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Research Article

The Relationship between Science Learning Skills and Science Literacy Levels of Classroom Teacher Candidates

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Abstract

The science learning skills and science literacy levels of prospective primary school teachers, who are the teachers of the future, are very important. In this respect, this study is considered to be important in terms of determining this situation. Aim of this study is to investigate the relationship between science learning skills and science literacy levels of primary school teacher candidates. Relational survey model was used in this study. The sample of research consisted of 242 teacher candidates. Science learning skills scale and science literacy scale were used as data collection tools. In addition to descriptive statistics, independent t-test and ANOVA analysis were applied to analyze the data. According to findings, it was determined that the science learning skill levels of the classroom teacher candidates were above average. Besides, there was no significant difference between the science learning skill scores of the teacher candidates in terms of gender and grade level variables. When the science learning skill scores and science literacy scores were examined in terms of the grade level and gender variables, it was concluded that there was a significant difference between the scores of the prospective teachers. Besides, science literacy levels of classroom teacher candidates were below average. There was at medium level positive and significant relationship between the science learning skills and science literacy levels of teacher candidates.

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Introduction

For more than a century, educators have insisted that science education is useful to all students, even those not bound for scientific or technical careers (Feinstein, 2010). In the last decades, science literacy has been progressively emphasised as an aim of science education (Almeida, et al., 2023; Kaya & Elster, 2019). Science and technological developments have an impact on many areas such as education, economy, health, industry, transportation, social, and communication. Science is the most basic and realistic tool for understanding the world and contributes to individuals making the right decisions for the future of the world. The ultimate goal of teaching science is to equip students with the knowledge and skills to enable

them to carry out the process of science inquiry to answer testable questions and/or gather information in a systematic manner (Apanasionok, et al., 2019).

One of the main objectives of science education is to ensure that students grow up to be scientifically literate. Scientific literacy is related to the interpretation of scientific knowledge (Ural & Yolagiden, 2021). A new system needs to be created where science is effective in people's thinking and decision-making. One of the situations encountered in our age is globalization and competition between countries. In order to gain a good place in this competitive environment, countries have given priority to educating their individuals well in the scientific field. In order to follow and understand scientific events, it is necessary to know, understand, interpret, discuss and decide on basic science-related subjects and concepts. The fact that students make connections between science concepts and the activities they carry out by making connections with daily life makes this course easier to learn (Uyanık, 2018). The most important task for the individuals trained in this field and the future of the countries falls on the education system (Murcia, 2005). The main purpose of science education is not to transfer existing knowledge to students as it is, but to guide students in finding knowledge. Science education conducted from this perspective will provide students with creative thinking skills, as well as the ability to question a problem and produce solutions. Individuals with these skills are expected to communicate better with their environment and to more easily solve the problems they encounter in daily life (Uyanık, 2016).

In the globalizing world, it is seen that there are rapid changes and developments in the field of science every day. This globalization has caused competition between countries, and in this competitive environment, individuals are aware of the need to receive effective science education in order to get ahead. It has become mandatory for every individual to be educated as a science literate in order to create a strong future, considering that this competition will continue to increase with scientific and technological developments in the future. Modern countries aim to raise scientifically literate individuals who can research, question, interpret and make decisions, and they strive to teach ways to access the knowledge. In today's knowledge age, it is not about transferring knowledge directly to students, but about students comprehending the knowledge and structuring the knowledge themselves to achieve permanent and meaningful learning. In order to raise individuals who are suitable for this purpose, students need to be provided with high-level thinking skills.

These skills can be provided to individuals through scientific literacy (Tatar, 2006). In order for individuals to adapt to the world that is changing and developing every day, they need to have more scientific knowledge and the ability to use this knowledge than they do today. In our world, which is filled with research and studies in the field of science, science literacy is becoming important for everyone. Individuals need to have scientific literacy skills in order to make the right choice among the many situations they encounter in their daily lives. Individuals who are always in interaction with their environment need science literacy skills in order to understand what is happening around them (Kaya & Elster, 2019; Soylu, 2004).

