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I would like to thank my colleagues who have contributed to the journal with their articles.

Prof. Dr. Ahmet AKKAYA
Editor

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Education under Siege and Fire: Experiences of PBL for Leadership Skills Development from Gaza

Amjad Joma[a], Safa Migdad[b], Olivier Arvisais[c]

[a] *Psychology department, Faculty of Art and Humanities, A'Sharqiyah University, Sultanate of Oman amjad.joma@asu.edu.om*

[b] *MA in Curricula & Teaching Methodology, English Teacher, Education Program, UNRWA, GAZA, sjoma1984@hotmail.com*

[c] Faculty of Education, Université du Québec à Montréal (UQAM), Canada, arvisais.olivier@uqam.ca

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Abstract

Designing and implementing emergency education solutions during an ongoing crisis is a significant issue. Since 2007, the Israeli blockade and the ongoing conflict have had a significant negative impact on the education sector in Gaza. This field note addresses the issues affecting the education sector in the Gaza Strip and outlines Project-Based Learning (PBL), an education technique for developing leadership abilities that could serve as an emergency response to education. This intervention was done with 76 third graders from Al Zaitun Coed Elementary C School in Gaza and two classes of third graders were selected at random. The participants were separated into two groups of equal size, each containing 38 pupils. The experimental group was taught English using the project-based learning strategy, whereas the control group was instructed using the traditional way. The research instrument was an observation card on which the student's leadership qualities were scored prior to and after application. On the post-application observation card, the experimental group's leadership skills were rated higher on average by the results. These findings were attributable to the project-based learning technique, which the researchers advocate for developing leadership abilities in English classes.

Keywords: Education Under Siege, Project-Based Learning, Leadership Skills.

Introduction

In the following paper, we will highlight the political context, the geography and demography, the population density, the socioeconomic context, and especially the educational context caused by the protracted crisis in the Gaza Strip. After that, we will present experience from the field with Project-Based Learning (PBL), an education strategy to develop leadership skills, with suggestions and research perspective.

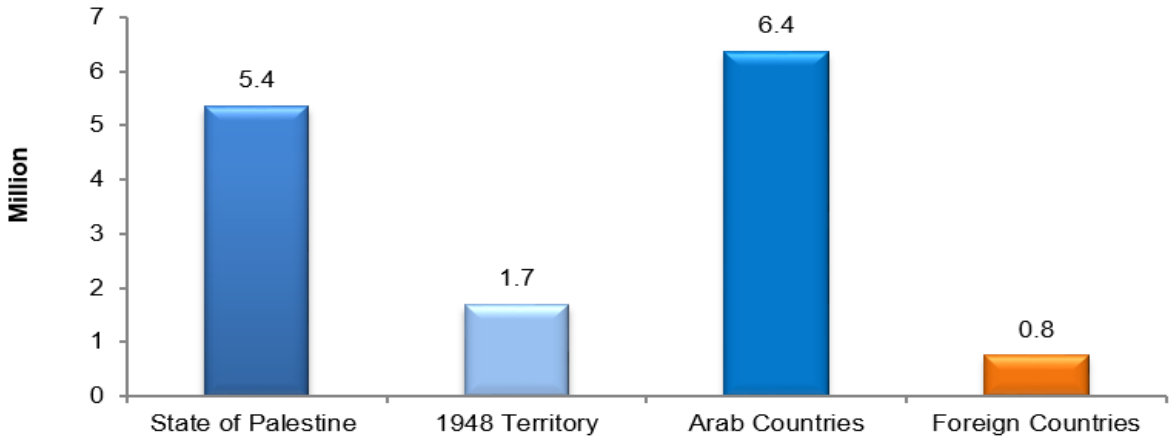
Background

More than 1.4 billion people live in countries affected by violence and conflict (World Bank, 2020). During the last two decades, many political events and humanitarian crises have occurred in the Gaza Strip. The Palestinian people in the Gaza Strip live in continuous conflict and clashes, having witnessed the consequences of three wars, a continuing heavy siege, and the Great March of Return protests. All these conditions obviously affected different humanitarian aspects such as the socioeconomic, psychosocial, and educational wellbeing of students and teachers, as well as the quality of education (Joma et al., 2021; Thabet et al., 2011; Qouta and Odeh, 2005).

Setting and population: Since 2012, some parts of Palestine are considered as occupied territories according to the United Nations General Assembly Decision 67/19. The country is known for the extreme tensions taking place on its soil because of Israeli violations against the Palestinian people in Gaza, the West Bank and East Jerusalem. Israeli settlements and the racial apartheid wall in the West Bank, as well as frequent wars and the constant blockade in the Gaza Strip, have contributed to the insecurity prevailing since the establishment of the Palestinian Authority in 1993.

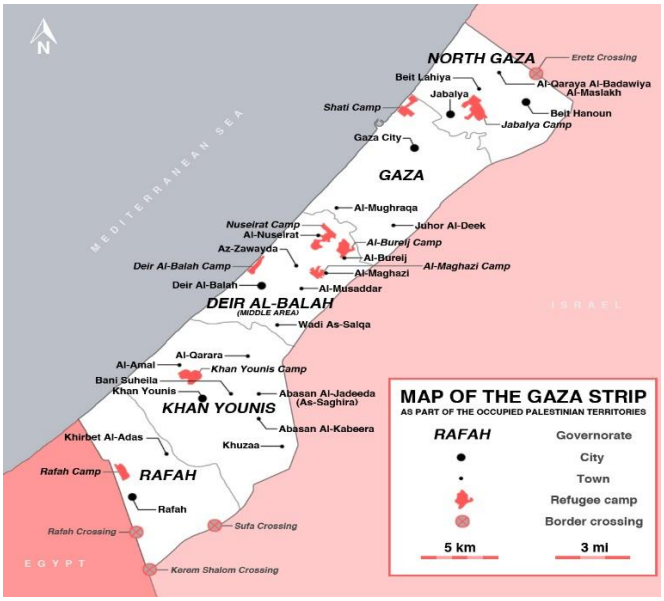
The state of Palestine is a geographic region in western Asia located on the eastern coast of the Mediterranean Sea. Based on population estimates prepared by PCBS, there are about 14.3 million Palestinians live around the world in mid-2022 and about 5.35 million live in the State of Palestine. The estimated population of the West Bank was 3.19 million (1.62 million males and 1.57 million females). While the estimated population of Gaza Strip was 2.17 million in the same year (1.10 million males and 1.07 million females). (Palestinian Central Bureau of Statistics, 2022). The Palestinian population is relatively young: 38 percent of the total population is aged 0-14 years, while only3 percent is aged 65 years and above.

Figure 1: Palestinian Population by Country of Residence (PCBS 2022)



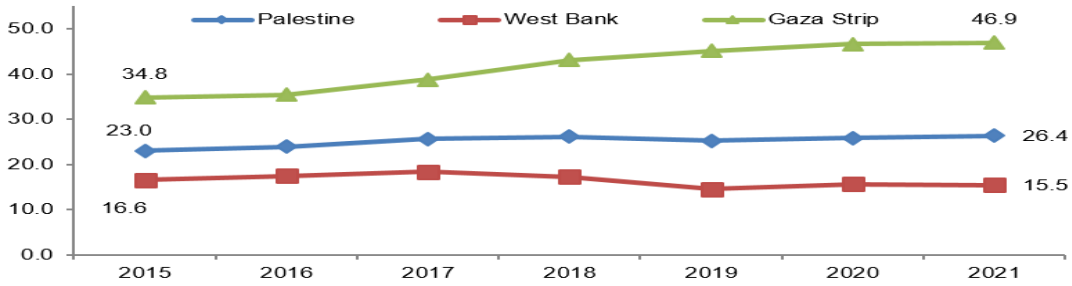
Living Conditions in Gaza Strip: Gaza is a narrow piece of land on the coast of the Mediterranean Sea between Israel and Egypt. The Gaza Strip covers an area of 365 square kilometers and is very densely populated with two million people. Gaza is split into five Governorates (North Gaza, Gaza, Deir Al-Balah, Khan Younis, and Rafah) and eight refugee camps which house two-thirds of the Gazan population. Most of the people living in the Gaza Strip are refugees, with about 73 percent of the population living in the camps managed by the United Nations Relief and Works Agency for Palestine Refugees (UNRWA), established in December 1949.

