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Full Length Research Paper

Promoting active participation of children with intellectual disabilities in social activities through citizenship education in disability centers in Tabuk, Saudi Arabia

Mohammed Ali Alkahtani^{1*} and Hanadi Hussain Al-Qahtani²

¹Department of Special Education, Faculty of Education, King Saud University, Kingdom of Saudi Arabia.

²Department of Special Education, Faculty of Education and Art, University of Tabuk, Kingdom of Saudi Arabia.

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This study evaluates the positive impact of citizenship education in students with an intellectual disability in disability centers in Saudi Arabia. The understanding of citizenship rights is widely perceived to be helpful for the successful integration of disabled students in a diverse society. A qualitative close-ended questionnaire was used as a data collection tool to evaluate the citizenship knowledge of 6-12-year-old students who were randomly recruited from the disability centers in Tabuk, Saudi Arabia. The study revealed an average level of citizenship knowledge among the students with intellectual disabilities. The results of the present study are statistically significant and suggest the importance of reforms in the educational institutes of disabled students, in order to ensure the development of citizenship knowledge in these students and help them to be a part of a diverse society.

Key words: Citizenship, students, intellectual disabilities, citizenship education.

INTRODUCTION

All around the world, people with intellectual disabilities face difficulties in every aspect of their lives and are often barred from enjoying their fundamental human rights. In many cases, these people are the victims of social discrimination, resulting in their inability to obtain acceptance or full integration into society. Citizenship is the right of every person regardless of their health status. However, while individuals with intellectual disabilities have equal citizenship rights, they are often deprived of them. The provision of equal citizenship rights to people

with intellectual disabilities is only possible by providing them access to education and giving them employment opportunities where they can express their talent. Considering the current situation and policies about people with intellectual disabilities, policymakers in Western countries have endeavored to maximize the opportunities for their social inclusion, empowerment, and independence.

The successful acceptance of intellectually disabled people in the society is associated with the behavior of

*Corresponding author. E-mail: Mak1396@hotmail.com.

the general population. Special education schools also play a vital role in the preparation of students with intellectual disabilities for active citizenship in diverse societies. This is important, given that many children with intellectual disabilities have poor intellectual security and are vulnerable to the harmful consequences of their behavior. These children are often unable to interpret difficult situations, which can adversely affect their overall well-being (Beirne-Smith et al., 2006). Schools and intellectual disability centers play a crucial role in developing the concept of citizenship in students with an intellectual disability, thereby enhancing their intellectual security.

Opportunities for students with intellectual disabilities to develop citizenship can also be promoted through different learning and social networking programs (O'Brien et al., 2009), which teach skills that develop intellectual thinking and self-advocacy (Hart et al., 2010). One study argues that citizenship for intellectually disabled individuals seems impossible, due to the common traditional concept in the society (Johnson et al., 2010). This means that individuals with an intellectual disability will often need to contribute more to society in order to access full citizenship rights (MacIntyre, 2014; Moore and McNaught, 2014). However, it can be challenging for individuals with an intellectual disability to actively contribute to the current diverse society. Another study found that disempowerment and oppression of individuals with intellectual disabilities can sometimes be associated with political issues. Effectively, the authorities protect their political interests by not giving full citizenship rights, which can be argued as being a kind of an attack on the intellectual security of individuals. However, intellectual security can be improved through teaching students with intellectual disabilities about their citizenship rights.

National education systems should be capable of providing apolitical education to all children, irrespective of their disabilities and thereby ensure that their citizenship remains intact (Lampropoulou, 2015). However, many children who are intellectually disabled encounter problems in acquiring an education that teaches them about these rights. The political position of children with intellectual disability remains weak, making them vulnerable to an intellectual security breach. As a consequence, government policies should be reformed to ensure the provision of equitable education to all students. The main goal of public education institutes is to provide necessary citizenship education to all children regardless of intellectual ability, which is fulfilled by the social studies curriculum (Anthony, 2010). The main objective of this curriculum is to promote the active participation of students in their societies and enhance their intellectual security (Permata, 2017). The concept of citizenship can be developed in students with intellectual disabilities through the inclusion of the citizenship curriculum in social studies.

Citizenship education is also valuable in developing life

skills, which are the basic competencies required to live in a particular society. Students who study citizenship rights can also develop valuable skills, such as critical reasoning, decision-making, and problem-solving skills. The teachers of disability centers should therefore emphasize the development of those citizenship abilities that make the students more intellectually secure. This can also support the acquisition of the necessary skills that are essential for becoming an active citizen.

Ultimately, the objective of citizenship education is to prepare students with an intellectual disability to be an important part of democratic society. Related to this overarching goal, citizenship education is therefore not only limited to the development of citizenship skills, but it also provides students with the opportunity to progress in their careers and to contribute to their society. Citizenship education is a continuous process, so every interaction that students with an intellectual disability make with their peers can support the development of their intellectual skills and interaction should therefore be encouraged (Fernández-López et al., 2013). Working in groups is also beneficial for students with intellectual disabilities to develop essential citizenship skills and can enable them to critically think about their personal life experiences, supporting the development of positive self-concepts (Davies, 2011).

The present research has focused on the development of citizenship skills in people with disabilities. However, there is a gap in the research to determine how the students with mental ages of 6 to 12 years can develop as active citizens of society.

Aim and objectives

The present study has the following aims and objectives:

- (a) How are civic rights promoted in students with intellectual disabilities?
- (b) How does active participation of students with intellectual disability in social activities improve their citizenship skills?
- (c) What is the role of social skills in the development of citizenship education?

METHODOLOGY

Study design

This study sought to learn how students with intellectual disabilities can become more active citizens and strengthen their intellectual security during their educational training in the disability centers in Saudi Arabia. A qualitative descriptive research study design was selected for data collection, using an open-ended research questionnaire that provides a description of citizenship understanding among students with intellectual disabilities.

Study participants

Initially, 50 students with intellectual disabilities and a mental age

ranging from 6 to 12 years were recruited from the disability center of Tabuk, Saudi Arabia by means of diversity sampling. This type of sampling helps to develop similarities between the diversified situations and provide different dimensions of the problem (Yildirim and Simsek, 2008). Out of 50 participants, 36 participants completed the questionnaire while others were excluded from the study due to their health condition. The response of 36 students was analyzed further to evaluate the data findings.

Data collection tool

A research questionnaire was developed to investigate the current knowledge of the participants with regards to citizenship and to gather information on their level of participation in community activities. The students were asked to provide the answers to the questions with the assistance of an instructor who helped them to understand the questions accurately. The internal consistency of the questionnaire was determined through reliability testing. The Cronbach's alpha value was found to be $\alpha \geq 0.708$. Although this value is slightly lower than the expected value, but it is acceptable and shows that all the items of the questionnaire provide answer to the research question.

Validity of data collection tool

In order to test the validity of the data collection tool, a pilot study was conducted in the Intellectual Disability Center, Tabuk City. Ten students with a mental age of 6 to 12 years were selected randomly. The data collection tool was administered to the selected students in order to evaluate their understanding of citizenship. The mean score of the pilot study showed good understanding of citizenship concepts in the students with intellectual disability. However, two questions were modified in order to ensure that the objectives of the study were achieved. Question 2 and Question 3 were modified. Initially, Question 2 was about the interactions with peers in the school environment. However, to better understand the social interactions in the community, the question was changed. Likewise Question 3 was about respecting family members; therefore it was changed to generalize the findings which are more related with respecting community and the country.

Social validity

The social validity of the research objective was developed by conducting a short survey to evaluate the perspective of teachers on the citizenship knowledge of their students with intellectual disabilities. The teachers therefore completed a short questionnaire using a Likert Scale (1 = false, 2 = somewhat false, 3 = somewhat true, and 4 = true) to determine teacher perceptions of the knowledge level of their students. At the end of the questionnaire, the teachers also gave individual suggestions about how it might be possible to improve the citizenship knowledge of students with intellectual disabilities. The social validity questionnaire is available in Appendix.

Data analysis

The completed questionnaires were collected and the data was compiled in the SPSS (Statistical Package for Social Studies) version 22. Descriptive statistics were performed to find out the percentage of citizenship knowledge in the students and their level of participation in community activities. The results were compiled based on the data analysis.

FINDINGS AND DISCUSSION

The participating students with intellectual disabilities were given the close-ended questionnaire in order to determine their awareness of citizenship rights and knowledge about the roles of citizens in society. The results (Table 1) reveal that their overall knowledge and awareness of citizenship is average. However, a detailed analysis of the results shows that students have some information about their civic rights. The first item of the questionnaire concerned participation in community activities: 63.9% responded that they actively participate. It should be noted that some studies have shown that the community participation of intellectually disabled students tends to focus on physical exercise rather than social inclusion (Amado, 2014). However, the results of the present study do not reveal whether participation in community activities is intended to foster social inclusion or physical inclusion. Another study shows that adults with intellectual disabilities often participate in community activities, such as shopping and hanging out (Wu, 2011). Despite this, many still face social isolation and loneliness. Therefore, policies should be developed to enhance the social integration and community participation of children with disabilities in order to improve their citizenship understanding and therefore their quality of life.

The results of the present study reveal that 58.3% students with an intellectual disability help others in the community to improve their social interactions (Table 1). These results also suggest that these students demonstrate knowledge of human rights and that many participants have some understanding of citizens towards other citizens. However, the results also show that students need to improve these skills to better integrate within their communities. Helping others also demonstrates the training of youth, which leads to a flexible community (Flanagan and Levine, 2010). It is evident from a recent study that helping others in a community creates more opportunities, in turn improving the prevailing social issues of a community. This collaborative spirit also enhances information sharing, which is beneficial to the positive integration of volunteers into a community. These findings therefore suggest that students with an intellectual disability actively help others to improve their social relations and increase their contacts, based upon their understanding of the important features of a responsible citizen in a diverse community.

When asked about whether the participants love their country and respect their community, the results were quite promising. A sizeable majority (88.9%) of the participants reported feelings of love and respect towards their country and community, respectively. These findings show that participants understand the meaning of country and community and their responsibility towards it. A strong national identity is strongly correlated with

Table 1. Descriptive statistics of questionnaire.

Variable	Response	Mean	Frequency (n)	Percentage
I take time to actively participate in community activities	Agree	0.36	23	63.9
	Disagree		13	36.1
I help others in the community to improve the social interactions	Agree	0.42	21	58.3
	Disagree		15	41.7
I love my country and respect my community	Agree	0.11	32	88.9
	Disagree		4	11.1
I respect the rights of other people	Agree	0.72	10	27.8
	Disagree		26	72.2
I participate in the community activities to contribute my due role	Agree	0.64	13	36.1
	Disagree		23	63.9
I understand my civic rights in the community	Agree	0.33	24	66.7
	Disagree		12	33.3
I respect my country's flag	Agree	0.00	36	100
	Disagree		0	0

awareness of citizenship rights and therefore crucial in fostering community engagement and encouraging individuals to respect their community (Akar, 2007). The findings of the present study are consistent with Akar's findings.

Respect for others is an important feature of citizenship, allowing better integrating of individuals into a diverse community where social interactions occur on a daily basis. In other words, showing respect towards others is an important feature of citizenship (Waghid, 2009; Kubow, 2007). Only 27.8% students showed respect towards other people in a community, suggesting that they do not have information about the rights of other people. Previous studies have shown that students with disabilities typically have some knowledge and respect towards the rights of other people. The result of the present study reveals a lack of respect towards others, which shows the deficiency in citizenship knowledge of students with an intellectual disability.

The participants were asked whether they perform their due role in the community and only 36.1% stated that they did. These results show that most of the participants do not feel that they contribute their due role in the community. Therefore, there is a need to properly train students with intellectual disabilities about their due role in the community. The result of the present study is consistent with the extant literature, which shows that participants typically have no knowledge about their due role in the community (Tipton and Blacher, 2014). These findings can be associated with different factors, such as poor communication skills, friendly behavior, and a lack of citizenship knowledge (Porto and Byram, 2015).