The most important duties and responsibilities in raising science literate individuals fall on teachers. In order to achieve this, teachers must first be good scientific literates. Teachers who are good science literate can provide their students with the skills to understand and use science, generate ideas about science, value science, and understand the interaction of science-technology and society (Çepni, et al., 2012). Teachers should educate students in a way that will help them understand the nature of science in order to create interest and curiosity in science. Most of the events we encounter in our daily lives are related to science. Students being able to see and relate much of the knowledge they learn at school to events that affect their daily lives will have a positive effect on them becoming scientifically literate. If they are not given science education at school in which they can see this relationship, they cannot acquire the necessary science learning skills that will make their lives easier in the world where science rules. Students who have taken a good science course use their science learning skills throughout their lives and make their lives more meaningful by using these skills (Akbudak, 2005). Especially classroom teachers who introduce students to science lessons for the first time are of critical importance in providing science learning skills and raising science literate individuals.

The most important role in raising future generations as scientifically literate individuals and also in providing them with science learning skills falls on classroom teachers. In this context, universities have a great responsibility in training science literate classroom teachers who believe in the importance of being scientifically literate. Therefore, it is very important to investigate the science literacy levels and science learning skills of classroom teacher candidates. Students can learn science more easily with science literate teachers who reflect their knowledge and skills to daily life and internalize science. In this context, it is obvious that it is important to educate classroom teacher candidates as

scientifically literate (Uludüz, 2017). When the related literature was examined, it was determined that there were studies examining pre-service teachers' science learning skills and science literacy levels (Caymaz, 2008; Özdemir, 2010; Uca-Tabak & Çil, 2018; Ural & Yolagiden, 2021). In this context, it is very important for classroom teacher candidates to graduate with both academic and daily skills that will allow them to reflect what they have learned in daily life. Based on this, the aim of this research is to examine the relationship between science literacy levels and science learning skills of prospective classroom teachers. In order to achieve this goal, the following sub-problems were sought:

1. What are the science learning skill levels of classroom teacher candidates?

2. Do the science learning skills of classroom teacher candidates show a significant difference according to the gender variable?

3. Do the science learning skills of classroom teacher candidates show a significant difference according to the grade level variable?

4. What are the science literacy levels of classroom teacher candidates?

5. Do the science literacy levels of classroom teacher candidates show a significant difference according to the gender variable?

6. Do the science literacy levels of classroom teacher candidates show a significant difference according to the grade level variable?

7. What is the relationship between the science learning skills and science literacy levels of classroom teacher candidates?

Method

Research Model

The relational survey model was used in this research. Relational survey model is a research model that aims to determine the existence of co-variation between two or more variables. In this research model, it is tried to determine whether the variables change together and if there is a change, how it happens (Karasar, 2011). In this context, science learning skills and science literacy levels of classroom teacher candidates were examined in terms of gender and grade level variables. In addition, it was determined that what kind of relationship between the science learning skills and science literacy levels of classroom teacher candidates.

Sample

The sample of the research consisted of a total of 242 teacher candidates studying in the Classroom Education undergraduate program of Kastamonu University, Faculty of Education, in the spring semester of 2018-2019 academic year. In determining the sample of study, the convenient sampling technique was used due to the easy accessibility of the researcher. There were 54 teacher candidates in the first grade, 65 in the second grade, 67 in the third grade and 56 in the fourth grade. The sample consisted of 180 female teacher candidates and 62 male teacher candidates. Descriptive statistics of the sample are shown in Table 1.

Table 1. Descriptive statistics of the sample

		n		
Grade Level	**Female**	**Male**	**Total**	**%**
First	41	13	54	22,3
Second	45	20	65	26,9
Third	50	17	67	27,7
Fourth	44	12	56	23,1
Total	180	62	242	100

When Table 1 is examined, it is seen that 22.3% of the classroom teacher candidates forming the sample were in the first grade, 26.9% were in the second grade, 27.7% were in the third grade and 23.1% were in the fourth grade.