Figure 2: Over 12 Years of Israeli Land, Air and Sea Blockade



The election for the second Palestinian Legislative Council was held on January 25, 2006 and won by the Hamas movement. Since the Hamas movement took control of the Gaza Strip in 2007, Israel has imposed a land, air, and sea blockade on the territory, restricting the movement of goods and persons in and out of the Gaza Strip. The continuing Israeli blockade and border closures led to a clear humanitarian crisis and a deterioration of the socioeconomic situation in the Gaza Strip. Unemployment reached 26.4 percent in 2021—15.5 percent in the West Bank and 46.9 percent in the Gaza Strip—, with the poverty rate in Gaza exceeding 53 percent.

Figure 3: Unemployment Rate Among Labor Force Participation 15 Years and Above in Palestine by Region, 2005-2021



Source: Palestinian Central Bureau of Statistics, 2022. Database of the Labor Force Survey 2021. Ramallah - Palestine.

The UNRWA, the largest organization supporting Palestinian refugees in the camps in the Gaza Strip, faced budget cuts in 2017-2018 after the United States of America, its largest donor, interrupted funding. Thus, the UNRWA has reduced its services for Gazan refugees in all programs, including education, health, and social services. The emergency program has been suspended, school counselor positions were turned into part-time jobs, and hiring teachers has become a day-to-day system.

Wars Waged in Gaza: Palestinians in the Gaza Strip have endured three wars in the last two decades. It began with "Operation Cast Lead" in 2008-2009, which lasted three weeks and ended with 1,385 fatalities, 5,300 injuries, 719 disabilities, and 386 children who lost one or both parents. It was followed by “Pillar Deafens Operation” in 2012, which lasted 8 days and ended with 168 fatalities, 242 injuries, 719 disabilities, and 17 children who lost one or both parents. The 2014 war on Gaza, "Defensive Shield", was the worst, largest, longest (51 days), and most aggressive. It ended with 2,251 fatalities, 11,231 injuries, 2,073 permanent disabilities, and 270 children who lost one or both parents. Over 100,000 people were displaced from border areas and approximately 18,000 houses were destroyed or severely damaged (OCHA, 2019).

Ongoing Electricity Crisis: The Director of the West Gaza Educational District declared to the Ma’an News Agency (2013) that electricity outages have hampered the educational process, in particular the performance of students. When there is no electricity in schools, classrooms are dark, especially in the afternoon shifts, and school activities that depend on electricity, such as computer and science labs, are disrupted. He added that the shortage of electricity has led to communication difficulties between schools, Education Directorates, and the Ministry of Education, which hampered instructions, reports, official emails, and daily statistics. On the other hand, the Director-General of Counselling and Special Education at the Ministry of Education believes that the power cuts have had behavioral and psychological consequences for students, as they have interfered with the daily school system, students' daily routines at home, study habits, and homework completion.

Protracted Crisis Impacts on Education Sector in Gaza: The education sector in Gaza was severely affected by the Israeli siege and attacks. The OCHA (2018) reported that 327 schools were partially or completely destroyed during Israel's 2014 military offensive and 44 United Nations schools were used as emergency shelters for internally displaced persons. The shortage of school buildings in 2014 also created major challenges for the quality of education in Gaza. One out of four children requires psychosocial support because of the trauma and losses experienced during the conflict, including physical injury, fear of bombing, and deaths of family members or friends (OCHA, 2018). Reports and research studies recently indicated that over 520,000 school children across Palestine face challenges in accessing quality education in a safe, child-friendly environment, while 52,000 people, including 26,000 children, need mental and psychosocial health support because of Gaza's ongoing tension (OCHA, 2018). Moreover, 9 500,000 children and youth need education assistance (UNESCO, 2017), 70 percent of UNRWA schools and 63 percent of the Ministry of Education schools operate on a double or triple shift system in Gaza (OCHA, 2018), and 95 percent of children displayed symptoms such as feelings of depression, hyperactivity, preference for being alone, and aggression (Save the Children, 2019). Studies have also reported that the Non-governmental organization that provides psychosocial support for traumatized Palestinians in the Gaza strip are facing many challenges such as the continuation of the escalation and blockade, difficult economic

conditions, Children's parents' lack of awareness of ways to deal with their children's problems, a huge number of traumatized persons, The lack of specialists within the institutions and fund for psychosocial support projects (Joma et al., 2021).

Furthermore, the given high rate of poverty and unemployment in Gaza, many children have entered the labor market. According to the PCBS (2018), out of 372, 600 children aged 10-17, approximately 4,840 were involved in full-time labor, and 1,490 were working while attending school in Gaza in 2018. In total, this represents two percent.

Education System: General Education in Gaza

The Ministry of Education and Higher Education (MOEHE) in Palestine manages and supervises all education sectors in the Gaza Strip: preschools/kindergartens; general education; vocational and technical education; and informal education and higher education.

Preschools/kindergartens: Pre-schools extend over two years for children aged 4-5 and are optional. This stage aims to develop the child's personality in physical, psychological, and social terms. The private sector and non-governmental organizations manage the kindergartens directly, but the MOEHE is indirectly responsible, by issuing authorizations, specifications, and conditions and establishing guidelines for education programs. Table 1 shows the number of kindergartens in Gaza

Table 1

Number of Kindergartens by Region and Supervising Authority, 2019-2020

Supervisory Authority	# Kindergartens	# Classrooms	Density of students at classrooms	# Educators	# of children in Kindergartens		
					Male	Female	Total
Government	1	5	17.20	5	45	41	86
Privet	695	2697	24.87	2810	34545	32889	67434
Total	696	2702	24.99	2815	34590	32930	67520

(Source : MOEHE, 2019)

General education (basic and secondary education): General education consists of the following stages: (basic and secondary)

1) Basic education stage: grades 1 to 9, divided into two stages:

- Lower basic stage (grades 1 to 4): A foundation stage in education, it aims at developing a child's character in all aspects. The child acquires basic skills in Arabic and math, learns how to employ them in daily life, and strengthens national values.

- Higher basic stage (grades 5 to 9): An empowerment stage, it aims to empower students with different knowledge and scientific backgrounds.

2) Secondary education stage: Including grades 10 to 12, it offers various academic, vocational, and technical branches, according to students' abilities and averages.

Afterwards, learners can pursue higher education or begin work life. Table 2 shows the number of schools in Gaza.