Therefore, it is important to teach students with an intellectual disability to contribute appropriately and to perform their duties as citizens.

Participants were also asked about their understanding of civic rights in the social community. Two third (66.7%) reported a sound knowledge of civic rights, which is a higher proportion than in the majority of previous studies. Individuals with disabilities in Latin America, for example, have shown a very poor level of understanding about civic rights (Quaynor, 2012). Similarly, another study also shows a low level of civic knowledge (Frisancho and Reátegui, 2009). The present study shows significantly higher knowledge of citizenship. Social studies classes in schools have been shown to play an important role in the development of the concept of citizenship in the students (Myers, 2006). Promoting social interactions is also beneficial for students with an intellectual disability to develop a citizenship concept. Comparison of the results of the present study with established research literature clearly shows that a citizenship concept develops in students with an intellectual disability through increased social interactions. Few other studies have highlighted the role of teachers and instructors at the disability centers in developing students with intellectual disability into good citizens (Gay, 2002).

The present study has shown the importance of active participation in the community and also respect towards the community. Other studies have shown that students often consider social participation and being respectful to other people as an element of great virtue (O'Brien and Smith, 2011). Students also consider good virtue as an indispensable duty of good citizens (Schultheis, 2011).

Many have the perception that being a good citizen means being respectful of other people, obeying the rules, loving their country, and keeping the environment clean (Tonga and Keles, 2014). The results of the present study are quite promising, suggesting that proper training and better social integration of students with intellectual disabilities can develop the concept of citizenship. This process can also help them to obey the rules and respect their fellow citizens. The findings of the present study illustrate a comparatively high level of citizenship knowledge among the intellectually disabled students of Saudi Arabia. However, this study is based on close-ended questions, meaning that a detailed analysis was not performed. The results of the present study will assist future research on the ways to develop the concept of citizenship in students with intellectual disabilities.

Conclusion

The survival of individuals in a diverse society is significantly influenced by their knowledge of citizenship. Students with intellectual disabilities often possess poor understanding on the rights and roles of citizens in a society. Citizenship knowledge in these students is a matter of interaction and communication, with active participation in community activities helping them to establish communication skills and improve their awareness of citizenship. The results of the present study reveal slightly better citizenship awareness. The involvement of social studies and proper training has therefore been shown to be necessary for the development of a greater understanding of citizenship rights among students with intellectual disabilities. The results of the present study will inform future research into the best ways to develop citizenship awareness among students with intellectual disabilities.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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APPENDIX**Social validity**

Students with intellectual disability needs understanding of their citizenship rights.

False * Somewhat False * Somewhat Trust * True *

Teaching citizenship rights to the students with intellectual disability will benefit these students to integrate in the community.

False * Somewhat False * Somewhat Trust * True *

Citizenship knowledge help my students to become an active citizenship of the society.

False * Somewhat False * Somewhat Trust * True *

Inclusion of social studies in the curriculum is beneficial in the development of citizenship knowledge in students with intellectual disability.

False * Somewhat False * Somewhat Trust * True *

Use the below box to suggest different ways of developing citizenship knowledge in the students with intellectual disability.

Full Length Research Paper

Exploring the opinions about the concepts of “formula” and “rule” in mathematics

Esra Altıntaş* and Şükrü İlgün

Department of Mathematics and Sciences Education, Faculty of Education, Kafkas University, Kars, Turkey.

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The purpose of this study is to draw attention to the concepts of “formula” and “rule” in mathematics, thereby revealing the views of pre-service teachers relating to these concepts by exploring their knowledge in, and their capacity to exemplify these concepts. The study is important in that it would reveal how pre-service teachers see the concepts of “formula” and “rule”, and to what extent they associate these concepts with mathematics, and further contribute to the field as there is currently no similar study in the literature. For this purpose, researchers prepared a diagnostic test consisting of ten questions. Nine (9) of the questions were open-ended, and 1 was multiple-choice. With this diagnostic test, pre-service teachers were expected to explain the concepts of formula and rule, reveal the formula and rule that first come to their mind, express the formulas and rules they learned during secondary and high education, describe what sort of a mathematics without formula and rules would be, and finally answer the question “is mathematics without formula and rules possible?”. The sample of the research was composed of a total of 159 pre-service mathematics teachers including Grades 1, 2 and 3 students in Kars. The data were analysed by qualitative analysis and results were tabulated to indicate frequency and percentage values. It has been concluded that pre-service teachers associate the concepts of formula and rule with mathematics, they mathematically internalize and correctly interpret these concepts, they are accustomed to and familiarized with these concepts, and they believe mathematics without formulas and rules is not possible. Mathematics without formula and rule would be meaningless and difficult, take long time to study, and would not be possible, and mathematics can only be implemented through solving with individually proven concrete concepts and describing the rationale behind them.

Key words: Mathematics education, pre-service mathematics teachers, formula, rule.

INTRODUCTION

Identifying how students perceive formula and rule, the concepts that typically come to mind first as far as mathematics is concerned, especially what formulas and rules are permanent in their minds, how their relationship

with mathematics is perceived, and what students think about these concepts, is critical in establishing the mathematics education programs as well as the teaching methods to be employed by teachers. It is also believed

*Corresponding author. E-mail: hoca_kafkas@hotmail.com. Tel: +090 5538231958.

that formula and rules involved in mathematics lessons have a typical role in negative attitudes and concern developed by majority of the students towards mathematics. The student feels that if the necessary formula or rule cannot be remembered, (s)he would not be able to do anything due to the lack of essential infrastructure, and this leads to a dislike of the lesson. Taking these facts into consideration, it is important to question these concepts that are frequently involved by teachers in mathematics education programs.

A mathematician typically strives to reach correct results by employing the rules and formula of logic and mathematics. However, the formula referred to here actually serve as tools only. In other words, mathematics does not mean a huge pile of formula (Altintas, 2005). What is important in equipping students productively and raising them towards success in real life is not simply to teach mathematical formula and rules, but rather to teach how to integrate mathematics into life. Students may be expected to know mathematical formula and rules, and use them where necessary. However, it is not very logical to dictate the memorization of this data and making assessments based on such data. Rather, by teaching when, where and why to use such knowledge throughout life, effective curricula could be built that deliver essential knowledge and skills instead of non-useful mass of information (Yildiz and Uyanik, 2004).

The goal in mathematics lessons should not be to memorize the theories, and formula and then to solve questions based on what have been memorized because, in this case, students are urged to act without knowing why they solve the particular problem (Nasibov and Kacar, 2005). For example, in their study, Sisman and Aksu (2009) found that students have difficulty in effectively using various formulas. What is important here is the ability to think comprehensively, considering all existing conditions, to understand what consequences would arise after certain circumstances, and to learn and teach how to think logically and systematically (Nasibov and Kacar, 2005).

Formulae are typically short algebraic expressions used to show relations between quantities. In other words, they summarize the relations between quantities through mathematical symbols (Isik et al., 2005). According to Turkish Language Association (2017a), a formula is a set of symbols describing a general phenomenon, rule or principle. It is a mathematical expression serving to calculate a quantity linked with one or several quantities. Additionally, according to Turkish Language Association (2017b), a rule is defined as a principle and guideline which is fundamental to and guiding an art, a science, and a system of thought and behaviour. Furthermore, it is also defined as a general judgement established after long research and trial in a specific field, and a guideline demonstrating how to achieve a good result in a process (Turkish Language Association, 2017c).

The purpose of the mathematics curriculum for primary grades 6 to 8 is to lead students to principally create the basic concepts, relations-correlations and formula through structured activities concerning circumferences and surface areas of planar figures including squares, rectangles, triangles, parallelograms, rhombuses, trapezoids and circles, as well as the surface areas and volumes of geometrical figures including cubes, rectangular prisms, squares and triangular prisms, spheres, cones, cylinders and pyramids. Moreover, in all other subjects involving formula, the fundamental principle is to associate the formula with previous subjects rather than directly presenting them, so that students can principally investigate and learn them (Ministry of Education, 2009). Nevertheless, the concern of getting the result fast in practice takes students and teachers closer to a formula. The problem here is that formulae are presented directly to the students without building on previous knowledge, and therefore they are not persistently established in students. The same also applies to rules in mathematics. The rules are not just the data to be delivered through memorization, but information that should be presented to students in a logical sequence.

The study of Ahuja et al. (1998) states that teachers should develop formulae with students to involve thinking rather than just dumping the formula on them. They must encourage students to think more – “don’t spoon feed and don’t encourage them to memorise”. In their study, Isik et al. (2005) explored the ability of pre-service mathematics teachers to recognize and remember some mathematical concepts. One of these mathematical concepts is formula. Pre-service teachers were asked “What do you think a formula is?” and answered as follows:

1. Fixed expressions
2. Shortcuts to solve problems
3. Short solutions previously proven
4. Rule, and
5. Others.

In addition, they were asked to answer the question “Which of the following describes the formula concept?” and pick one of the following options:

1. Shortcuts to solve problems
2. Short solutions previously proven
3. Summarized form of a subject with mathematical symbols, and
4. None.

An analysis of the answers revealed that the subjects failed to state the expected answers in open-ended questions, and could answer correctly only 5.6% of the multiple-choice questions. And it was concluded based on the findings that recall rates of the subjects were

relatively higher, despite being low from the general angle, compared to recognition.

In their study, Altay and Umay (2011) argued that mathematics is not just a set of rules to be applied, and therefore it is necessary to emphasize and discuss meanings beyond the teaching of rules. In their study where the effect of realistic mathematics teaching on student achievement, as well as students' opinions are explored, Ozdemir and Uzel (2011) concluded that students should be guided not by formula but reasoning structured under three main headings: imparting the ability to interpret, avoiding mere memorization, and focussing on the subject and its aspects. Moreover, it was further found that when students develop formulas by themselves, try different methods and associate their learnings with daily life, a huge contribution is made to understanding the subject.

In his study, Karakus (2014) found that 82.53% of pre-service teachers attempted to learn geometry during their past study by memorizing the formula or rules and solving problems. This reveals that memorizing rules and formula and solving problems represent the most preferred method of learning geometry. Accordingly, it may be concluded that without formula and rules, pre-service teachers will have difficulty in learning mathematics because they associate mathematics, especially geometry, with formula and rules.

In their study, Ozudogru (2016) concluded that conceptual learning is not fully realized in students, learning is limited to the operational level, and students attempt to solve problems on functions and find the result based on memorized rules.

The conclusions from the study of Pale (2016) are as follows: Approximately 58% of students viewed learning mathematics as mostly memorizing formulas and rules less than half of them who viewed mathematics as interesting. Teachers must provide students with learning opportunities in which they experience the excitement that comes from making sense of mathematics instead of memorizing formulas and rules. Instead of focusing on formulas and rules, mathematics teachers should help their students make sense of the mathematics they are learning.

The purpose of this study is to draw attention to the concepts of "formula" and "rule" in mathematics, thereby revealing the views of pre-service teachers relating to these concepts by exploring their knowledge in, and their capacity to exemplify these concepts. The study is important in that it would reveal how pre-service teachers see the concepts of "formula" and "rule", and to what extent they associate these concepts with mathematics, and further that it would contribute to the field as there is currently no similar study in the literature.

Taking the views of pre-service teachers about the place and use of the concepts of "formula" and "rule" in mathematics is also important as it would reveal their opinions in mathematics. The present study is also important in that it could provide the opportunity to

interpret the root causes of negative attitudes, anxieties and prejudices developed against mathematics. In addition, it is also believed that the findings of this paper would also serve as a guide for structuring the mathematical curricula and hence the course contents and also guides the teachers to elaborate their lesson plans and educational methods. A similar study could be found neither in local nor the foreign literature. In this study thus representing an unprecedented one, particularly the data gathered and their interpretations were involved extensively.