Data Gathering Tools

Science Learning Skills Scale and Science Literacy Scale were used as data collection tools in the research. A basic science literacy test was applied in order to measure the science literacy levels of classroom teacher candidates in this study.

The "Basic Science Literacy Test", adapted to Turkish by Duruk (2012) and whose validity and reliability analyses were conducted, consists of 49 items. The data were evaluated based on "1 point" for the answers given to the correct items, "0 points" for the answers given to the wrong items and "0 points" for the answers given to the "I don't know" option. The Cronbach Alpha value, which is the reliability coefficient of the items in the scale, was calculated as .82. The highest score that can be obtained from the scale was determined as 49 and the lowest score as 0 (zero).

The science learning skills scale adapted to Turkish by Şenler (2014) consists of 29 items. The item options were rated on a five-point likert-type scale as follows; "Strongly Disagree" (1), "Disagree" (2), "Undecided" (3), "Agree" (4), "Strongly Agree" (5). The Cronbach Alpha value, which is the reliability coefficient of the scale, was determined as .93. The highest score that can be obtained from the scale was calculated as 145, and the lowest score was calculated as 29.

Data Analysis

SPSS statistical package program was used in the analysis of data. Independent t-test, One-Way ANOVA and Pearson correlation analysis were performed for relational comparison. The findings were evaluated at the significance level of *p<.01.

Findings

Findings Regarding the First Sub-Problem

In order to find an answer to the question "What is the science learning skill levels of classroom teacher candidates?", the relevant scale was applied to the teacher candidates and the analysis results related to the scale are given in Table 2.

Table 2. Results regarding the science learning skill levels of classroom teacher candidates

Grade Level	*n*	$\overline{X}$	SD
First	54	82,68	5,73
Second	65	83,24	6,42
Third	67	102,88	12,08
Fourth	56	102,53	10,47
Total	242	93,02	13,45

When Table 2 is examined, it is seen that the average score of the science learning skill scale of the first-year teacher candidates was $\overline{X}$ =82,68, and the average score of the second-year teacher candidates was $\overline{X}$ =83,24. However, it is seen that the average score of the third-year teacher candidates on the scale was $\overline{X}$ =102,88 and the average score of the fourth-year teacher candidates was $\overline{X}$ =102,53. According to this finding, it can be said that the science learning skill levels of the third- and fourth-year teacher candidates are higher than the first- and second-year teacher candidates. It is seen that the general average score obtained from the scale by all teacher candidates participating in the research was $\overline{X}$ =93,02.

According to this result, it can be said that the science learning skill levels of the classroom teacher candidates were above average.

Findings Regarding the Second Sub-Problem

Do the science learning skills of classroom teacher candidates show a significant difference according to the gender variable? The results regarding this sub-problem are given in Table 3.

Table 3. Independent t-test results of the science learning skills scale scores of classroom teacher candidates according to the gender variable

Gender	*n*	$\overline{X}$	SD	df	t	p
Female	180	93,25	12,95	240	.451	.652
Male	62	92,35	14,89			

*p<.01

When Table 3 is examined, it is seen that there is no statistically significant difference between the science learning skill scale scores of classroom teacher candidates in terms of gender variable ($t_{(240)}$=.451, p>.01). According to this result, it can be said that the science learning skills of female and male classroom teacher candidates were at similar levels.

Findings Regarding the Third Sub-Problem

Do the science learning skills of classroom teacher candidates show a significant difference according to the grade level variable? The results regarding this sub-problem are given in Table 4.

Table 4. ANOVA results of the science learning skills scale scores of classroom teacher candidates according to the grade level variable

Source of Variance	Sum of Squares	df	Mean Squares	F	p	Significant Difference
Between groups	23562,214	3	7854,071	93,144	.000*	4-1, 4-2, 3-1, 3-2
Within groups	20068,683	238	84,322			
Total	43630,897	241				

*p<.01

1=First Grade, 2=Second Grade, 3=Third Grade, 4=Fourth Grade

According to Table 4, it is seen that there is a statistically significant difference between the mean science learning skill scale scores of the classroom teacher candidates studying at different grade levels F(3, 238)=93.144, *p<.01. In order to determine which groups the significant difference between grade levels were between, the Tukey test, one of the multiple comparison tests, was applied. According to the results of the Tukey test, it was determined that there was a significant difference between the scale scores of the first and

second grade teacher candidates and the scale scores of the third and fourth grade teacher candidates in favor of the third and fourth grade teacher candidates. According to this finding, it can be said that the science learning skill levels of the classroom teacher candidates studying at the first and second grade were lower than the third and fourth grade teacher candidates.