Table 2

Number of Schools by Region and Supervising Authority, 2019-2020

Supervisory Authority	# Buildings	# Schools	# workers	# of students in Basic and secondary schools			# of Classrooms	Density of students at classrooms
				Male	Female	Total		
Government	291	409	15940	127425	138384	265809	6747	39.40
UNRWA	178	274	10040	143821	134979	278800	6767	41.20
Privet	54	54	1512	10676	6527	17203	765	22.49
Total	523	737	27492	281922	279890	561812	14279	39.35

(Source: MOEHE, 2019)

Overview of Education Barriers in the Ministry of Education Schools: Numerous obstacles and challenges for education arise from the siege, occupation, and ongoing escalation in the Gaza Strip. Namely, around 50 percent of the 5 to 17-year-olds have suffered from deteriorating school performance and low academic achievement due to ongoing crises and siege (Ministry of Education and Higher Education 2017, 2020). Furthermore, about 50 percent of schools hours are completed without power electricity. Around 43 percent of employees and teachers receive their salaries every month, while the rest do not get paid regularly and receive 40 percent of their salaries every 50 days. More than 7,000 students are faced with psychological, behavioral, and academic problems resulting from the successive wars on Gaza in 2014, which destroyed approximately 1,245 schools for an estimated cost of more than $82 million. Delayed delivery of textbooks to West Bank students due to the closure of the crossings also hampers the educational process (Ministry of Education and Higher Education 2017, 2020).

Gaza Education Gaps and Needs in MOE Schools: The crippling circumstances and significant shortages led to many gaps and needs that affect the quality of the educational process in Gaza schools. For example, MOE Schools lack school stationery, printing materials, sports items, and cleaning supplies and struggle to maintain canteens, water bars, water tanks, toilets, water pumps, and supplies. Schools need 26,000 liters of fuel per month to operate generators due to the daily power cuts and more than 1,600 teachers need transportation to get to school because they have not received a regular salary. Schools are faced with a shortage of 600 teachers and need capacity building for teachers, counselors, and supervisors. Schools need furniture, laboratory equipment, computers, recourse rooms for special needs students, and more parental engagement with school (MOEHE 2017, 2020).

Objectives

The main objective of this study was to address the issues affecting the education sector in the Gaza Strip and outlines Project-Based Learning (PBL), an education technique for developing leadership abilities that could serve as an emergency response to education.

Project-based learning (PBL) is a promising new learning strategy that respond to children's needs for active learning. Researchers have defined (Hallermann et al. ,2011; Migdad et al., 2021) PBL as a systematic teaching method that engages students in learning important knowledge and 21st-century skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and learning tasks. PBL has been shown to benefit a variety of students in developing collaborative skills. For example, through PBL, elementary students were able to understand multiple perspectives and acquire conflict resolution skills.

METHODOLOGY

Participants and Study design

The researchers purposively sampled 76 third graders from Al Zaitun Co-ed Elementary C School in Gaza and randomly sampled two groups of 38 students: an experimental group and a control group (both taught by the researcher). The PBL was applied for teaching the experimental group, whereas the traditional method was used with the control group. The experiment lasted for six weeks. The researchers used PBL to teach the experimental group for six weeks. They managed to have most of his teaching project-based learning during the experiment. They prepared lessons depended on projects and included a poster presentation at the end of each lesson. Each group of students worked together to achieve the goals of their project, then they presented their work. The population of the study consisted of all third graders at UNRWA schools in Gaza enrolled in first semester of the school year.

Data collection and Instrument

An observation card was prepared by the researchers to measure the impact of the PBL strategy on third graders' leadership skills. This observation card was used before and after the experiment for both the experimental and control groups. It was composed of eleven domains, involving thirty-seven items. A five-point Likert scale was used to measure teachers' observations. Here is the observation card domains and number of items:

Table 3

Leadership Skills Observation Card Domains and Number of Items

Domains	Number of items
Planning skills	4
Communication skills	4
Problem solving skills	3
Decision making	3
Self-confidence	4
Presentation skills	3
Time management skills	3
Teamwork / group work	3
Personal effectiveness skills	4
Initiation	3
Opportunities for responsibilities	3
Total	37

Leadership skills are conceptualized in the present paper as the set of skills that children should have to enable them to influence others to achieve common goals. These skills include project planning, communication skills, problem solving, decision making, self-confidence, presentation skills, time management, teamwork, personal effectiveness skills, initiation, and opportunities for responsibilities (Migdad et al., 2021).

These steps were followed to implement PBL strategy with students:

(1) Create teams of three or more students to work on an in-depth project for three to eight weeks; (2) Introduce a complex entry question that establishes a student's need to know, and scaffold the project with activities and new information that deepens the work;

(3) Calendar the project through plans, drafts, timely benchmarks, and a presentation to an outside panel of experts drawn from parents and the community;

(4) Provide timely assessments and/or feedback on the projects for content, oral and written communication, teamwork, critical thinking, and other important skills.

Data Analyses

The observation card was applied before the intervention on both groups. Then, it was reapplied after the intervention on the experimental group only. The scores of each item were calculated as 1 is the minimum and 5 is the maximum. Mean scores were calculated and analyzed using SPSS program. Results revealed higher mean scores in leadership skills for the experimental group in the post-application observation card. The researchers attributed these findings to the PBL and recommend its use in teaching English to develop leadership skills.

RESULTS

The activities and tasks that the students were asked to perform involved a lot of movement and interaction, which helped the students perform and complete them easily, promoted self-confidence, and encouraged them to express their opinions and feelings without hesitation. Implementing projects gave the students the opportunity to set goals and prepare materials needed for each project. This strategy helped to improve their planning skill, which is one of the most important leadership skills. The domain items were used as performance indicators for the domain. For example, the first domain which is planning has four items that represent four performance indicators:

1. The student can set the maingoals of the project.
2. The student can determine and prepare the materials.
3. The student can use alternative materials and procedures to achieve the goal.
4. The student can rearrange the activities according to their importance.

The fifth domain, for instance, self-confidence, has three items that were also dealt with as performance indicators:

1. The student says opinion confidently.
2. The student expresses feelings without hesitation.
3. The student accepts the constructive criticism.

The last domain, Opportunities for responsibilities, also has three performance indicators:

1. The student depends on herself to complete the mission.
2. The student does best to achieve the goal.
3. The student is responsible of behaviors and decisions.

Two teachers were observing the students in the pre and post observation cards. The means then was calculated. Each item was set a score out five on the Likert scale text to the item. This way helped the observers have a clearer idea of the project-based learning. It also provided data that was analyzed and treated to find out mean scores.

During the projects, most students communicated with each other positively, politely, and friendly to achieve the main project goals. They shared and exchanged ideas and information using effective written, verbal, and nonverbal skills, and were more involved in discussing their projects with members of the group. Communication skills were thus developed through the PBL strategy.

Students were asked to complete each activity within a set time frame, which led them to divide each task or activity into smaller tasks to finish them in time. The teacher trained them and encouraged them by creating a competitive atmosphere that enhanced their time management skill.

All the students, even the low achievers, were motivated and excited by the activities. They all raced to participate effectively by bringing the needed materials, helping each other, acting different roles inside the class, and asking the teacher any questions they had. This helped promote an initiative mindset, which is necessary to be an effective leader.

Every group had to choose a leader to present the project to their peers, giving many students the opportunity to play that role. The presenters were aware to use body language and gestures properly and to face the audience confidently to explain their project. These presentation skills, which are essential for effective leaders, were clearly developed among many students in the experimental group. Students expressed interest in practicing in activities as they were totally involved in tasks. The observer noticed how active students were during the PBL.

DISCUSSION

Based on the overall experience with PBL strategy with Palestinian students in Gaza, we consider PBL activities applicable for students in emergency settings: they can be adapted and teachers working in emergency circumstances can use them regardless of the kind of subject.

The most serious problems the researchers faced while implementing PBL strategy were that some students did not use the target language for communication, but their mother tongue instead. The researchers dealt with this by modeling, simplifying the language they should use, and encouraging them to use English. In addition, although clear roles for group members were assigned, some students dominated the work, and the large number of students inside the classroom affected the opportunity for all these students to participate. The researchers overcame this problem by dividing the class into small groups and assigning a role for each group member.