Based on these descriptions, the problem statement of the research is as follows: What is the capacity of pre-service teachers to define and exemplify the concepts of "formula" and "rule" in mathematics, and what are their opinions in these concepts?

METHODOLOGY

Research model

The content analysis from the qualitative data analysis approaches was used in the present study. The intentions and perceptions of subjects often enjoy a privileged position in qualitative research, because of the access they can give us to the meaning of action for particular observers. Qualitative research often seeks to illuminate the ways individuals interact to sustain or change social situations. Through analysis, a fresh view of the data can be obtained. Progress can be made from initial description, through the process of breaking data down into bits, and seeing how these bits interconnect, to a new account based on reconceptualization of the data. The data is broken down in order to classify it, and the concepts created or employed in classifying the data, the connections made between these concepts, provide the basis of a fresh description. The core of qualitative analysis lies in these related processes of describing phenomena, classifying it, and seeing how these concepts interconnect (Dey, 1993). Content analysis is a widely used qualitative research technique. Rather than being a single method, current applications of content analysis show three distinct approaches: conventional, directed, or summative. In the present study conventional content analysis is used. The advantage of the conventional approach to content analysis is gaining direct information from study participants without imposing preconceived categories or theoretical perspectives (Hsieh and Shannon, 2005). While making content analysis, codes are created from the data and common directions between codes are found. Through the codes the data are categorized (Yildirim and Simsek, 2011). The answers gotten from pre-service math teachers were analysed qualitatively, and percentage and frequency values were given in Tables.

The study group

The research was carried out in the spring semester of 2015 to 2016 academic year. The research group of the study consisted of 159 pre-service teachers of primary mathematics at 1st, 2nd and 3rd grade from Kafkas University in Kars. While determining the participants, convenience sampling was conducted for some practical reasons, such as ease of transportation, implementing the study rigorously and ease of communication because the researchers work at Kafkas University. Also the so-called semester there comprised of only 1st, 2nd and 3rd grade students in primary mathematics education department in Kafkas University in Turkey.

When subjects are chosen because of the close proximity to a researcher, that is, the ones that are easier for the researcher to access, it is called a convenience sampling (Etikan et al., 2016).

Data collection tool

A "diagnostic test" which was prepared by the researchers was used within the scope of this study. "Diagnostic test" is composed of 9 open ended and 1 multiple choice questions. The questions in the test are as follows:

1. "What is formula?"
2. "What is rule?"
3. "What is the first formula you remember?"
4. "What is the first rule you remember?"
5. "Please state a formula you learned in primary school"
6. "Please state a rule you learned in primary school."
7. "Please state a formula you learned in secondary school"
8. "Please state a rule you learned in secondary school"
9. "Is there mathematics without formula and rule?"
10. "According to you, how does mathematics without formula and rule become?"

For validity of the diagnostic test, the views of two experts were taken and some arrangements were made in the test. In presenting the ideas of pre-service teachers about the terms of formula and rule, pre-service teachers were required to express their ideas about formula and rule. They were required to express the formula and rule they remembered first to determine which formula and rule became permanent in their minds. Regarding the question of "According to you, how does mathematics without formula and rule become?" The researchers aimed to obtain data about how the pre-service teachers adapt to terms of formula and rules with mathematics and how they envisage mathematics.

Data analysis

Nine open-ended questions in diagnostic test were analysed qualitatively. One multiple-choice question answers were analysed as "Yes" or "No". By using content analysis, answers given by the pre-service math teachers were categorized and the categories obtained were given on tables by giving frequency (f) and percentage (%) values. Inter-coder reliability was made confirmable. For consistency, double-coding method of Miles and Huberman (1994) was used. The consistency value was found as 0.78. It shows that there is harmony between researchers. For transmissivity, the answers of participants were used in the present paper. For cogency, expert views were used. The researchers are mathematics instructors and expert on the so-called matter. Also the researchers made literature research about which examples in mathematics are formula or rule. Hence, they determined which answers are formula or rule and categorized the answers as true or false.

RESULTS

In the results part, tables were provided for analysis made in view of the data at hand. As shown in Table 1, answers of pre-service teachers to the question "What is formula?" are grouped into 23 categories. These categories can be sorted by a number of answers as follows: "Practical information for the simple solution of a problem", "Solution method used for a specific subject",

"Stereotyped statement requiring memorization with no underlying rationale illustrated", "There is nothing called formula", "Concept formed by symbols", "Conclusion part of the proofs", "Provable rules", "Proven form of the theories", "Set of symbols relating to the phenomenon, principle or rule", "A correlation", "Concrete form of abstract thoughts", "Fixed form of specific aspects" "Theoretical part of mathematics, the abstract side", "Summary of the subjects, the theme", "Simplified form of statements", "Shortcuts finally proven after tests", "Frequently used mathematical statements", "The vital aspect for the meaning of mathematics", "Operations invented later in time", "A term used in mathematics", "Something with informative quality", "Home to mathematics". 4.40% of pre-service teachers skipped this question.

As shown in Table 2, answers of pre-service teachers to the question "What is rule?" are grouped in 26 categories. These categories can be sorted by number of answers as follows: "The path to the solution of a problem", "A principle that people should respect", "Shortcuts to simplify complicated operations", "Conclusive", "Ensures that the lesson is studied in a systematic manner", "A precondition and necessity in problem solving", "Theory", "Anything previously proven and accepted to be true", "Limits, borders and criteria specific to each matter", "Something indispensable for the matter", "The rationale, core of a subject", "An element that makes the maths meaningful", "Something that cannot be proven and changed", "The path to implementing the formula", "Fixed form of results derived from certain aspects", "An essential behaviour", "Shows the method and place of a mathematical process", "A pretext to impose the intended action", "A must-know statement", "Fixed form of the formula", "The formula leading to the result", "Discipline and responsibility", "Student's assistant", "Necessity to do what's required", "A principle fundamental to and guiding a science and art". In addition, 9.43% of pre-service teachers skipped this question.

While giving the answer examples of pre-service teachers, the researchers categorized them as "true" and "false" by considering the following explanations: Rules are not general statements. Also in the rule statements, the right sides of equality are the expansions of left sides. They only help researchers in arriving at the results easily. But the researcher might want to use other ways to arrive at the result. Without using the rules, the researchers can arrive at the results. But the formulas are the general statements and they contain rules. Also, the literature search was made and the expert's idea was taken by separating formula and rule.

According to Table 3, based on answers to the question "What is the first formula you remember?", 88.05% of pre-service teachers give true answers while 8.80% give false answers and 3.14% skipped the question. Predominantly, true answers are as follows:

Table 1. Categorization of answers to the question “What is formula?”

Categories	Frequency (f)	Percentage
Provable rules	7	4.40
Solution method used for a specific subject	25	15.72
Concept formed by symbols	8	5.03
Stereotyped statement requiring memorization with no underlying rationale illustrated	12	7.54
Practical information for the simple solution of a problem	65	40.88
A correlation	5	3.14
Conclusion part of the proofs	8	5.03
There is nothing called formula	10	6.28
Proven form of the theories	7	4.40
Empty	7	4.40
Concrete form of abstract thoughts	5	3.14
Fixed form of specific aspects	5	3.14
Shortcuts finally proven after tests	4	2.51
Frequently used mathematical statements	4	2.51
Theoretical part of mathematics, the abstract side	5	3.14
Summary of the subjects, the theme	5	3.14
Operations invented later in time	3	1.88
Set of symbols relating to the phenomenon, principle or rule	7	4.40
Simplified form of statements	5	3.14
The vital aspect for the meaning of mathematics	4	2.51
Home to mathematics	1	0.62
Something with informative quality	2	1.25
A term used in mathematics	3	1.88

“The Pythagorean relation: $a^2 = b^2 + c^2$ ”, “Area of the square: a^2 ”, “Distance = Speed \times Time: $x = V.t$ ”, “Area of the circle: πr^2 ”, “Discriminant: $\Delta = b^2 - 4ac$ ”, “Area of the triangle: $\frac{\text{Taban kenar} \times \text{yükseklik}}{2} = \frac{a.h_n}{2}$ ”

Predominantly, false answers are as follows:

“ $\sin^2 x - \cos^2 x = 1$ ”, “ $(x + y)^2 = x^2 + 2xy + y^2$ ”, “ $r = -\frac{b}{2a}$ ”, “ $\sin 2x = 2 \sin x \cos x$ ”, “ $\log \frac{a}{b} = \log a - \log b$ ”

According to Table 4, based on answers to the question “What is the first rule you remember?”, 80.50% of pre-service teachers gave true answers while 8.80% gave false answers and 10.69% skipped the question. Predominantly, true answers are as follows:

“ $\sin^2 x + \cos^2 x = 1$ ”, “The sum of the angles in a triangle is 180 degrees.”, “In triangles, the sum of two interior angles is equal to the non-adjacent exterior angle.”,

“ $\tan x = \frac{\sin x}{\cos x}$ ”, “The big angle faces the long edge”, “The L-Hospital rule”, “Order of operations (parentheses-multiplication, division-addition, subtraction)”, “Only a single line can pass through two points.”, “Indefinite number of lines can pass through a single point”,

“Multiplication of two numbers gives an even number.”

Predominantly, false answers are as follows:

“The Pythagorean relation”, “ $h^2 = p.k$ ”, “Area of a rectangle: Short edge \times long edge = axb ”, “Volume in prisms (Base area \times height)”

According to Table 5, based on answers to the question “Please state a formula you learned in secondary school.”, 67.92% of pre-service teachers gave true answers while 18.86% gave false answers and 13.20% skipped the question. Predominantly, true answers are as follows:

“The Pythagorean relation: $a^2 = b^2 + c^2$ (In a right triangle, the sum of the squares of legs is equal to the square of the hypotenuse)”, “ $\Delta = b^2 - 4ac$ ”, “Area of the square: $a.a$ ”, “Area of the rectangle: length of the short edge. Length of the long edge (a.b)”, “Volume: Base area \times height ($V = a.b.c$)”.

Predominantly, false answers are as follows:

“ $(x + y)^2 = x^2 + 2xy + y^2$ ”, “ $\tan \theta = \frac{\sin \theta}{\cos \theta}$ ”,

“ $\cot \theta = \frac{\cos \theta}{\sin \theta}$ ”, “ $\sin^2 x + \cos^2 x = 1$ ”, “ $\tan x \cdot \cot x = 1$ ”.

Table 2. Categorization of answers to the question “What is rule?”

Categories	Frequency (f)	Percentage
A principle that people should respect	20	12.57
An element that makes the maths meaningful	5	3.14
Something that cannot be proven and changed	5	3.14
Limits, borders and criteria specific to each matter	6	3.77
Shortcuts to simplify complicated operations	15	9.43
The path to the solution of a problem	45	28.30
An essential behaviour	4	2.51
Something indispensable for the matter	6	3.77
The path to implementing the formula	5	3.14
Fixed form of the formula	3	1.88
Theory	7	4.40
The formula leading to the result	3	1.88
Fixed form of results derived from certain aspects	5	3.14
Anything previously proven and accepted to be true	7	4.40
Conclusive	12	7.54
A principle fundamental to and guiding a science and art	2	1.25
Shows the method and place of a mathematical process	4	2.51
Ensures that the lesson is studied in a systematic manner	10	6.28
Discipline and responsibility	3	1.88
A pretext to impose the intended action	4	2.51
A precondition and necessity in problem solving	10	6.28
The rationale, core of a subject	6	3.77
A must-know statement	4	2.51
Student’s assistant	3	1.88
Necessity to do what’s required	3	1.88
Empty	15	9.43

Table 3. Categorization of answers to the question “What is the first formula you remember?”:

True		False		Empty	
Frequency (f)	Percentage	Frequency (f)	Percentage	Frequency (f)	Percentage
140	88.05	14	8.80	5	3.14

Table 4. Categorization of answers to the question “What is the first rule you remember?”:

True		False		Empty	
Frequency (f)	Percentage	Frequency (f)	Percentage	Frequency (f)	Percentage
128	80.50	14	8.80	17	10.69

Table 5. Categorization of answers to the question “Please state a formula you learned in secondary school.”:

True		False		Empty	
Frequency (f)	Percentage	Frequency (f)	Percentage	Frequency (f)	Percentage
108	67.92	30	18.86	21	13.20

According to Table 6, based on answers to the question “Please state a rule you learned in secondary school.”,

71.69% of pre-service teachers gave true answers while 6.28% gave false answers and 22.01% skipped the

Table 6. Categorization of answers to the question “Please state a rule you learned in secondary school.”

