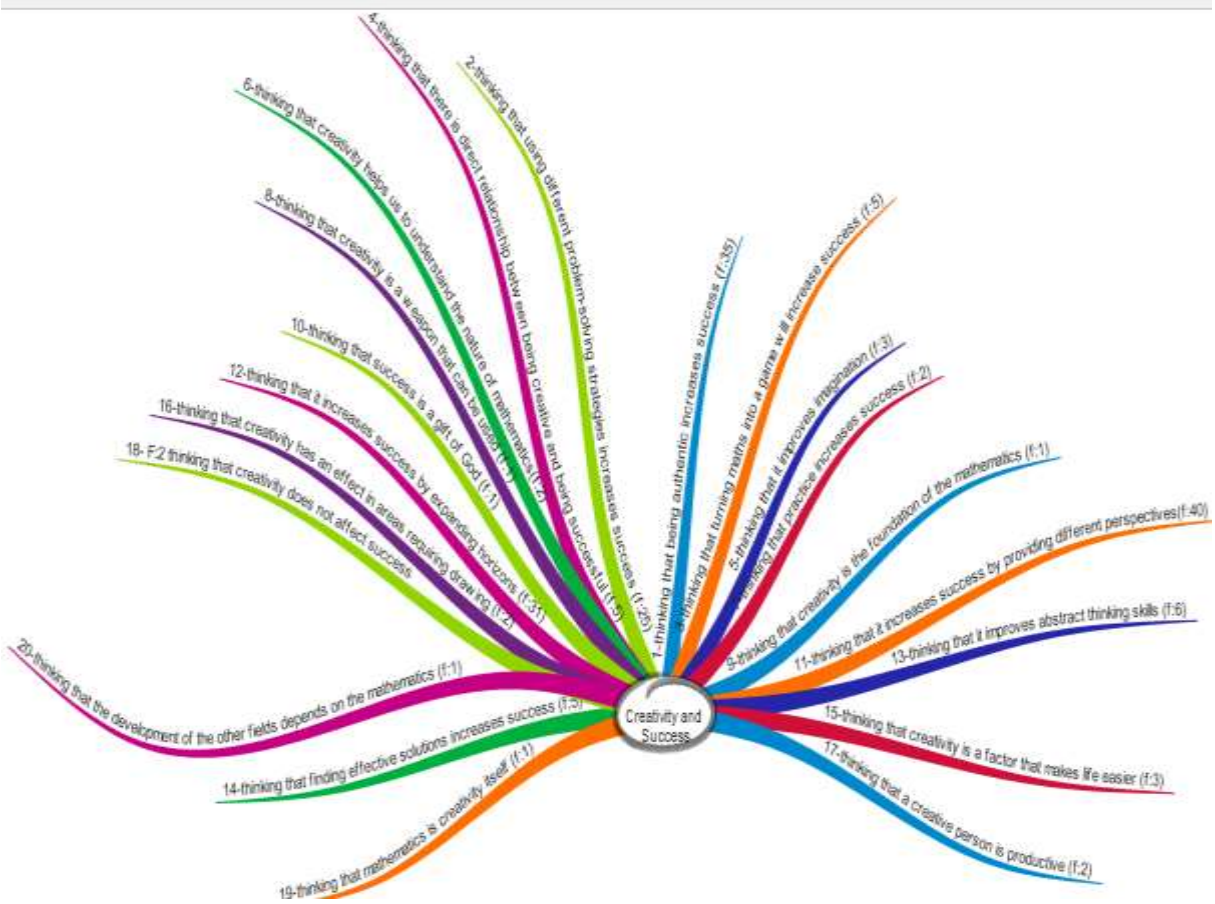

Diagram 10. Findings related to the being a sharer theme

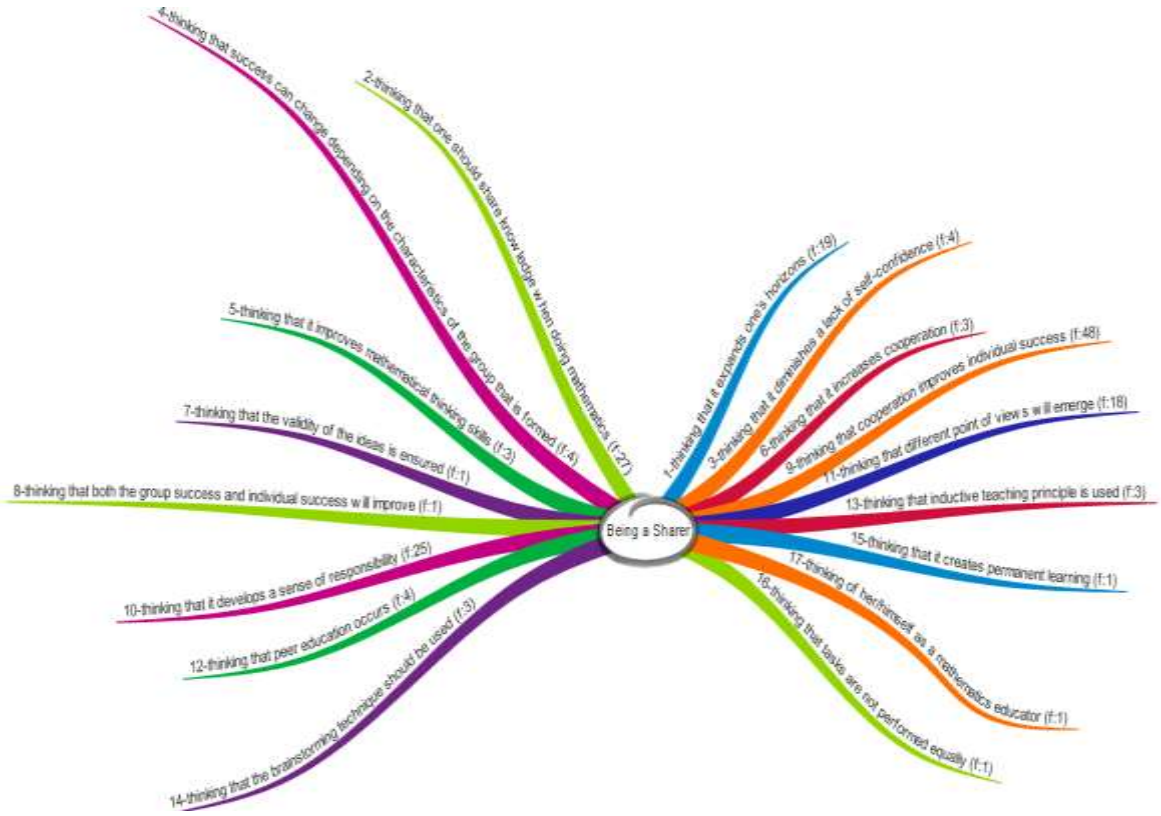

Diagram 11. Findings related to the independent and free thinking theme