Thus, we suggest the following recommendations to educators, researchers and educational policymakers: (1) enrich the curriculum with different projects adapted to the students' age, needs, and abilities and that address different topics and skills; prepare and design guiding content to help teachers apply PBL and other new strategies; (2) conduct other studies on the effect of PBL on developing different

thinking skills for the future; similar studies on different school subjects; studies on the effect of PBL on the development of kindergarten children's leadership skills.

CONCLUSION & RESEARCH PERSPECTIVE

Considering the above, education officials, policymakers, researchers, and education workers— from both governmental and non-governmental sectors— should focus on providing high-quality education in emergency contexts. Therefore, special emphasis should be placed on four main areas. First, providing early education for children in preschools by developing early childhood care programs and plans. Second, improving access to education and safe learning by working hard to overcome school drop-out and child labor for both men and women, and providing them with additional protection. Third, improving the quality of educational services so that Palestinian curricula meet the needs of the labor market and provide students with twenty-first century skills; building the capacity of teachers, counselors, school principals, and educational supervisors; expanding school buildings and facilities to create a safe learning environment; and promoting active learning styles. Fourth, improving the well-being of students by providing psychoeducational support to students who have been affected by the wars and conflict in Gaza.

Researchers are looking forward to studying the psychological well-being of Palestinian students and the effects of the conflict on cognitive functions and academic performance in the Gaza Strip. Linking data on student well-being to other relevant variables in the Gaza Strip would help design appropriate interventions for education in emergencies.

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Explicit-Reflective Teaching of the Nature of Science for Primary School Students[1]

Mehmet Kucuk[a], Ozge Beyaz[b]

[a] *Orcid: 0000-0001-5910-4099. Recep Tayyip Erdogan University, Faculty of Education, Rize, Turkey. Tel: +90-532 666 51 38. E-mail: mehmetkucuk@gmail.com*

[b] *Orcid: 0000-0001-5912-5033. Ministry of National Education, Rize, Turkey. Tel: +90-507 454 60 00. E-mail: ozgebeyaz28@gmail.com*

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Abstract

This study aimed to investigate the effect of a teaching material designed to teach the nature of science to 4th-grade students. For the research, a teaching material was designed, which reflects the tentative, inferential, imaginative, and creative aspects of the nature of science. It was implemented for a total of eight primary school 4th grade students and lasted for two-course hours. Firstly, a preliminary interview was conducted with them. Immediately after the teaching, they were interviewed for the last time. The data were collected through the nature of a science student interview form developed by Khishfe and Abd-El-Khalick (2002) and consisting of a total of six questions. Each student's pre and post-nature of science profiles on three aspects were created and compared. It was determined that the naive views about the tentative, inferential, creative, and imaginative nature of science were observed in the pre-interviews and varied greatly in the post-interviews in a short time. Students who initially believed that scientific knowledge was impeccable and that scientists were 100% sure almost completely abandoned these naive views. We wonder if the change will be permanent and this should be tested with follow-up studies and also how the short time teaching will reflect their daily lives.

Keywords: Teaching the Nature of Science, Primary School Students, Science Education.

1 This study was presented at the 11th National Science and Mathematics Education Congress held at Cukurova University

Introduction

It is well known that the main goal of 21st-century science education is to raise scientifically literate individuals (Bybee, 1985; National Research Council, 1996). Therefore as in many other countries, the main goal of the science curriculum in Turkey has been announced as educating all students as science and technology literate (Ministry of National Education, 2018). One of the many components of scientific literacy is known as the nature of science as a unifying and critical factor (Holbrook & Rannikmae, 2007; Kucuk, 2006). Although the debate about the definition of the nature of science continues among philosophers, sociologists, and historians of science, there is still consensus on the well-known components of the nature of science (NOS) for students. These elements that students from preschool to high school should know about are the tentative nature of science, its inferential nature, imagination, and creative nature, and also others (Lederman, 2007). Kucuk (2006) stated that a student who knows the nature of science understands science, scientific methods, the products resulting from these methods, and the methods encountered in daily life; participates in discussions and decision-making processes on scientific problems; understands the norms of the scientific society and can learn the science subject area more effectively. The decisions made in the institutional and individual fields are largely based on scientific data, it is important to know the NOS for these decisions to be correct. In addition, it is known that primary school students' images of scientists are largely stereotyped (Kucuk & Bag, 2012). There may be a strong correlation between the students' naive views on the NOS and images of scientists, which should probably be tested.

The nature of science can be defined as all the values and beliefs that exist in the development of scientific knowledge. It is still being discussed how to teach science and the nature of science to children, starting from early childhood, to include the values and beliefs in question. Some teaching methods that serve this purpose are put forward and research is continuing about which one gives better results (Khishfe & Abd-El-Khalick, 2002). In the early days, the NOS could be taught implicitly to children and therefore no extra effort was needed. Accordingly, it was deemed sufficient for children to be explicitly exposed to scientific studies, that is, to experience scientific research directly to learn about the NOS. Although some significant gains were observed in some components of the NOS, the continuation of the problem in terms of others encouraged subject field experts to look for new ways. The historical approach, which includes teaching how scientific knowledge (for example, the atomic model) has progressed in the historical process, has been emphasized. The success achieved with this approach has not been satisfactory. There is a consensus that, as a last resort, teaching the nature of science in an explicit reflective way raises the bar (Khishfe & Abd-El-Khalick, 2002; Kucuk & Cepni, 2015). In other words, the NOS should be taught directly, not as a by-product, just as in teaching scientific subjects and concepts. It has been revealed that many activities that serve this purpose have been designed (see Lederman & Abd-El-Khalick, 1998) and have given successful results in many studies all around the world (Khishfe & Abd-El-Khalick, 2002; Kucuk, 2006).

Even with a small examination, it is revealed that middle, high school, and higher education students are taken as the target group in the mentioned research (Dogan & Abd-El-Khalick, 2008; Kucuk, 2008). Although primary school students are mostly excluded from the scope, it is revealed that primary school teachers and primary student teachers' views on the NOS are frequently studied (Abell & Smith,

1994; Lunn, 2002; Murcia & Schibeci, 1999). There were elements in the conceptions of the NOS articulated by these groups which were not in accord with modern views. In this context, the materials in the intervention studies are also designed to serve the relevant target audience. However, the nature of science needs to be taught to students starting from early childhood. For example, the lack of materials for teaching it to primary school students is immediately apparent. It is also concluded that regardless of the learning level, the concepts of the students at the preschool, primary, secondary, high school, and even university levels about the NOS are still naive or transitional. For this reason, it is an important need to develop a teaching material structured at the primary school level and measure its success of it. It is also a necessity to give priority to the NOS teaching materials that can be applied economically in all aspects of new studies.

This study aimed to investigate the effect of a teaching material designed to teach the nature of science to 4th-grade students. To reveal the magnitude of this effect, the difference between the student's views on the NOS at the beginning and after the teaching was measured and compared.

Method

This research is an interpretive study as it focused on the meanings that the students attributed to the nature of science as in some other studies examining students' views on the nature of science (see DiBenedetto, 2015; Kucuk, 2006). The development of students' views about the NOS is analyzed qualitatively in the current research, it can be considered a qualitative study. The study is an interpretive one in nature because it focused on the meanings that the participants attributed to the different elements of the NOS (Lecompte & Preissle, 1993). The research was completed in three stages. Firstly, the views of eight primary students in the study group, in which the second researcher was the official classroom teacher, about the NOS were measured and coded through interviews. Secondly, the teaching material designed for the group was applied. Finally, students' final views on the NOS were re-measured through interviews and coded. In this way, it has been demonstrated to what extent the material in question can improve students' views on the NOS.