True		False		Empty	
Frequency (f)	Percentage	Frequency (f)	Percentage	Frequency (f)	Percentage
114	71.69	10	6.28	35	22.01

Table 7. Categorization of answers to the question “Please state a formula you learned in high school”.

True		False		Empty	
Frequency (f)	Percentage	Frequency (f)	Percentage	Frequency (f)	Percentage
99	62.26	31	19.49	29	18.23

Table 8. Categorization of answers to the question “Please state a rule you learned in high school.”:

True		False		Empty	
Frequency (f)	Percentage	Frequency (f)	Percentage	Frequency (f)	Percentage
100	62.89	9	5.66	50	31.44

question.
Predominantly, true answers are as follows:

“Inside opposite angles are equal to each other.”, “A single line passes through two points.”, “In an equilateral triangle, the length and angle of edges are the same.”, “In an equilateral triangle, all angles are 60 degrees.”, “In a right triangle, the edge facing 90 degrees is the longest and called hypotenuse.”, “The sum of angles in a rectangle is 360 degrees.”, “The sum of angles in a triangle is 180 degrees.”, “The sum of exterior angles of a triangle is 360 degrees.”, “The big angle faces the long edge”, “Numbers ending with 0 or 5 are divisible by 5.”, “ $\sin^2 x + \cos^2 x = 1$ ”, “Multiplication of two negative numbers gives a positive result.”, “Order of operations (parentheses-multiplication, division-addition, subtraction)”

Predominantly, false answers are as follows:

“Volume of a circle = $\frac{4}{3}\pi r^3$ ”, “Area of a right triangle: half of the multiplication of legs.”, “ $\Delta = b^2 - 4ac$ ”, “ $a^2 = b^2 + c^2$ (In a right triangle, the sum of the squares of legs is equal to the square of the hypotenuse = the Pythagorean theory)”.

According to Table 7, based on answers to the question “Please state a formula you learned in high school.”, 71.69% of pre-service teachers gave true answers while 6.28% gave false answers and 22.01% skipped the question. Predominantly, true answers are as follows:

“Volume of a sphere: $\frac{4}{3}\pi r^3$ ”, “Area of a circle: πr^2 ”,

“Volume of a cube: a^3 ”, “ $\Delta = b^2 - 4ac$ ”, “ $x_{1,2} = \frac{-b \pm \sqrt{\Delta}}{2a}$ ”, “Area of a trapezoid: $\frac{(a+b).h}{2}$ ”, “ $h^2 = e.f$ ”, “ $\bar{x} = \frac{x_1+x_2+\dots+x_n}{n}$ ”, “Circumference of a circle: $2\pi r$ ”, “The Pythagorean theory: $a^2 = b^2 + c^2$ ”, “ $h^2 = p.k$ ”, “Volume of a cylinder: $\pi r^2 h$ ”, “ $y - y_0 = m(x - x_0)$ ”.
Predominantly, false answers are as follows:

“ $\lim_{x \rightarrow \infty} f(x) + g(x) = \lim_{x \rightarrow \infty} f(x) + \lim_{x \rightarrow \infty} g(x)$ ”, “ $\sum_{i=1}^n a_i = a_1 + a_2 + \dots + a_n$ ”, “ $x^3 + y^3 = (x - y)(x^2 + xy + y^2)$ ”, “ $\log_a b = \frac{1}{\log_b a}$ ”, “ $(\sin x)' = \cos x$ ”, “ $\sin 2a = 2 \sin a \cdot \cos a$ ”, “ $\sin^2 x + \cos^2 x = 1$ ”, “ $\tan x = \frac{1}{\cot x}$ ”, “ $y = mx + n$ ”, “ $r = \frac{-b}{2a}$ (peak value of the parabola)”, “ $n! = 1.2.3 \dots (n-1).n$ ”, “ $\log_a b^a = a \cdot \log_a b$ ”.

According to Table 8, based on answers to the question “Please state a rule you learned in high school.”, 62.89% of pre-service teachers gave true answers while 5.66% gave false answers and 31.44% skipped the question. Predominantly, true answers are as follows:

“ $\log_a b^a = a \cdot \log_a b$ ”, “ $\sin^2 x + \cos^2 x = 1$ ”, “ $\log_a b$, when $b=1$, $\log_a 1=0$ ”, “Two angles of an isosceles triangle are the same.”, “The highest degree in a polynomial is the polynomial’s degree.”, “Minimum 3 points are needed for a figure to define a plane.”, “Odd exponential of negative numbers is again negative.”, “Injective and surjective functions have inverses.”, “Inscribe angle is equal to the half of the arch it faces.”, “ $\tan x \cdot \cot x = 1$ ”, “If $\Delta < 0$ then there is no real root”, “If ACB ve BCC then ACC ”, “ $i^2 = -1$, $i^4 = 1$ ”, “The L-Hospital rule”, “ $\sin 2x = 2 \sin x \cos x$ ”.

Table 9. Categorization of answers to the question “Is there mathematics without formula and rule?”

Yes		No	
Frequency (f)	Percentage	Frequency (f)	Percentage
59	37.10	100	62.89

Table 10. Categorization of answers to the question “According to you, how do mathematics without formula and rule become?”

Categories	Frequency (f)	Percentage
Maths would get more difficult and meaningless	22	13.83
Maths would get very abstract	2	1.25
Since subjects are interrelated in maths, the mathematical process would rely upon encoding and decoding	1	0.62
Students would be involved in the process	2	1.25
Empty	13	8.17
It would become a mix of unsolvable problems	6	3.77
I even don't want to think	1	0.62
Then there is no maths	10	6.28
It would be excellent	3	1.88
No learning and knowledge acquiring would take place	3	1.88
It would be needed to develop solutions with individually proven concrete elements	14	8.80
We even would become unable to do the four basic operations of maths	1	0.62
Maths would be more productive	10	6.28
We could not rely upon any piece of information and everything would be baseless	3	1.88
It would be more instructive and permanent	9	5.66
It would foster curiosity	1	0.62
It may get complicated in absence of certain rules	2	1.25
Maths would be interpretation-oriented	6	3.77
It would cause loss of time	13	8.17
Memorization could be eliminated	8	5.03
Maths would get a concrete form	6	3.77
It would be more detailed and meaningful	4	2.51
It would lose its distinguishing nature	1	0.62
Students would be afraid of maths	1	0.62
It would be based on employing and illustrating the logic	14	8.80

Predominantly, false answers are as follows:

“Menelaus’ theorem”, “ $\Delta = b^2 - 4ac$ ”, “Area of a rectangle = short edge . long edge”, “The Euclidean relation”, “Area of an equilateral triangle: $\frac{a^2\sqrt{3}}{4}$ ”.

According to Table 9, based on the answers to the question “Is there mathematics without formula and rule?”, 37.10% of the pre-service teachers answered yes while 62.89% answered no. According to Table 10, based on the answers of pre-service teachers to the question “According to you, how do mathematics without formula and rule become?” the results are grouped into 25 categories. These categories are: “Maths would get more

difficult and meaningless.”, “Maths would get very abstract.”, “Since subjects are interrelated in maths, the mathematical process would rely upon encoding and decoding”, “Students would be involved in the process”, “It would become a mix of unsolvable problems.”, “I even don't want to think.”, “Then there is no maths.”, “It would be excellent.”, “No learning and knowledge acquiring would take place.”, “It would be needed to develop solutions with individually proven concrete elements.”, “We even would become unable to do the four basic operations of maths.”, “Maths would be more productive.”, “We could not rely upon any piece of information and everything would be baseless.”, “It would be more instructive and permanent.”, “It would foster curiosity.”, “It may get complicated in absence of certain

rules.”, “Maths would be interpretation-oriented.”, “It would cause loss of time.”, “Memorization could be eliminated.”, “Maths would get a concrete form.”, “It would be more detailed and meaningful.”, “It would lose its distinguishing nature.”, “Students would be afraid of maths.”, “It would be based on employing and illustrating the logic.”, Pre-service teachers stated that maths without formula and rules would get complicated and become meaningless, and therefore they would have difficulty in explaining any theory, and such formula and rules are indispensable elements of maths. Maths would be very abstract, and therefore be only limited to theory and assumption. It would be a mix of unsolvable problems. They stated that just as plants would not grow without water, there would be no maths without formula and rules. That maths would be implemented by way of individually proven concrete solutions, namely proofs. That maths would be more productive, in other words, it would allow the invention of new concepts. That maths would be interpretation-oriented, and hence different solutions and different answers would arise. That this would cause loss of time, resulting in extended operations. And finally, that maths would gain a concrete nature, subjects would be taught in concrete forms, namely through physical materials or real-life examples.

DISCUSSION

The findings of the research are the following:

It is shown that answers of pre-service teachers to the question “What is formula?” are grouped into 23 categories. These categories can be sorted by a number of answers as follows: “Practical information for the simple solution of a problem”, “Solution method used for a specific subject”, “Stereotyped statement requiring memorization with no underlying rationale illustrated”, “There is nothing called formula”, “Concept formed by symbols”, “Conclusion part of the proofs”, “Provable rules”, “Proven form of the theories”, “Set of symbols relating to the phenomenon, principle or rule”, “A correlation”, “Concrete form of abstract thoughts”, “Fixed form of specific aspects” “Theoretical part of mathematics, the abstract side”, “Summary of the subjects, the theme”, “Simplified form of statements”. 4.40% of pre-service teachers skipped this question. Each student exhibits that formula represents a justification in his/her mind. In the answers, a clear conceptual definition of the formula emerges. It was found that students mathematically transform formula into a field-specific term, and are aware of the significance of formula for maths. It is evident that formula as a component of maths actually makes a scientific sense for the students.

It is shown that answers of pre-service teachers to the question “What is rule?” are grouped in 26 categories.

These categories can be sorted by number of answers as follows: “The path to the solution of a problem”, “A principle that people should respect”, “Shortcuts to simplify complicated operations”, “Conclusive”, “Ensures that the lesson is studied in a systematic manner”, “A precondition and necessity in problem solving”, “Theory”, “Anything previously proven and accepted to be true”, “Limits, borders and criteria specific to each matter”, “Something indispensable for the matter”, “The rationale, core of a subject”, “An element that makes the maths meaningful”, “Something that cannot be proven and changed”, “The path to implementing the formula”, “Fixed form of results derived from certain aspects”, “Shows the method and place of a mathematical process”. In addition, 9.43% of pre-service teachers skipped this question.

While presenting mathematics to students, the main goal of teachers is to provide a quick understanding of the concepts and deliver the premises that will bring solution to the question. Perhaps the most important of these premises is the virtual keys called “rules”. Because teachers generally believe that maths could be presented more easily with this strategy, answers suggest that this is not a wrong approach. The vast majority of pre-service teachers think that the mathematical logic can be reduced down to rules. This perception draws an important framework for lecturing. It is believed that the answers provided can drive the emergence of new teaching methods for mathematics. Students believe that fitting the rule sequence into a logical framework would streamline learning. Student answers support the definition of rule as simple understanding. If the teacher involves into the mental process the logical rule statements hidden in each subject, understanding would further be easier.