Findings Regarding the Fourth Sub-Problem

What is the level of science literacy of classroom teacher candidates? The results regarding this sub-problem are given in Table 5.

Table 5. Results regarding the science literacy levels of classroom teacher candidates

Grade Level	*n*	$\overline{X}$	SD
First	54	13,22	3,17
Second	65	13,12	2,52
Third	67	18,92	2,16
Fourth	56	19,51	2,45
Total	242	16,23	3,96

When Table 5 is examined, it is seen that the average science literacy scale score of the first-year prospective teachers was $\overline{X}$ =13,22, and the average score of the second-year prospective teachers was $\overline{X}$ =13,12. However, it is seen that the average scale score of the third-year prospective teachers was $\overline{X}$ =18,92 and the average score of the fourth-year prospective teachers was $\overline{X}$ =19,51. According to this finding, it can be said that the science literacy levels of the third- and fourth-year prospective teachers were higher than the first- and second-year prospective teachers. It is seen that the general average score obtained from the scale by all the prospective teachers participating in the research was $\overline{X}$ =16,23. According to this result, it can be said that the science literacy levels of the classroom teacher candidates were above the average.

Findings Regarding the Fifth Sub-Problem

Do the science literacy levels of classroom teacher candidates show a significant difference according to the gender variable? The results regarding this sub-problem are shown in Table 6.

Table 6. Independent t-test results of science literacy scale scores of classroom teacher candidates according to gender variable

Gender	*n*	$\overline{X}$	SD	df	t	p
Female	180	16,36	4,02	240	.903	.367
Male	62	15,83	3,78			

*p<.01

When Table 6 is examined, it is seen that there is no statistically significant difference between the science literacy scale scores of classroom teacher candidates in terms of gender variable ($t_{(240)}$=.903, p>.01). According to this result, it can be said that the science learning skills of female and male classroom teacher candidates were at similar levels.

Findings Regarding the Sixth Sub-Problem

Do the science literacy levels of classroom teacher candidates show a significant difference according to the grade level variable? The results regarding this sub-problem are shown in Table 7.

Table 7. ANOVA results of science literacy scale scores of classroom teacher candidates according to grade level variable

Source of Variance	Sum of Squares	df	Mean Squares	F	p	Significant Difference
Between groups	2208,084	3	736,028	110,523	.000*	4-1, 4-2, 3-1, 3-2
Within groups	1584,958	238	6,659			
Total	3793,041	241				

*p<.01

1=First Grade, 2=Second Grade, 3=Third Grade, 4=Fourth Grade

According to Table 7, it is seen that there is a statistically significant difference between the science literacy scale average scores of the classroom teacher candidates studying at different grade levels F(3, 238)=110,523, *p<.01. In order to determine which groups the significant difference between grade levels were between, the Tukey test, one of the multiple comparison tests, was applied. According to the results of the Tukey test, it was determined that there was a significant difference between the scale scores of the first and second grade teacher candidates and the scale scores of the third and fourth grade teacher candidates in favor of the third and fourth grade teacher candidates. According to this finding, it can be said that the science literacy levels of the classroom teacher candidates studying at the first and second grade were lower than the third and fourth grade teacher candidates.

Findings Regarding the Seventh Sub-Problem

What is the relationship between the science learning skills and science literacy levels of classroom teacher candidates? The results of this sub-problem are shown in Table 8.