The research sample

The sample of the study consisted of eight students attending the 4th grade in a village primary school located in the Cayeli district of Rize in Turkey in the second term of the academic year. Three of them are girls and the others are boys. In this study, students were assigned to four research groups consisting of male and female students. The second researcher reported that these students' experiences with science and scientists are quite limited to the visuals and explanations in the textbook.

Data collection

An interview form created by the researchers was used to evaluate the students' views on the NOS. In this form, six questions are measuring the three dimensions of the nature of science that are tentative, the difference between observation and inference, and the creative and imaginative nature of science. These questions were taken from the nature of the science student questionnaire and simplified in a way that primary school students can easily understand (Khishfe & Abd-El-Khalick, 2002). The interviews with each student and conducted by the second researcher with the permission of the student's parents outside of the class hours before teaching and in the classroom were completed in an average of 30 minutes and were transcribed.

Teaching Process of the NOS

For the research, a teaching material called 'Little Detectives' aimed at changing and improving primary school students' views on the NOS was designed. This material was designed for a special course called 'teaching the nature of scientific knowledge, which the second researcher took in her master's program and was also given by the first researcher. This material development process was completed in a total of seven weeks. In this activity, a last-minute traffic accident news was shared as an audio recording while students watched a video about scientists' lives. In line with the curiosity awakened in the students, they were asked to work on their own and focus on a researchable question about why and how the accident happened. Now, the second researcher gave a few examples, referring to the fact that scientists also started their scientific studies with researchable questions. When the questions were ready and also written on a worksheet, they were divided into groups of four. They were told to consider what data they needed and to request it to be able to answer the questions. During this activity, necessary precautions were taken to prevent the groups from being influenced by each other. During this process, the requested data were given to them via color cards. They were asked to write down each data they received and their explanations about this data on the worksheet. This process aimed for each group of students to produce an explanation based on the data they have and to enrich their explanations continuously. Now, the second researcher referred to the fact that scientists also collect data by observing to find answers to their questions and make inferences by combining them appropriately. In this process, they were also warned many times that their observations and inferences must be based on data. In this event, it has been emphasized many times that they do a little scientific investigation and work like scientists while recording the data and deciding which data to combine and how. In this way, each group worked together and used their data to create the perfect explanation for the cause of the accident. It was shared that they could use their imagination and creativity while doing this. Now, the second researcher referred to the fact that scientists use their imagination and creativity while making inferences using data. Finally, the groups shared their defensible explanation of how much data they had collected and how much of it they had used with others. In this way, possible differences in the data the groups used and the way they combined them were revealed. The activity ended by sharing the statement by the second researcher that "the more data there is, the more detailed explanation can be made and the explanations will not be correct no matter how much data there is".

Data Analysis

The group of eight students' profiles of the NOS was created based on the semi-structured interviews conducted with them. Many studies, which aimed to detect both students' and teachers' NOS understandings, employed this method (Khishfe & Abd-El-Khalick, 2002) (Kucuk & Cepni, 2015). The coding rule for categorizing the participants' views of NOS was built on the perspective that the student's views have a constant change (Khishfe & Lederman, 2003). The student's views of NOS have been categorized in three ways: naïve, transitional, and informed. Before explaining this analytical framework, we need to mention that multiple elements of NOS were explained in more than one questionnaire item. The tentative nature of science is explained based on the student's answers given to the item about the change of scientific knowledge, the item about atoms, and the item about the dinosaurs; the first, second, and third items. To categorize the participants' all views about the tentative nature of science as informed, they were asked to provide evidence that they have informed views in their answers given to all items. If they

did not provide enough views for the three items about the NOS, the view held them was categorized as naive. If they provided some views on some items but not others, the views were categorized as transitional. This categorization method was also used in a study conducted by Khishfe, 2004).

Reliability of Data Analysis

A special study was given to establish the reliability of the pre-and post profiles of the participants regarding the NOS. Both pre-and post-interview data on the NOS were coded by both researchers, and a limited number of possible contradictions were fully resolved in a small meeting. Similarly, the validity was established by quoting directly from the students' views, which were used as evidence in the creation of the aforementioned profiles.

Results

Each of the students was identified with a code name that represents them, and their views at the beginning and end of the implementation on the three elements of the nature of the science targeted by the teaching activity were classified using one of the categories— naïve, transitional, and informed—and presented in Table 1 and 2. Table 1 below includes the initial profiles of students about the NOS based on the interview data.

Table 1

Initial profiles of students about the nature of science

Group	Participant Code	Tentative Nature of Science			Difference between Observation and Inference			Creative and Imaginary Nature of Science		
		informed	transitional	naïve	informed	transitional	naïve	informed	transitional	naïve
1	E1		x				x			x
	K1	x			x			x		
2	E2		x				x			x
	K2			x			x		x	
3	E3			x			x			x
	E4			x			x			x
4	E5			x			x			x
	K3			x			x			x

K: Female E: Male

In Table 1, it is revealed that all of the students, except one (K1), had naïve or transitional views about the tentative nature of science. In this case, most of the students believed that scientific knowledge is true and will never change. Regarding the uncertainty factor of science, the answers given by them to the first three questions in the interview were taken into account. The first of these questions is about whether the scientific information in science books will change in the future. Five of the students stated that they would not change this question. The student coded K2 said that "*scientists searched and found the right information and wrote it in the books, so it doesn't change*", while the student coded E5 said, "e*veryone saw*

that there is correct information, so they wrote it in the book. It does not change.' From this, it was revealed that the students believed that the scientific information was correct and that they could not be included in the science books if they were not accepted by everyone. Similarly, from the answers given by the students to the second and third questions, it was seen that they firmly believed in the information described in the science books about the structure of the atom and dinosaurs.

In addition to this, the views of the other two students are as follows:

"Scientists have seen the structure of the atom themselves" [E3]

"They combined the fossils and found out what the dinosaur looked like. They are sure of the figure they have found" [K3]

However, the views of two of them on this subject were classified in the transitional category.

'Some information never changes, for example, the shape of the world is round, this never changes. But information about colors may vary. New colors may come out' [E2]

Only one of the students' views about the change of scientific knowledge before the teaching was classified in the informed category.

'Yes, it can change because as time progresses, new things emerge, for example, no one thought that they could see images on the phone before, but now these are done [K1]

The views of all but one about the difference between observation and inference were classified in the naive category.

[Scientists] are sure that they see the shape associated with the atom and its structure [E4]

[Scientists] saw dinosaurs by looking [K3]

These results made it clear that many students do not know the difference between inference and observation.

In this dimension, the views of the same student (K1) were classified in the informed category.

[Scientists] measure the fossils they find, try to combine them, and say something about the shape of the dinosaurs [K1]

Six of their views on the imaginative and creative nature of science were classified in the naive category. In this context, students who cannot think abstractly cognitively reported that scientists have seen the picture of dinosaurs or themselves, and even if they have not seen it themselves, they have always listened to it from someone who has.

In this dimension, one student's (K1) views were informed, and another student's (K2) were classified in the transitional category.

"Scientists use their imaginations in what they do and think it would be better if I did this" [K1]

Table 2 below includes the final profiles of students about the NOS based on the interview data.

Table 2

Final profiles of students about the nature of science

Group	Participant Code	Tentative Nature of Science			Difference between Observation and Inference			Creative and Imaginary Nature of Science		
		informed	transitional	naïve	informed	transitional	naïve	informed	transitional	naïve
1	E1	x			x			x		
	K1	x			x			x		
2	E2	x			x					x
	K2	x			x			x		
3	E3			x	x			x		
	E4	x			x			x		
4	E5	x			x			x		
	K3	x			x			x		

K: Female E: Male

At the beginning of this study, only one of the students' views on the tentative nature of science was classified as informed, but then the views of all the others, except one, were changed to informed. From the answers given by them to the questions in the last interview, it was revealed that they started to think that scientific knowledge could change for many reasons.