Based on answers to the question “What is the first formula you remember?”, 88.05% of pre-service teachers gave true answers while 8.80% gave false answers and 3.14% skipped the question. Answers reveal that students mostly formulate the concept of formula correctly in their minds, and that most answers are parallel. The reason of such parallelism between answers may be argued that teachers frequently refer to these formulas conceptually during their presentations in the class, teachers create strong ties with these formulas when solving problems, and that formula strongly stick to mind. The multiplicity of similar formulas paves the way for reviewing the curriculum. The answers of pre-service teachers can be taken into consideration in fine-tuning the course contents and distribution of the questions.

Based on answers to the question “What is the first rule your remembering?”, 80.50% of pre-service teachers gave true answers while 8.80% gave false answers and 10.69% skipped the question. For students, rules serve as a pill. The steps of the subject are further reinforced by rules and this approach underlines the necessity to build a discipline in presenting the rule. Student answers

reveal that rather symbolic and frequently used statements are permanent in mind. Again, majority of the answers show that rule statements are dominant in subjects where the teacher has no difficulty to present. It may further be argued that the order of importance of subjects shapes student answers.

Based on answers to the question "Please state a formula you learned in secondary school.", 67.92% of pre-service teachers gave true answers while 18.86% gave false answers and 13.20% skipped the question. During secondary education, teacher should initially present more reasonable concepts, in other words concepts requiring less memorization to students. Because, in such a period when the fundamentals of maths are laid, the teacher should avoid a memorization reflex in students, and illustrate them that everything has a logical explanation. However, this is quite difficult to apply for maths because, due to interaction with individuals in social life, the student comes to class loaded with a prior assumption that maths is a series of formula. This way of thinking makes the teacher's job difficult and teachers have to destroy this wrong belief first. Especially, when parents frequently mention about their bad experiences with maths during their education life, student's perception of maths is adversely impacted because parents also perceived maths as being pinched into a formula form, thus formulating it that way in their mind. Such formulation is similarly transmitted to children. Student answers support these comments " $a^2 = b^2 + c^2$ ". Answers such as " $b^2 - 4ac = \Delta$ " etc, may be provided as a proof of the fact that information flow is linked with conveyances. Furthermore, especially for formula expressions where students have difficulty, teacher statements like "this will have relevance in upcoming lessons" causes frequent repetition of such similar expressions.

It should be taken into consideration that the majority of answers are jointly included in the secondary and high school curricula. An analysis of the answers suggests that the Pythagorean relation, the association frequency of trigonometric symbols, identities, multiplicity of area and circumference equations of simple geometric figures or frequently repeated geometric forms as highly repeated subjects, are the basis of persistence in the minds of students.

Based on answers to the question "Please state a rule you learned in secondary school.", 71.69% of pre-service teachers gave true answers while 6.28% gave false answers and 22.01% skipped the question. Answers reveal that pre-service teachers frequently repeat the mathematical discourses that make up the basic phenomena. In particular, it is shown that pre-service teachers are more familiar and better in the subjects of angles, divisibility and arithmetic operations. The presentation of these subjects intensively and systematically by pre-service teachers in information form may suggest the proper formulation of the secondary

school curriculum. These data show that mathematical teaching can be directed to correct methods. The secondary school mathematics curriculum is aimed at ensuring that students learn by practice and answers reveal the benefits of learning by practice as well. The answers of pre-service teachers also indicate that the "rule" perception is managed properly.

Based on answers to the question "Please state a formula you learned in high school", 71.69% of pre-service teachers gave true answers while 6.28% gave false answers and 22.01% skipped the question. The multitude of examinations for future in high school tells us that the concept of formula needs to be discussed in a different platform. Because, during this period, students only focus on two key words, "time" and "correct". Time is important for them because exams are measured by performance against time, and again the "correct answer" is important for students because this defines the score. Particularly during the high school period, due to aforementioned reasons, students care more about the phenomena considered as "formula". The basic assumption of this care is that each student can easily achieve both objectives of time and correct answer if they know more "formula". In particular, the facts in Table 7 should be analysed in the light of the two reasons above.

Among the answers, the multitude of $x_{1,2} = \frac{-b \pm \sqrt{\Delta}}{2a}$,

trigonometric expressions, limit formula and polygonal circumference concepts, are critical proofs indicating that second-degree equations, trigonometry, limit and concepts of area and circumference, respectively are experienced frequently. Also identity is accepted as one of the key subjects that can be involved in this group. Frequent mention of the aforementioned items in the answers of pre-service teachers may suggest that these subjects constitute basis to all other subjects in high school.

Based on answers to the question "Please state a rule you learned in high school.", 62.89% of pre-service teachers gave true answers while 5.66% gave false answers and 31.44% skipped the question. Based on the answers to the question "Is there mathematics without formula and rule?", 37.10% of the pre-service teachers answered yes while 62.89% answered no.

Based on the answers of pre-service teachers to the question "According to you, how do mathematics without formula and rule become?" are grouped into 25 categories. These categories are: "Maths would get more difficult and meaningless.", "It would become a mix of unsolvable problems.", "Then there is no maths.", "It would be needed to develop solutions with individually proven concrete elements.", "Maths would be more productive.", "We could not rely upon any piece of information and everything would be baseless.", "It would be more instructive and permanent.", "It may get complicated in absence of certain rules.", "Maths would be interpretation-oriented.", "It would cause loss of time.",

“Memorization could be eliminated.”, “Maths would get a concrete form.”, “It would be based on employing and illustrating the logic.”,

No adequate resource could be found in literature after review within the scope of this study. Based on resources found, the answers of pre-service teachers for the question “What is formula?” point to a parallelism between this study and the study of Isik et al. (2005). Considering the answers to the question “According to you, how do mathematics without formula and rule become?”, this study shows a parallelism with the studies of Ozdemir and Uzel (2011), Altay and Umay (2011), Ahuja et al. (1998) and Pale (2016), as particularly supported by the answers of “it would be based on employing and illustrating the logic”, “memorization could be eliminated.”, and “students would be involved in the process”. Moreover, considering the opinion “no learning and knowledge acquiring would take place” stated in this study, the latter also shows a parallelism with the study of Karakus (2004). Since students perceive maths as a process of memorizing formula and rules, opinions such as “I can’t imagine maths without formula and rules”, “It would become a mix of unsolvable problems”, “We could not rely upon any piece of information”, “It may get complicated in absence of certain rules” and “Maths would be interpretation-oriented” may arise.. In this respect, the study further shows a parallelism with the studies of Pale (2016) and Ozudogru (2016). The following suggestions may be developed based on this study:

Pre-service teachers have used examples involving similar formula for many times. Accordingly, the suggestions are:

1. To review the curriculum as well as the teaching methods and techniques;
2. To restructure the distribution of topics in high school and redesign the study hours;
3. Maths teachers should teach topics as accompanied by their rationale, their origin and areas and methods of using them;
4. Teachers should encourage the use of formula in an aim to prevent students from taking the easy way out;
5. Teachers should infuse a higher level of awareness when presenting the topic;
6. Transforming the student’s belief of “formula helps to solve the problem more easily” into more logical and more educational concepts;
7. To discuss the concepts of formula and rule in maths education on subject basis. Hence, the study could be more specifically addressed.
8. To analyse how students construct in their minds the examples given by the teacher to support the concepts of formula and rule;

9. Teachers should arrive at formulas and rules collectively with their students. They must avoid spoon feeding the students and prevent them from memorizing.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Opinions of teachers and preservice teachers of social studies on geo-literacy

Hatice MEMİŞOĞLU

Department of Turkish and Social Sciences Education, Faculty of Education, Abant İzzet Baysal University, Bolu, Turkey.

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The purpose of this study is to investigate the opinions of teachers and preservice teachers of social studies on geo-literacy. The study used the qualitative research design of phenomenology to collect data. The study consisted of 20 teachers and 30 prospective teachers of social studies. The purposive sampling method of criterion sampling was taken as a basis. Descriptive analysis method was used to analyze the data obtained via interviews. As a result of the study, most preservice teachers of social studies defined geo-literacy as having geographical knowledge, as well as reading and interpreting geographical information; while social studies teachers define it as making sense of interpreting geographical information. When the opinions of preservice teachers of social studies on their efficacy levels were asked, they stated that they knew about geographical information- conceptual information on an intermediate level, they also stated that they did not find themselves capable in spatial perception skills, association, relation, and critical geography dimensions. Regarding the problems experienced in geo-literacy, teachers and preservice teachers of social studies stated that trips-observations are not included, abstract information is not materialized, concepts are not completely explained, skills of spatial perception and practice levels are not sufficiently included. Despite the high number of targeted outcomes in the curriculum, class hours is a limitation, and teachers are not sufficiently knowledgeable about geo-literacy.

Key words: Geo-literacy, social studies, social studies teacher, social studies preservice teacher.

INTRODUCTION

Geography is the science of investigating the distribution of natural, human and economic activities on the entirety of the earth or a part of it, the relationships among these and causalities (Özey, 2002). Doğanay (2011) defined geography as the science that investigated the natural, human and economic environment factors of the earth by association with humans. As seen here, geography

necessitates not only the understanding of the world, but also making sense of it and associates it with humankind. In geography instruction, the fundamental principle is to train individuals who have geographical inquiry skills with a comprehension of geographical information. In geography, the expectation is not only that the individual is aware of the space around them, but also, they have the

E-mail: haticememisoglu2008@hotmail.com. Tel: +90 537 3082299.

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awareness of being responsible in all geographical interactions all over the world and have an awareness of creating solutions (Öztürk, 2008). The main purpose of the science of geography is to have students understand the world they are living in. Goals of geography include achieving sustainable development, playing a role in the establishment of development plans, creating patriotism, raising awareness for the environment and natural disasters, facilitating comprehensive look at events, understanding the world and respecting different cultures, providing individuals with not only information but also skills, values and attitudes, and putting these into practice in their daily and professional experiences (Aydın and Güngördü, 2015). While reaching these goal, geography utilizes the principles of distribution, causality and relationship (Doğanay, 2011). Frequently used instruction principles regarding geography teaching are learner-oriented teaching, proximodistal, from known to unknown, from abstract to material, clarity, comprehensiveness, actuality and economicality (Ünlü, 2014).

The power and beauty of geography allow one to see, understand and interpret the network of relationships among people, places and environments. Analysis of differences and similarities in space and different geographical appearances contributes to comprehension of the earth as the residence of humans and therefore better utilization of it. The roots of and solutions to various domestic and international economic or political problems depend highly on geography (Aydın and Güngördü, 2015).

In order to ask geographical questions in making national and international decisions, training people who are aware of global developments, achieving sustainable development both in daily life and in the scientific sense and raising geographical awareness, geographical information is needed. Geographical information is significant due to its relationship with the problems of the world we live in. This information improves the critical thinking skills of students by teaching them how to read maps and interpret information on local and global scales. Therefore, it helps students understand the world. Thus, in order to have skills of geographical thinking and shape human life, geography should be the center of life. This is only possible by provision of a qualified training of geography (Şahin, 2003).

Geography training changes the current development of children in terms of geography, their sense of space, awareness of the world, attitudes and values. It increases their experiences about the world. It informs children about places and environments, and develops questions and skills that require children to inquire about the local and global environment (Catling, 2015).

Geography is not a discipline of general knowledge that only provides general knowledge and helps enlightened individuals comprehend the systematique of event in the world. In addition to these function, it is also effective in development of patriotism in individuals. Loving,

defending and managing a place where one lives, require a good geography education. This means, geography education is a mutual necessity for everyone and every part of the society (Meydan, 2011). The interaction of the humankind with the natural environment has gained a different dimension today in comparison with the past. The humankind pays more attention on developments in the world, and wants to have more information on the events taking place in the world. Awareness and knowledge of humans on events in the world will be possible by an effective geography education and training (Şahin, 2010).