Table 8. The relationship between science learning skills and science literacy levels of classroom teacher candidates

Score	*n*	$\overline{X}$	SD	r	p
Science Literacy	242	16,23	3,96	.577**	.000*
Science Learning Skills	242	93,02	13,45		

*p<.01

When Table 8 is examined, it was determined that there was at medium level positive and significant relationship between the science literacy levels of classroom teacher candidates and their science learning skills, (r = .577, *p<.01). Accordingly, it can be said that there was a relationship between the science literacy levels of classroom teacher candidates and their science learning skills and that they change together.

Discussion and Conclusion

The science literacy levels and science learning skills of classroom teacher candidates were examined in this research. According to the results obtained from the research, it was determined that the science literacy levels of classroom teacher candidates were under the average. In Huyugüzel-Çavaş's (2009) research, it was concluded that the science and technology literacy levels of classroom teachers were not sufficient. Similarly, Özdemir (2011) also stated that the science literacy levels of classroom teachers were not sufficient. In addition, Işık-Terzi (2008) concluded that the science literacy levels of both classroom teachers and science and technology teachers were at a low level. In this context, it can be said that these results are similar to the results obtained in this study. On the contrary, Uludüz (2017) evaluated the science literacy levels of classroom teacher candidates as sufficient in his study. Yolagiden (2017) concluded in his research with classroom and science teacher candidates that their science literacy levels were slightly above average.

In this study, it was concluded that there was no statistically significant difference between the science literacy levels of classroom teacher candidates according to the gender variable. In their studies, Huyugüzel-Çavaş (2009), Uludüz (2017), Duruk (2012), Işık-Terzi (2008), and Soysal (2011) concluded that there was no significant difference according to the gender variable. It can be said that these results are similar to the results of this study. On the

contrary, in their studies, Özdemir (2011), Yolagiden (2017), Yakar (2010) and Ulutaş (2009) concluded that there is a significant difference in favor of women in science literacy levels in terms of the gender variable.

In this study, it was determined that the science literacy levels of classroom teacher candidates showed a significant difference in terms of the class level variable. Yolagiden (2017) and Akgün (2010) also found that the science literacy levels of teacher candidates showed significant differences according to the grade level variable. On the contrary, in the study of Uludüz (2017), it was found that there was no significant difference between the science literacy levels of classroom teacher candidates and their grade levels. The science learning skill levels of classroom teacher candidates were examined in this study and it was concluded that the science learning skill levels of teacher candidates were slightly above average. This result is similar to the results obtained from the research of Yolagiden (2017).

In this study, it was concluded that the science learning skill levels of classroom teacher candidates did not show a significant difference according to the gender variable. This result is similar to the research result of Yolagiden (2017) in the relevant literature. On the contrary in Çetin's (2017) study it was found that there was a statistically significant difference in terms of gender variable.

When the science learning skill levels of classroom teacher candidates were examined according to the grade level variable, it was concluded that there was a statistically significant difference. In this context, it was determined that the scores of the third and fourth grade teacher candidates were higher than the first and second grade teacher candidates. This result is similar to the research results of Çetin (2017), Yolagiden (2017) and Karamustafaoğlu and Celep-Havuz (2016) in the relevant literature.

In this study, it was determined that there is a moderately positive and significant relationship between the science literacy levels of classroom teacher candidates and their science learning skills. According to this result, it can be said that the science literacy level and science learning skills change together. At the primary school level, where students encounter science classes for the first time, classroom teachers have great responsibilities in raising scientifically literate individuals. The fact that classroom teachers have accurate and valid knowledge about basic science subjects will contribute greatly to the students they will educate throughout their careers in learning these subjects correctly (Uyanık, 2016). Classroom teachers should raise their students as individuals who can relate science to their

daily lives, think logically and critically, develop problem-solving skills and higher-order thinking skills, and have science learning skills.

In order to provide students with these skills, first of all, classroom teachers need to be science literate individuals who have science learning skills. Education faculties have important duties in training teachers with this knowledge and equipment. In this context, it is of great importance for classroom teacher candidates to gain science learning and teaching skills and science literacy characteristics during their undergraduate education.

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Author Contribution Statement

Gökhan UYANIK: *Literature review, methodology, data collection, processing, analysis, interpretation, general supervision, review-writing and editing*

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