"If scientists reach different data, their previous thoughts may change" [E2]

"Scientists cannot know scientific information exactly, they solve the case using their imagination and creativity" [K3]

Moreover, it is significant that all of the students stated that scientists cannot know the structure of the atom exactly and cannot be sure about the appearance of dinosaurs.

"Scientists can never know exactly what dinosaurs looked like because they couldn't see it with the naked eye" [E1]

"Scientists cannot know the outward appearance of dinosaurs. While drawing, they draw by imagining" [K2]

At the beginning of this study, only one of the student's views on the difference between observation and inference were again classified as informed, while after the teaching, all of the views were assigned to this category.

"Scientists can only guess what dinosaurs looked like" [E2]

"Scientists construct the shape of dinosaurs in their heads" [E3]

"Since an atom cannot be seen with the naked eye under a microscope, scientists have guessed it by looking at the data" [E4]

At the beginning of this study, only one of the students' views on the imaginative and creative nature of scientific knowledge was again classified as informed, but after the teaching, the views of the others, except one (E2), were assigned to this category.

"Scientists imagine what dinosaurs looked like" [K1]

"A scientist without imagination cannot be a good scientist" [E3]

Discussion

It is known that students at the K-12 level, who do not receive special education for teaching the NOS, mostly have naive views on the nature of science (Akerson & Donnelly, 2010; Akerson et al., 2011; (Akerson et al., 2013; Alan, 2014; Celikdemir, 2006; Demirel, 2010; Dogan & Abd-El-Khalick, 2008; Khishfe & Abd-El-Khalick, 2002; Kucuk & Cepni, 2015). In support of this claim, the views of the 4th-grade primary school students were classified in the present study about three important elements of the NOS under the category of naive or transitional except for one student (see table 1). However, to solve the aforementioned problem, a new teaching material was designed apart from the methods employed in the literature and its value was measured. It is clear that when the material was applied almost all of the students turned their views on the three aspects of the NOS from naive to informed (see table 2). Frequent reminders by the second researcher who made the teaching to the students that they should think of themselves as scientists throughout the activity were effective in this success claimed by also Kucuk (2006). That is, on the one hand, the students collected data to examine the cause of the accident by running a questioning process throughout the activity, brought these data together, and were encouraged to make explanations in this way. The interestingness of the subject made the students continue to question with excitement from the beginning to the end of the activity. In this process, the researcher provided unique opportunities for them to establish relationships between the groups' consideration of different data, not including some data in their explanations, and ultimately inferring different meanings, and referring to real lives in the lives of scientists. Meanwhile, it has been noticed that the number and quality of the data can change the scope of the explanations and finally, due to the possibility of adding new data to the data, it was realized that the explanations made were limited by the imagination and creativity of the groups. Now, the researcher referred to scientific events and emphasized that experiences similar to children's experiences were encountered by scientists in their work. As a final point, it has been stated that the data collected after the observations are raw findings and the effort to produce meaning from them is inference. By giving scientific examples to this, it is explained what is observed and what is inference in the activity. In this context, it is clear that the activity employed in the current research is enriched with reflections on science, as it offers the opportunity to directly teach the NOS, as in the activities brought to the literature by (Lederman & Abd-El-Khalick, 1998). In the end, explicit reflective teaching like science has achieved targeted success with primary school level children, supporting the existing literature (Khishfe & Abd-El-Khalick, 2002; Kucuk & Cepni, 2015). It has been revealed that the activity produced in this study can be used functionally to fill the real gap.

Conclusion

Teaching the NOS activity designed and implemented within the scope of this study in an explicit-reflective way has led to the fact that, except for a few of the students, the views they have about the tentative inferential, imaginative and creative nature of science can go from the "naive" level to the "informed" level. From this point of view, it is believed that the explicit-reflective nature of science teaching activity is successful in teaching students the three elements related to the NOS. That's why a reflective nature of science approach should be preferred in teaching students about the NOS. In other words, students should make connections between the activities they carry out and the elements related to science and the nature of science, share these with their peers, experience ways of reaching scientific knowledge and reflect on it. It is known that students who know that science is not static but dynamic, tend to contribute more to science. From this point of view, if the NOS is taught to students correctly, it will be easier for students to comprehend that science and scientific knowledge have a dynamic structure, and students will want to make more effort to engage with it and reveal new things. Innovative opportunities should be provided for students to take a more critical view of and constantly criticize scientific information that they perceive to be not 100% correct. In this way, in-class discussions can increase the process of science lessons. This can lead to new learning. Accompanied by these explanations, the material used in the present study could be effective in teaching the NOS by revealing the aforementioned outputs for students at the primary level.

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An Analysis of Preservice Geography Teachers' Scientific Research Self-Efficacy

Erdal Oztura[a]

[a] *ÇanakkaleOnsekiz Mart University, Faculty of Education, Department of Geography Education, Çanakkale, Turkey*

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Abstract

The purpose of the study is to examine the scientific research self-efficacy of preservice geography teachers studying at COMU Faculty of Education. To this end, a scientific research self-efficacy scale consisting of six factors and 37 items was used. The sample group of the study was the teacher candidates studying in the Department of Geography Education, Turkish and Social Sciences Education, at a Faculty of Education of a state university in Marmara region of Turkey. The sample of the research consists of 72 teacher candidates who continue their education in the same department (1,2,3 and 4th grades). The results show that male geography teacher candidates' opinions on scientific self-efficacy were more positive than their female peers. It was also determined that they had high self-efficacy in continuing investigation, but that their self-efficacy was low in identifying the problem situation. While the candidates had high self-efficacy in examining the literature in the context of the problem situation, they had low self-efficacy in accessing national and international databases for literature review. It was also observed that the geography teacher candidates had high self-efficacy in determining the appropriate method for testing hypotheses, but had low self-efficacy in performing validity and reliability analyses of the data collection tools. It was further observed that they had high self-efficacy in discussing and presenting study findings to the reader in the reporting process, and low self-efficacy in writing the reporting process according to the testing of the hypotheses.

Keywords: Geography Education, scientific research, self-efficacy, reporting, data analysis, method, hypothesis, defining the problem.

Introduction

The integration of education and science is a fundamental phenomenon. Throughout history, human beings have tried to recognize, understand and/or make sense of their environment, as a result of which the knowledge has been accumulated and gained a scientific character. In the process of producing scientific knowledge, it is examined and evaluated in all aspects of the matter as a result of the determination of problem and the use of scientific methods (NA, 2014). Today, scientific knowledge is produced in various laboratories in various research centers, especially universities. The function of universities is to research and transfer the research results to students through education, and to try to improve social development. However, although universities emphasize developing the investigative characteristics of individuals, the content and quality of education are not compatible with that emphasis (Saracaloğlu, 2008, 180; Tasdemir, 2011).

Science has a significant impact on everyone's life, and it is expected to play an increasingly important role in the future of countries (Bowtwll, 1996). Today, the number of scientific studies on different subjects in different fields is increasing day by day. The purpose of theoretical research is to expand knowledge (Thebaud, 1978).