It is not sufficient to only have information in geography education. Usage of this information requires being geo-literate. Welton (1988) described geo-literacy by combining three main elements as knowledge of the physical environment, map usage skills and knowledge of the main concepts of geography. In the cultural and functional sense, geo-literacy goes further by having the location information of places, and it may be described as having talents that contain basic map skills and skills oriented around human-environment relationship (Gençtürk, 2009). Geo-literacy is also defined as learning, making sense of and deciding on the main information, concepts and processes regarding geography, and using these (Tuna, 2013), and as the skill to understand and comprehend various types of geographical information and turn them into skills (Dikmenli, 2013).

Different scientific schools of thought determined some principles in terms of geo-literacy. Education National Geographic divided geo-literacy into three titles: "interaction, connection and effects". They stated that geo-literacy mainly requires three things, and these are interaction, interconnections and inferences (Edelson, 2012).

Geo-literacy progresses on three different levels as lower-intermediate-upper. Lower-lower level geo-literacy covers the skills of knowing names and locations of places that are the fundamentals of geographical information. Intermediate-level geo-literacy covers understanding of the relationship of humanity with the environment with its reasons, and skills of questioning, confirming, examining and analyzing geographical information. Upper-level geo-literacy covers the critical geography approach. This approach requires students to have critical thinking skills and ability to understand the relationship of geography with different natural resources and strengths of nations. For critical geography, the way the strength of places affects the political and economic processes in individuals' lives is important (Oigara, 2006).

According to Bliss (2005), a geo-literate person understands the reasons for preference of living spaces, why people live in communities, and how the places they live in affect their lives. Geo-literacy provides an approach where social justice is achieved, which aims for a future that is more egalitarian, peaceful and serene

(Erol, 2015). According to Nishimoto (2012), geo-literacy covers the decisions we make in solutions for problems we meet in our daily life. It provides individuals with an approach that increases collaboration among people and aims at a future that is egalitarian, peaceful, socially just and serene. Learning about the physical and human systems in the rapidly globalizing world is not sufficient in our time. Geography needs to answer the following questions: Why? and How? Why does technology change? Do developments in transportation systems affect economic activities? Why do political borders change? Does this change affect neighbor countries? Geo-literacy allows students to conduct analyses and syntheses on such issues (Erol, 2014).

In a society with high geo-literacy levels, people reach richness and good quality of life, and they also become qualified individuals who have awareness of national and international responsibilities. In addition to this, individuals act responsibly against economic and social values, while it is emphasized that geo-literacy has a significant role in developments of the national identities of individuals (Yildirim, 2016). The geographical skills to teach geography and help development of geographical teaching in students may be listed as: skills of asking geographical questions, gaining geographical information, organizing and analyzing this information, and responding to geographical questions (Demirkaya, 2003).

Geography education and geo-literacy are also important in terms of the subject of social studies. Social studies teaching is an education program that uses information and methods derived from social studies and humanities in order to train capable individuals who make decisions based on information in the changing conditions of their country and the world and are able to solve problems (Öztürk, 2007). The course of social studies is a multidisciplinary one, therefore, it has areas of learning in geography. 3 of the 9 learning areas in the Social Studies Curriculum are directly or indirectly related to geography. The learning areas are people, places and environments; production, distribution and consumption; global connections. The geography units in the 4th-7th grade geography curricula are: Where We Live; Let Us Know Our Region; Life on Earth; Population of Our Country; From Production to Consumption; What We Produce; Resources of Our Country; Economy and Social Life; My Friends That Are Far Away; The World That Belongs to All of Us; Our Country and the World; Bridges between Countries. Two of the six skills regarding social studies are directly related to topics of geography. These are skills of observation and spatial perception. Additionally, other skills students are expected to gain via geography topics are usage of atlases, perception of time, reading maps, and reading and preparing charts (MEB, 2005).

Standards were developed for teachers of social studies regarding their field. The geographical capabilities of teachers of social studies are the following: They

should lead students to use mind maps to organize their knowledge about people, places and environments in the spatial context. They should help students understand the physical and human characteristics of places. They should help students develop their conception of area in order for them to understand and interpret the complex structure of the world. They should lead students to understand how different cultures and experiences affect people's perception of place and region. They should help students analyze how physical systems affect human activities (National Council for The Social Studies (NCSS), 2002: 12-23).

Several studies have been conducted to measure geo-literacy (Cross, 1987; Wood et al., 1988; Bein, 1990; Donovan, 1993; Eve et al., 1994; Saarinen and MacCabe, 1995; Kitchin, 2016; Roger, 1997; Thomas, 2001; Nolan, 2002; National Geographic Roper Survey, 2002, 2006; Tuncel, 2002; Winship, 2004; Sievertson, 2005; Oigara, 2006; Gençtürk, 2009; Demirkaya, 2009; Tuna, 2013; Erol, 2014, 2015). These quantitative studies revealed that students, prospective teachers and adults with different levels of education lacked the knowledge and skills they required regarding the physical and human environment. It was also determined that students did not have high levels of cognitive thinking skills. Therefore, it is important to get the opinions of teachers and prospective teachers of social studies on geo-literacy.

Objective

The purpose of the study is to investigate the opinions of teachers and preservice teachers of social studies on geo-literacy. Therefore, answers were sought for the following questions:

What are the opinions of teachers and preservice teachers of social studies on:

1. The definition of geo-literacy and importance of it for the subject of social studies,
2. How to develop geo-literacy,
3. Characteristics that people with geo-literacy need to have,
4. Skills-values to gain in order to become geo-literate and the reasons,
5. Problems experienced with regards to geo-literacy and recommendations,
6. What are the opinions of preservice teachers of social studies on their geo-literacy efficacy levels?

METHODOLOGY

Study model

This study used a qualitative research model to collect data. A qualitative study is defined as a form of study where qualitative data collection methods such as observation, interview and document analysis are used, and a qualitative process is followed towards

revealing cases and events in a realistic and comprehensive way in their natural environment (Yildirim and Şimşek, 2013). The reason for using qualitative design in this study is that it is suitable for focusing on and understanding the special languages, meanings and concepts formed and used by social studies teacher and preservice teachers regarding the issue of geo-literacy. Therefore, it aimed to join the inner-world of the teachers and determine the meaning of what they experienced for themselves. This allowed obtaining a comprehensive outlook of the study's context and formation of inferences and patterns in this context.

Study design

This study used qualitative research model of phenomenology to analyze the opinions of teachers and preservice teachers of social studies on geo-literacy. Phenomenological studies show methodological, careful and in-depth presentation and description of how people experience some phenomena (Patton, 2014).

Sample

The sample of the study consisted of 20 teachers and 30 preservice teachers of social sciences. The study used the purposive sampling method called criterion sampling. Purposive sampling allows in-depth examination of cases that are considered to be information-rich. In many cases, purposive sampling methods are helpful in discovering and explaining cases (Patton, 2014). The main idea in the method of criterion sampling is studying the cases that correspond to a set of pre-determined criteria. The criteria may be formed by the researcher or a previously prepared list of criteria may be used (Yildirim and Şimşek, 2013).

Therefore, the researcher determined the criteria for teachers of social studies as: graduation from a social studies education department (1), graduation from different universities (2) and voluntary participation in the study (3). It was expected that teachers who graduated from different universities would have different opinions, social studies education graduates would approach the issue in terms of social studies education, and volunteers would provide more reliable information. The criteria determined for prospective teachers of social studies were: being enrolled in the 4th year of their study (1) and having taken more than one elective geography course (2). It was expected that preservice teachers who were enrolled in their 4th year and selected more than one elective geography course would be able to make a reliable interpretation on geo-literacy. Table 1 shows the demographic characteristics of the participants.

As shown in Table 1, the sample consisted of 15 female and 15 male preservice teachers and 10 female and 10 male teachers of social studies. The teachers of social studies graduated from 10 different universities.

Data collection

The study collected the data with a semi-structured interview form. Using the semi-structure interview form, the opinions of the teachers of social studies on social participation were determined. Interview is a significant method for revealing the perspectives, experiences, feelings and perceptions of people (Yildirim and Şimşek, 2004). Semi-structured interviews make participants to describe the world they perceive by their own opinions (Merriam, 2013).

The relevant literature was utilized while forming the questions in the semi-structured interview form. When preparing the interview form, careful consideration was given to the principles of forming the questions so that they can be easily understood, asking open-

ended questions, avoiding directing the person, asking questions with a broad scope, and organizing the questions reasonably. Social studies education (1), geography education (1), measurement evaluation (1) experts examined the interview form questions to determine whether they are sufficient in supporting each other and reaching the required information. The interview form prepared for the study consists of two sections that contain questions regarding personal information and the topic of the study.

The questions took their final form based on the feedback received from the experts. Preliminary implementation was made with 2 teachers and 3 preservice teachers of social studies. With the positive outcome from the implementation, the interview form took its final shape and the main implementation was started. The interview form contains 6 questions. These questions were prepared based on sub-problems. The teachers answered the open-ended questions in the interview form in half an hour in the teachers' lounge. Clarifications were made when questions were not understood. Social studies candidate teachers determined according to the criterion sampling were interviewed in the faculty meeting room outside academic hours. Information about the study was given, and explanations were made. Interview form was filled within 25 and 40 min.

Data analysis

Descriptive analysis method was used to analyze the data obtained by the means of interviews. Descriptive analysis allows the data to be organized according to the themes revealed by the research questions and to be presented with consideration of the questions and dimensions used in the interview. In this type of analysis, the purpose is to present the obtained findings to the reader in an organized and interpreted way. The data obtained with this purpose are firstly described in a logical way, and then, causality relationships are reached by interpretation (Miles and Huberman, 1994; Yıldırım and Şimşek, 2013). Within this scope, the answers given to the questions were examined and various categories were created. The answers to each question were compared after coding within the context of the categories was performed. A study on the inter-rater reliability was conducted in the research. In the inter-rater reliability study, coding was carried out by the researcher and a domain expert (social studies specialist). The researcher and the expert carried out the evaluation independently of each other. The "Consensus" and "Dissensus" of the researchers and the expert were counted and the numerical values obtained were applied to the formula. In order to calculate the percentages of inter-rater reliability, $(\text{consensus}/(\text{consensus} + \text{dissensus})) \times 100$ formula was used. As a result of this study, it can be seen that the inter-rater reliability averages vary between 75 and 100%. Mean inter-rater reliability was calculated as 95%.

In order to increase reliability in qualitative research, researchers are recommended to take some precautions. These precautions are rather related to why and how strategies utilized in the study were used, and therefore, helping other researchers to use these strategies in a similar way (Yildirim and Şimşek, 2013). At this point, the researcher will have taken significant steps in terms of the external validity of their research if they report their steps in a detailed and clear way, and in terms of internal validity if they convince the reader that they did not shape the results of their study based on their preferences or tendencies (Kabapınar, 2003). This situation was accounted for in this study.

Participant confirmation and expert examination were utilized for the reliability (internal validity) of the study (Başkale, 2016). Participant confirmation was achieved by asking the participants if they had anything to add or any experience to share right after the implementation. The obtained findings were shared with the participants and it was checked whether the researcher's comments and the participant's comments were consistent with each other.

Table 1. Demographic characteristics of the sample.

Teacher	No.	Preservice teacher	No.
Female	10	Female	15
Male	10	Male	15
Graduation		Class	
Social studies edu.	20	4 th	30
Experience		Number of elective gegraphy courses selected	
0-5 years	5	3	20
6-10 years	5	2	10
11-15 years	6		
16-20 years	4		

Table 2. Opinions of teachers and preservice teachers of social studies on geo-literacy.

Preservice Teachers	Frequency	Teachers	Frequency
Having geographical knowledge	13	Making sense of and interpreting geographical information	13
Reading and interpreting geographical information	12	Being able to read-interpret maps	9
Making connections – associations in geographical topics	11	Knowledge of basic geographical concepts	8
Establishing causality	10	Skills of using geographical information	8
Following-interpreting recent issues	8	Making connections	5
Using geography tools and equipment	5	Usage of cognitive skills	2
Looking at geography issues in a critical way	4	Awareness of issues of the world and the country	2
Knowing methods and techniques of geography	3		

Additionally, including direct quotes from interviewees and explaining the results based on these quotes are important steps for validity. Direct quotes were frequently included with the aim of increasing validity by explicitly reflecting the opinions of the interviewees. The information obtained from the interview form in the study was tabulated by forming themes. While coding, the opinions of the teachers were shown as “T.1, T.2, ...T.20” and the opinions of the prospective teachers were shown as “PT.1, PT.2, ...PT.30”.

RESULTS

Findings regarding the definition of geo-literacy and its importance in terms of social studies

As shown in Table 2, while prospective teachers of social studies defined geo-literacy as having geographical knowledge (knowledge of concepts and knowledge of country and the world) (13) and reading and interpreting geographical information (11), making connections – associations in geographical topics (connecting to the environment one lives, associating geographical events, Interpreting geographical events) (11); teachers of social studies rather defined it as making sense of and

interpreting geographical information (13). Some of the opinions of the prospective teachers and teachers of social studies are as the follows:

Geo-literacy covers qualities of being able to read, interpret and analyze information such as maps, tables and charts. It also means having up-to-date knowledge by following journals and magazines in the field of geography (PT. 21). Geo-literacy is mainly the knowledge of a person on their own environment, country and the world and association of geographical events with the life and current events (PT. 13). Geo-literacy can be used to understand the geographical events that take place in the province, region and world one lives in. It is knowing and being able to explain basic concepts related to geography. It is gaining the skills of understanding, interpreting, reading the economic and cultural events in the world. It is following, interpreting and being aware of the things happening in the media (PT. 8). Geo-literacy is interpretation and making sense of a set of terms, places, cases and genuine methods regarding geography by establishing causality relationships (PT. 29). Geo-

Table 3. Opinions of teachers and preservice teachers of social studies on geo-literacy in terms of its importance in social studies education.

Preservice teachers	Frequency	Teachers	Frequency
Interdisciplinary association	10	Recognizing national and international facts	11
Better understanding of geography topics	9	Being able to analyze the effects of geography on human life	7
Making sense of the geography one lives in	8	Better interpretation of historical topics	6
Reaching outcomes	7	Permanence of knowledge	5
Learning about-recognizing national resources	7	Reaching the goals and outcomes of the course	4
Questioning causality	7	Training capable citizens	4
Providing various skills	6	Being able to make connections about all topics	3
Being a conscious citizen (problem-solving individuals)	3	Spatial analysis skills	2

literacy is the ability to read, interpret a map-table when seen, relate current affairs to geography and use geographical tools (PT. 5). It is knowing about – recognizing basic concepts related to geography, have a knowledge about maps and be aware of national and international issues (T. 1). It is the skill to use geographical knowledge to a sufficient extent. It is able to use all kinds of terms, definitions and concepts related to geography. It is to know how to utilize geography and establish connections among events (T. 6).

Accordingly, both the teachers and preservice teachers of social studies used having geographical knowledge, making sense of- interpreting geographical knowledge, making connections and association as their common definition of geo-literacy. In difference to the teachers, the preservice teachers also used definitions of following and interpreting current events and looking at issues in a critical way.

As shown in Table 3, as social studies are interdisciplinary, the prospective teachers reported geo-literacy is important because of skills of interdisciplinary association (10) and better understanding of geographical topics; the teachers stated that it is important in terms of recognizing national and international facts (11) and being able to analyze the effects of geography on human life (7). Some of the opinions of the preservice teachers and teachers of social studies are as follows:

The social studies lesson is a highly interdisciplinary lesson. In this discipline, not all subject can be separated from each other, but they are connected. One utilizes geography while teaching topics of history. Geo-literacy is important in terms of associating subjects with each other. It is also included in the goals of social studies. Various topics and disciplines are related to each other and to geography. Various taught and learned disciplines have a relationship with and basis in geography. In this sense, it makes students to make sense of the

geography of the area they live in by knowing about it and do research on it by getting more curious (PT. 8). Geography is a very important field for the lesson of social studies. Geography should be taught and instructed better for a higher quality understanding of geography as one of the most important sources of the social sciences course, and better permanence of the targeted skills, outcomes and values; only then, the outcomes and behaviors aimed to be provided may be provided, and an effective role may be taken on (PT. 14). Knowledge of students on the world they are living in, their understanding of what is happening in the world and recognition of resources are important issues in training problem-solving individuals and citizens. Moreover, skills like basic skills of map-reading, atlas-usage and navigation, are skills that need to be held by all people. Students firstly become aware of issues of their own environment, then their country and finally the world and produce solution to issues. These are the characteristics of a responsible citizen. The purpose of the social studies course is to train responsible citizens (PT. 23). I think geo-literacy is important for the knowledge to be permanent. With geo-literacy, the students not only reach the outcomes of social studies, but they are able to correctly interpret topics of history (T. 10). The social studies lesson is a multidisciplinary course. A student who gains geo-literacy may learn all subjects better and establish connections. They may understand national and international realities better. They may relate issues to geography and interpret them better. It is important in terms of training citizens whose cognitive skills such as critical thinking, problem-solving and decision-making skills are advance (T. 6).

Findings regarding the characteristics a geo-literate individual should have

According to Table 4, while the prospective teachers of

Table 4. Opinions of teachers and preservice teachers of social studies on the characteristics a geo-literate individual should have.

Preservice teachers	Frequency	Teachers	Frequency
Advanced skills	41	Ability to reach causality (connection)	12
Knowledge of field-specific concepts	15	Advanced knowledge of maps	9
Ability to reach causality (connection)	14	Advanced cognitive skills	7
Interprets and utilizes information	12	Advanced ability of analysis and synthesis	6
Curious	9	Advance chart-table reading and interpretation	4
Environmentalist	3	Observant – utilizes geography information	4
		Problem-solver, curious	3

social sciences mostly stated that a geo-literate individual should have skills such as spatial perception, critical thinking, problem-solving, observation, research ... (41) and know about field-specific concepts, the teachers of social sciences mostly stated that such individuals should be people who are able to establish causality relationships (12) and have advanced map knowledge and cognitive skills. Some of the opinions of the prospective teachers and teachers of social sciences are as follows:

They should be critical-minded, curious, environmentalist, observant people who are able to solve problems based on scientific operation steps, with advanced map reading and interpretation skills, advanced navigation skills, interest in research, who produce rational solutions, and carry these qualities (PT. 4). They should have critical thinking and problem-solving skills and be able to solve problems they encounter. They should be curious people who like to observe (PT. 15). They should be able to understand and interpret the geographical events around them, and make inferences by connecting cause and effect (PT. 9). They should be people who know the basic concepts of geography with advanced map reading skills, critical way of thinking, observation skills and qualities of a researcher and observer (PT. 28). They should be people with advanced knowledge of maps, capable of perceiving the environment they are in via problem-solving skills, capable of reading and interpreting maps, tables and charts, establishing connections by thinking about the causes and effects of events, and use and transfer geographical information into other situations (T. 13). They should be people with advanced knowledge on maps and who are able to show locations on a map, make sense of their daily experiences better in the context of the geographies they take place, and use the ways of thinking in geography (T. 19).

Findings related to how geo-literacy is developed

As shown in Table 5, the teachers and preservice

teachers of social studies stated that spatial perception activities (map usage–interpretation–empty map, globe usage, chart-table reading and interpretations) (17-11), trips-observations (13-10) and usage of images (10-10) should be frequently employed to provide people with geo-literacy. The teachers also stated that it is important in providing geo-literacy to frequently asked questions such as why, for what and how, which improve thinking, fun games, repetitions, usage of current issues and materialization. Some of the opinions of the prospective teachers and teachers of social sciences are as follows:

In order to develop geo-literacy, firstly, the skills of reading and interpreting maps, tables and charts should be developed in students. Empty maps, tables, charts and maps should be frequently used in classes. Different methods and techniques that will encourage students should be employed, for example, the station techniques, question and answer, debate, observation, collaborative learning, or interviews about migrations. Field trips of virtual trips may be organized. Various topics of geography and projects related to the environment may be given as assignments. Documentaries, images should be frequently included in the classroom (PT. 9). Classes should be based on materialization instead of memorization. We should develop this in students as much as technology allows using three-dimensional simulations, images and trips-observations. Additionally, different techniques and methods should be used frequently in the classroom (PT. 17). Geo-literacy develops by providing the student with various skills such as critical thinking, research and observation skills. Additionally, usage of maps, tables, charts, empty maps, materials and images also improves skills (PT. 22). The most suitable method to develop geo-literacy is trips-observations. This is because the student finds the opportunity to learn by experiencing and doing in this process. Additionally, the teacher should use different methods and techniques in the classroom. Maps, empty maps should definitely be used, and the learning environment should be enriched by images (T. 3). Usage of maps, empty maps and atlases is important in developing geo-literacy. Activities of

Table 5. Opinions of teachers and preservice teachers of social studies on how geo-literacy is developed.

Prospective teachers	Frequency	Teachers	Frequency
By spatial perception practices	17	Developing spatial perception skills	11
Trip-observation activities	13	Demonstration-images	10
Demonstration (images)	10	Trip-observation	9
Material usage	9	Questions that improve thinking	6
Usage of different methods and techniques	7	Fun games	5
Improving skills	6	Usage of current issues	3
Activities-practice	5	Materialization-exemplification	2
Handling daily issues in the classroom	4	Usage of different methods and techniques	2
Materializing subjects	3		

reading and interpreting maps and charts should be employed. Research assignment should be given. Asking questions such as why, for what and how, which will encourage the student to think, improves the power of analysis and synthesis (T. 12).

Findings regarding the skills and values that should be provided to develop geo-literacy

According to Table 6, preservice teachers of social studies stated that the most important skills are spatial perception (24), critical thinking (23), problem-solving (20) and observation (19) and the most important values are awareness (26), responsibility (25) and patriotism. Teachers stated that most important skills are spatial perception (15), observation (8), problem solving (4) and the most important values are awareness (15), responsibility (8), patriotism (5). Some of the opinions of the preservice teachers and teachers of social studies are as follows:

In social studies classes, in order to develop geo-literacy in students, the focus should be on critical thinking, problem-solving, spatial perception and observation skills. Regarding values, as citizens, environmental awareness, responsibility, working hard, being scientific and patriotism should be emphasized as much as possible (PT. 13). The most important skill in geo-literacy is spatial perception. Skills of reading and implementing maps, tables and charts should be developed in students. Skills of questioning causality relationships should be focused on. Observations should be made by the people. Environmental awareness and citizenship responsibilities may be developed as values (T. 8). Values of patriotism (recognition of own country, land and nation), responsibility for the country and awareness of the environment and the country are important. Additionally, compassion for different geographies may also be developed (T. 14).

Issues about geo-literacy and recommendations for solutions

As shown in Table 7, preservice teachers of social studies stated that there is insufficient focus on spatial perception, lack of inclusion of images, trips and observations, problems in materializing abstract information, incomplete explanation of concepts and lack of practice activities. Teachers of social studies stated that trips and observations cannot be included enough due to the procedures at schools, and although the number of outcomes is high in the curriculum, the class hours are insufficient, there is a lack of sufficient activities and usage of maps, and teachers are inadequately knowledgeable about geo-literacy. Some of the opinions of the preservice teachers and teachers of social studies are as follows:

The topics are intensive and boring for students, teachers are not discussing the topics using different methods and techniques, some subjects are abstract and they are not materialized, some subjects and especially some concepts are not completely explained, the students are reluctant, and there is insufficient focus on the skills for reading and interpreting maps, tables and graphics (PT. 4). Visual materials are not used sufficiently while discussing geography topics, subjects are not materialized, different methods towards increasing permanence are not used, practices towards interpreting maps and tables are not included frequently, the curriculum is crowded with topics, the cause and effect relationships among events are not sufficiently emphasized, and there are no trips and observations (PT. 22). As the geography education is provided theoretically and it does not include practice, it cannot be internalized. As it is just memorized, as the system of memorization where the student is inactive, this literacy cannot be developed (PT. 11). There is lack of materials like maps in schools or their insufficient usage, failure to follow current

Table 6. Opinions of teachers and preservice teachers of social studies on the skills and values that should be provided to develop geo-literacy.