With the systematic development of science, many different methods have evolved. There are two types of scientific knowledge production: "Basic research" and "Applied research" (Oral and Çoban, 2020). The scientific method has certain standard processes that are assumed to be reliable (Karasar, 1999; Tavşancıl vd, 2010). Scientific knowledge production is as much related to the psychological and sociological state of the researcher as it should include originality and creativity rather than just a standard and routine process (Wilson, 1990). Researchers reach scientific results by compiling and analyzing data by applying a certain method to define the subject and problems they examine and to answer the questions they create. An analysis method used in inductive knowledge production is Meta-Analysis (Glass, 1976). Experimental studies are a priority in this analysis method, increasing the number of samples allows the result to have a wider scope of impact. As a result of the emerging inferences and theses, a scientific knowledge synthesis is generated as a result of comparison with the studies of other scientists (Aydoğdu et al., 2017).

Teachers with investigative characteristics contribute to individual development and research skills (Godson, 1994). Scientific thinking is the ability of an individual to solve a problem in a scientific, logical and consistent way. Scientific thinking is a process to establish hypotheses for the solution of the problem and to determine whether these hypotheses are correct or not. It is viewed as a testing process in a systematic way (Gündoğdu, 2001).

According to Stuessy (1984), scientific thinking is an individual's consistent, logical thinking applied to the solution of a problem. According to Geban (1990), the basic scientific processing skills are determining variables, identifying and expressing hypotheses, making funtional definitions, and interpreting results.

Self-efficacy affects the selection of activities, the effort and persistence of individuals, as well as expressing and motivating the individual's determination to do anything (Bandura, 1977; Kotaman, 2008). Students who lack self-confidence and doubt themselves work less and give up more easily than those who have confidence. The sense of motivation, which is supported with determination and belief, is an important internal factor that enables students to perform tasks with increasing learning ability. Through observational experiences and the projects they carry out, students gain information about their personal self-efficacy. Confidence

is gained through both psychological suggestions and physiological responses to evaluate self performance and self-efficacy. Guidance is another factor that increases motivation in this process. Therefore, the successful individual/student gains self-efficacy as a result of renewing his/her self-confidence. When all these are considered together, failure does not pose an obstacle for students since the problems/obstacles they encounter can be overcome with the formation of self-efficacy (Bandura, 1986).

Aim of the Study

The aim of the study is to examine the scientific research self-efficacy of geography teacher candidates at a state university in the Marmara region**.** As such, the following three key questions were asked**:**

These;,

1) What is the overall level of scientific research self-efficacy of geography teacher candidates?

2) Does it show a significant difference by gender?

3) Does it show a significant difference by grade level?

4) Does it show a significant difference depending on whether they have taken a research methods in education course or not?

5) What is the level of their self-efficacy regarding the dimensions of the Scientific Self-Efficacy scale?

Method

Research Design

In this study, the survey, one of the quantitative research designs, was used. The survey design reveals the knowledge of and attitudes toward a present or past phenomenon. In the general survey, in the universe consisting of more than one individual, a survey is carried out on a group of individuals to reach a general opinion about the universe (Karasar, 2011).

Research Sample

The universe of the research consists of the teacher candidates studying at the Department of Geography Education at Çanakkale Onsekiz Mart University, Faculty of Education, Department of Turkish and Social Sciences Education in the spring semester of the 2021-2022 academic year. The sample of the research consists of 72 teacher candidates in the same department (1,2,3 and 4th grades). Since n= N t2pq/ d2 (N-1)+t2pq=70 (Baş, 2003), the sample covers the universe. Since the universe of the research consists of 85 teacher candidates, the sample covers the universe. The sample of the study was determined randomly.

Data Collection Tool

In this study, the *Scientific Research Self-Efficacy Scale* developed by Akçöltekin (2019) was used. The measurement tool consists of 37 items and 6 dimensions in five-point Likert type. The sub-dimensions of the measuring tool are “Reporting” (Article 7), “Data Analysis” (Article 6), “Literature Review” (Article 7), “Method” (Article 6), “Determining hypotheses” (Article 5) and “identifying the problem” (Article 6), respectively. In this study, The Cronbach Alpha coefficient of the entire scale was calculated as 97. Akçöltekin (2019), on the other hand, determined the Cronbach Alpha reliability coefficient as 95.

Data Analysis

The data of the study were analyzed with statistical values such as arithmetic mean (x̄) and standard deviation (Ss). In addition, since the normality test was performed and calculated as skewness (-.52) and kurtosis (.36), it was determined that the research data showed a normal distribution (George and Mallery, 2010). T test and one-way Anova tests, which are among the parametric independent sampling tests, were also used.

Results

The findings obtained in the study were evaluated according to the independent variables and explained in tables.

Table 1. Geography Teacher Candidates' views on Scientific Self-Efficacy by arithmetic mean and standard deviation

Scale	x̄	ss
1	3,70	,71

According to Table 1, Geography Teacher Candidates' views on the subject of Scientific Self-Efficacy are mostly in the form of "I agree" (x̄=3,70). Thus, it can be said that Geography teacher candidates' perspectives on scientific self-efficacy are positive.

Table 2. Geography Teacher Candidates' views on Scientific Self-Efficacy by gender

Gender	N	x̄	ss	df	t	p
Women	36	3,67	.79	70	-381	.281
Men	36	3,73	.63			

When Table 2 is taken into account, the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not vary significantly by gender. [t(70)=.-381, p>.05] On the other hand, male geography teacher candidates' views on scientific self-efficacy (x̄=3.73) are more positive than female geography teacher candidates.

Table 3. Geography Teacher Candidates' views on Scientific Self-Efficacy by year of study

Scale	Sum of Squares	Sd	Mean of Squares	F	p	Difference
Between Groups	,647	3	,216	,412	,745	-
In groups	35,60	68	,523			
Total	36,25	71				

When Table 3 is examined, the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not show a significant difference in terms of year of study. [F(3,68) =.412, p>.05] In other words, it can be said that year is not an important variable that affects the Geography Teacher candidates' views on scientific self-efficacy.

Table 4. Geography teacher candidates' views on scientific self-efficacy by year of study

Year of study	Arithmetic Mean	Standard Deviation
1	3.7492	.68391
2	3.5420	.65455
3	3.7604	.65313
4	3.7696	84826

When the opinions of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy were examined in terms of the grade level variable in Table 4, it was seen that the 4th year teacher candidates had the highest arithmetic average, and the 2nd year teacher candidates had the lowest arithmetic mean. In terms of standard deviation values, the highest value belongs to 4th year students, while the lowest value belongs to 2nd year students.

Table 5. Geography Teacher Candidates' views on Scientific Self-Efficacy in terms of "Taking the Educational Research Methods course".

Course	n	$\bar{x}$	Ss	df	p	t
I Do	51	3,77	.69	70	1.25	.214
I Don't	21	3,54	.75			

When Table 5 is examined, it does not show a significant difference in terms of the "Taking the Educational Research Methods course" variable regarding the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy. [t(70)=1.25, p>.05] Therefore, it can be said that the teacher candidates who took the undergraduate course of *Educational Research Methods* have more positive views on the subject of scientific self-efficacy, but they do not show significant difference from those who did not take this course.

Table 6. The arithmetic mean and standard deviation results of Scientific research process of Geography Teacher Candidates about the self-efficacy levels

Article	Defining the Problem	$\bar{x}$	ss
1	I can identify the problem situation by observing the environment	3,87	,855
2	After identifying the problem situation, I can continue the research in this direction.	3,96	,813
3	I can conduct the process of identifying the problem situation individually	3,46	,903
4	When defining the problem situation, I consider that it will fill a gap in the relevant field.	3,94	,803
5	I can determine whether the problem situation has its original value	3,85	,883
6	I can identify the problem situation by considering the priorities and needs of the society.	4,11	,912
Article	Literature Review	$\bar{x}$	ss
7	I can analyze the literature in the context of the problem situation	3,61	,958

8	I can reveal originality of the problem situation with the literature review	3,54	,934
9	I have sufficient information about the purpose and rationale of the literature review	3,43	1,005
10	I can review the relevant literature with the help of keywords from appropriate databases	3,51	1,035
11	I can reveal the reasons of the problem situation with a literature review.	3,58	,989
12	I can access national and international databases for literature review.	3,40	1,146
13	I can transfer the information I obtained from the literature review according to the scientific rules	3,53	,978
Article	Identifying the Hypotheses	$\bar{x}$	ss
14	I make sure that the hypotheses are rational, clear and understandable.	4,08	,900
15	I can use the hypotheses as a guide to carry out other steps of the research	3,87	,887
16	I make sure the hypotheses are open to predictions, experiments and observations	4,03	,903
17	I make sure that the hypotheses are free of values and general judgments	4,01	1,014
18	I make sure that the hypotheses are testable.	4,03	,949
Article	Method	$\bar{x}$	ss
19	I can identify the appropriate method for testing hypotheses	3,94	,902
20	I can identify the limitations of the method I use	3,79	,978
21	I can determine the appropriate method to identify the study group (Universe/Sample)	3,76	,911
22	I can choose appropriate data collection tools for research.	3,81	,898
23	I can develop or adapt appropriate data collection tools for research	3,58	,915
24	I can do the validity and reliability analyses of the data collection tools that I will use in the research.	3,56	,948
Article	Data Analysis	$\bar{x}$	ss
25	I can test the assumptions of statistical analysis techniques I use in data analysis.	3,44	,977
26	I can make the data ready for the analysis I will apply	3,57	1,032
27	I can apply appropriate data analysis techniques (Quantitative/Qualitative) to test the hypotheses	3,63	1,106
28	I can statistically interpret the numerical statements I obtained during the data analysis phase	3,53	1,061
29	I can perform descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data.	3,37	1,168
30	I can use qualitative and quantitative data analysis programs	3,50	1,101
Article	Reporting	$\bar{x}$	ss
31	I can interpret the tables in the program outputs that I obtained as a result of the analysis in the context of hypotheses	3,54	,963
32	I can interpret the program outputs that I obtained as a result of the analysis by tabulating	3,57	1,059
33	I can write the reporting process according to the testing of hypothesis(s).	3,46	1,087
34	I can complete the reporting process by considering the	3,69	1,030

	research as a whole.		
35	I can support the reporting process with current research findings	3,85	1,030
36	I can make suggestions based on the findings I obtained from the study in the reporting process	3,81	,944
37	I can discuss the study findings in the reporting process and present them to the reader	3,87	1,034

When Table 6 is examined; the highest average found with $\bar{x}$ = 3.96 was the 2nd item “After identifying the problem situation, I can continue the research in this direction.”, while the lowest average found with $\bar{x}$ = 3.46 was the 3rd item “I can conduct the process of identifying the problem stuation individually”.

According to the literature review dimension, the highest average with $\bar{x}$ = 3.61 was the 7th item “I can analyze the literature in the context of the problem situation”, while the lowest average found with $\bar{x}$ = 3.40 was the 12th item, “I can access national and international databases for literature review.”.

According to the identifying the hypotheses dimension, the highest average with $\bar{x}$ = 4,08 was the 14th item “I make sure that the hypotheses are rational, clear and understandable”, while the lowest average found with $\bar{x}$ = 3,87 was the 15th item “I can use the hypotheses as a guide to carry out other steps of the research”.

According to the method dimension, the highest average with $\bar{x}$ = 3,94 was 19th item “I can identify the appropriate method for testing hypotheses”, while the lowest average, with $\bar{x}$ = 3,56, was the 24th item “I can do the validity and reliability studies of the data collection tools that I will use in the research”.

According to the data analysis dimension, the highest average with $\bar{x}$ = 3,63 was 27th item “I can apply appropriate data analysis techniques (Quantitative/Qualitative) to test the hypotheses”, while the lowest average found with $\bar{x}$ = 3,37 was 29th item “I can perform descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data”.

According to the reporting dimension, the highest average with $\bar{x}$ = 3,87 was the 37th item “I can discuss the study findings in the reporting process and present them to the reader”, while the lowest average found with $\bar{x}$ = 3,46 was 33th item “I can write the reporting process according to the testing of hypotheses”.

CONCLUSION

The results revealed that the Geography Teacher Candidates' views on the subject of Scientific Self-Efficacy were mostly in the direction of "I agree". Thus, it can be said that Geography teacher candidates' perspectives on scientific self-efficacy are positive. The views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not show a significant difference by gender. However, male geography teacher candidates' views on scientific self-efficacy are more positive than female geography teacher candidates.

Considering the difference in year of study, the views of the Geography Teacher Candidates on the subject of Scientific Self-Efficacy do not show a significant difference in terms of year. In other words, it can be said that the year variable is not an important variable that affects the Geography Teacher candidates' views on scientific self-efficacy. It does not show a significant difference in terms of the "Taking the Educational Research Methods course" variable regarding the views of the Geography Teacher Candidates who participated in the study and took the Educational Research Methods course on the subject of Scientific Self-Efficacy. Thus, it can be said that the teacher candidates who took the course of Educational Research Methods at the undergraduate level have more positive views on the

subject of scientific self-efficacy, but they do not show significant difference from those who did not take this course.

Based on the results, it can be said that the Geography Teacher Candidates have a high self-efficacy in continuing the research after determining the problem at the problem definition stage of the scientific research process within the scale. However, it was determined that they had low self-efficacy in defining the problem situation personally.

Regarding the literature review aspect of the research, it was revealed that Geography Teacher Candidates have high self-efficacy in examining the literature in the context of a problem situation, while they have low self-efficacy in accessing national and international databases for literature review.

The result obtained regarding the dimension of determining the hypotheses of the scale is that Geography teacher candidates have a high self-efficacy in paying attention to make make the hypotheses rational, open and understandable, while they have a low self-efficacy in using the hypotheses as a guide to carry out the other steps of the research.

According to the method dimension of the scale, Geography teacher candidates have a high self-efficacy in determining the appropriate method to test the hypotheses, and a low self-efficacy in doing the validity and reliability studies of the data collection tools they will use in the research.

Regarding the data analysis dimension, it can be said that Geography teacher candidates have a high self-efficacy in applying appropriate data analysis techniques (Quantitative/Qualitative) to test the Hypothesis(s),while they have low self-efficacy in performing descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data.

As regards the reporting dimension of the scale, Geography teacher candidates have high self-efficacy in discussing and presenting the study findings to the reader during the reporting process, and low self-efficacy in writing the reporting process according to the testing of the hypotheses.

Based on the findings, the following suggestions can be made to guide future work:

1. Geography teacher candidates need to be more informed in terms of individually identifying the problem situation more accurately to increase their scientific research self-efficacy.
2. Geography teacher candidates need to be more informed in accessing national and international databases for literature reviews to increase their scientific research self-efficacy.
3. Geography teacher candidates need to be more informed about how they can use the hypotheses as a guide to carry out the other steps of the research to increase their self-efficacy in scientific research.
4. Geography teacher candidates should be more informed about the validity and reliability studies of the data collection tools they will use to increase their scientific research self-efficacy.
5. Geography teacher candidates should be more informed about their ability to perform descriptive statistical operations (frequency, percentage, arithmetic mean, standard deviation, etc.) on data to increase their self-efficacy in scientific research.

6. Geography teacher candidates should be informed in terms of preparing the reporting process of scientific research according to the testing of hypotheses to increase their scientific research self-efficacy.

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