Skills	Preservice teachers		Teachers				
	Frequency	Values	Frequency	Skills	Frequency	Values	Frequency
Spatial perception	24	Awareness	26	Spatial Perception	15	Awareness	15
Critical thinking	23	Responsibility	25	Observation	8	Responsibility	8
Problem-solving	20	Patriotism	19	Problem-solving	4	Patriotism	5
Observation	19	Being scientific	10	Critical thinking	4	Compassion	2
Creative thinking	5	Being hardworking	10	Research	3		
Entrepreneurship	5						
Research	5						
Change and continuity	4						
Usage of IT	4						

Table 7. Opinions of teachers and preservice teachers of social studies on issues about geo-literacy.

Prospective teachers	Frequency	Teachers	Frequency
Insufficient focus on spatial perception	13	Lack of inclusion of trips and observation	9
Lack of inclusion of visual materials	10	Intensity of outcomes	8
Lack of inclusion of trips and observation	10	Lack of sufficient activities	7
Abstract information is not materialized	9	Lack of sufficient class hours	7
Lack of establishment of causality	8	Negligence of map usage	5
Incomplete explanation of concepts-terms	8	Inadequacy of textbooks	4
Lack of development in critical thinking	8	Incapability to understand abstract concepts	4
Lack of variety in methods and techniques	8	Anxiety about catching up with the curriculum	4
Negligence of skills and value dimensions	7	Inadequate knowledge of teachers	3
Packed-up structure of topics	6	Lack of reinforcement by images	3
Lack of inclusion of practice	6	Lack of student enthusiasm	2
Lack of following current topics	5	Crowded classrooms	2
Lack of sufficient class hours	3	Outdated information	2

issues and associate them with geography, lack of visual material usage, failure to provide fun methods and techniques (PT. 21). There are too many targeted outcomes in the curriculum. This is why we are struggling to catch up with the curriculum. There are not many activities towards geo-literacy. There is also lack of knowledge in this subject. I think textbooks are also insufficient in this matter (T. 7). Insufficient class hours, intensity of the curriculum, failure to take part in activities that will put geographical information into practice, difficulties of students to understand abstract subjects and their unwillingness seem to be the most important problems in my opinion (T. 19).

As shown in Table 8, as recommendations for solutions to issues in geo-literacy, the teachers and preservice teachers of social studies mostly stated increasing trips-observations (11-7), using practice in classes. The

teachers of social studies stated that the class hours for the social studies course should be included and the targeted outcomes should be reduces, textbooks should be made effective, and teachers should be given in-service training regarding geo-literacy. Some of the opinions of the prospective teachers and teachers of social sciences are as follows:

If we want to develop geo-literacy, we should first improve skills of reading and interpreting maps, tables and charts. Trips-observations should be made more frequent in our schools. We are only looking at the knowledge dimensions, but the values and skills dimensions should also be focused on. The subjects should be provided in compliance with teaching principles, and practices should be taken on to lead students to establish causality relationships and think creatively (PT. 9). Trips-observations should be increased in number. Materials, visuals

Table 8. Recommendations of teachers and preservice teachers of social studies for issues in geo-literacy.

Preservice teachers	Frequency	Teachers	Frequency
Increasing trips-observations	11	Increasing trips-observations	7
Enrichment of materials	7	Increasing class hours	7
Using practice in classes	7	Materializing subjects	6
Materializing subjects	6	Focusing on spatial perception skills	6
Improving spatial perception skills	6	Using practice for geographical information	5
Including the skills and values dimension	6	Reduction of the targeted outcomes in curric.	5
Inclusion of current issues – updates	5	Making textbooks comprehensible	5
Activity based education	5	In-service training for teachers	4
Usage of active learning techniques	5	Increased usage of images	4
Increasing class hours	3	Inadequate curriculum	3

and simulations should be enriched. Critical thinking skills should be improved and establishment of connections among subjects should be achieved. The practice part should be focused on more than the theoretical part. Current information should be provided, and at the same time, connections should be established with geographical topics by including current issues (PT. 12). The students mainly learn by seeing. For example, when I saw Karapınar in Konya [Turkey], I was moved by the erosion example. Therefore, trips and observations should be included. The procedure and responsibility of trips limit the teachers extensively. Images, maps, tables, charts, photographs, conceptual maps and similar visuals attract students during classes. Smartboards should be used effectively in this matter (T. 4). As students have difficulty in understanding abstract concepts, the subjects should be taught by materializing those concepts. Students should be asked to practice and taught how to use the information in daily life. Class hours should be increased, trips should be organized in relation to topics, the quality of books and textbooks should be increased and teachers should be improved with in-service training (T. 18).

Findings regarding the geo-literacy levels of preservice teachers of social studies

As shown in Table 9, while the prospective teachers of social studies stated that they were on an intermediate level in terms of knowing geographical information and concepts and causality; they stated that they did not find themselves sufficient in terms of spatial perception skills (reading and interpreting maps-tables-charts), making connections among events, association, as well as in the dimension of following geographical issues and looking at things critically.

I cannot say that I see myself adequate in terms of geo-literacy. I do not think I am very capable of

concepts, and reading and interpretation of maps, tables and charts. I am not completely capable of solving scale and time problems. I do not see myself competent in making connections and association things. I should improve myself in this matter (PT. 5). I know the concepts in geo-literacy. However, I cannot say I am sufficient in interpretation of maps, tables, charts, making connections and associations, and relating geographical topics by following current issues (PT. 22). I know very much about some geographical concepts and I can describe them. However, I cannot describe some concepts even though I know what they are called. I do not completely know the reasons for some geographical events, and I do not know the details and the reasons why some happened. I am not very capable in the area of association and table-chart interpretation (PT. 14).

DISCUSSION

While the prospective teachers of social studies defined geo-literacy as having geographical knowledge, reading and interpreting geographical information; the teachers of social sciences defined it as making sense of interpreting geographical information and reading-interpreting maps. Welton (1988) described geo-literacy by combining three main elements: knowledge of the physical environment, map usage skills and knowledge of the main concepts of geography. The teachers and preservice teachers of social studies provided similar definitions. According to the definition of geo-literacy by Oligara (2006), the teachers and the preservice teachers mostly mentioned the steps of having knowledge on the lower-level, establishing relationship with the environment, inquiry and analysis on the intermediate-level, while the rarely mentioned the critical geography approach, which is higher-level literacy.

While the preservice teachers stated that geo-literacy is important for achieving association among disciplines

Table 9. Opinions of the preservice teachers of social studies on their geo-literacy capabilities.

Prospective teachers	Insufficient (n)	Intermediate (n)	Sufficient(n)
Knowledge of geographical information and concepts	6	18	6
Spatial perception skills	18	9	2
Causality	4	15	5
Making connections - association	13	7	5
Ability to look critically	12	5	3

and better understanding of geographical subjects as the social studies course is interdisciplinary, the teachers said it is important in terms of recognizing national and international realities and analyzing the effects of geography on human life. There was an agreement between the goals stated in the social studies course curriculum and the opinions (MEB, 2005).

As the characteristics that a geo-literate individual should have, the preservice teachers most frequently mentioned: skills of spatial perception, critical thinking, problem-solving and observation, and knowledge of field-specific concepts, while the teachers said they should be individuals who are able to establish cause and effect relationships of events and have advanced knowledge of maps and cognitive skills. According to the social studies curriculum, the skills directly related to geography topics are observation and spatial perception skills. Additionally, other skills that aimed to be developed via geography topics are skills of atlas usage, perception of time, reading maps and reading and preparation of charts (MEB, 2005). The teachers and preservice teachers of social studies also emphasized these skills.

The teachers and preservice teachers stated that, in order to develop geo-literacy, spatial perception practices, trips-observations and visual materials should be utilized frequently. The teachers also added that frequently asking questions that improve thinking such as why, for what and how, repetitions with fun games, usage of current issues and materialization of abstract subjects are important in developing geo-literacy.

Regarding what could be the values and skills to be provided while developing geo-literacy, the teachers and preservice teachers stated the the most important skills are spatial perception, observation, problem-solving and critical thinking, and the most important values are awareness (for the environment, country and world), responsibility and patriotism. The geographical skills necessary to teach geography and help development of geographical thinking in students may be listed as skills of asking geographical questions, gaining geographical knowledge, organizing and analyzing this knowledge, and answering geographical questions (Demirkaya, 2003).

While the preservice teachers stated that they knew about geographical information-concepts and reasons for events on an intermediate level, they said they did not see themselves as adequate in skills of spatial perception

(reading and interpretation maps-tables-charts), making connections among events, association, and being able to consider a geographical issues in a critical way by following them. Some other studies had similar results (Cross, 1987; Kinney et al., 1988; Saarinen and Maccabe, 1995; Wood et al., 1988; Chiodo, 1993; Eve et al., 1994; Hardwick et al., 2000; Thomas, 2001; Tuncel, 2002; Gençtürk, 2009; Demirkaya 2009). Relevant studies showed that the geo-literacy levels of university students are low.

Regarding the issues seen in geo-literacy; the preservice teachers stated that classes do not focus on skills of spatial perception frequently, visuals, trips and observations are not included, there are problems in materialization of abstract information, concepts are not completely explained, and there is no practice component. The teachers stated that trips-observations are not included in schools due to excessive procedures, class hours are short despite the high number of the targeted outcomes in the curriculum, there is a lack of sufficient activities and map usage, and teachers do not have enough knowledge about geo-literacy. Akengin et al. (2016) found that teachers of social studies did not have sufficient knowledge on map, and they failed to take part in sufficient practices to develop map literacy in students due to the lack of sufficient class hours and intensity of targeted outcomes. Erol (2016) examined social studies textbooks, and it was shown that content related to geo-literacy was seen most frequently in the 6th grade social studies textbook followed by the 5th grade textbook, while it was least frequently seen in the 7th grade textbook. As a result of the study, they concluded that the content in all three grade levels was not desirable in terms of quality and quantity. It was found that the ratio of outcomes related to geo-literacy among all outcomes in the social studies course curriculum was 7%. As stated by Akpınar and Ayvaci (2003), there are inadequacies in formation of curricula regarding the characteristics of the time, changed conditions, individual and social needs, and scientific and technological developments. The opinions of the teachers and preservice teachers in the field support these findings about the curriculum.

As a recommendation for solutions to issues experienced in geo-literacy, the teachers and preservice teachers of social studies mostly stated that, trips-

observations should be increased in frequency, and classes should be held in an applied/practical way. In the study by Demirkaya (2015), it was proposed to increase the amount of trips-observations for the sake of geo-literacy. Studies have shown that trips influence geo-literacy positively (Bein, 1990; Nolan, 2002; Winship, 2004; Oigara, 2006). The teachers of social studies stated that the class hours for the social studies course should be included and the targeted outcomes should be reduces, textbooks should be made effective and teachers should be given in-service training regarding geo-literacy.

RECOMMENDATIONS

The following recommendations are presented based on the opinions of teachers and preservice teachers of social studies. In order to increase geo-literacy, in middle schools and universities, trips-observations should be more frequent, classes should be held with practice/application components, spatial perception skills should be frequently focused on and the class hours of geography should be increased. In middle schools, the targeted outcomes of the social studies course should be cut down, textbooks should be made adequate, skills of spatial perception should be focused on more and teachers should be provided with in-service training for geo-literacy. Additionally, current issues should also be included in social studies and geography courses, associations should be made with topics of geography and adjustments should be made in textbooks.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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