



The Effect of Different Variables on Pre-service Science Teachers' Level of Digital Literacy¹

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Abstract

Technology has been developing since the early days of humanity. The process starting with the invention of the wheel, for example, has proceeded with the development of two-wheeled carts and then with today's four-wheeled cars equipped with technology. As technology advances, digital transformation steps are taken in the education and training process. Digital transformation has many contributions both for learning and teaching purposes. For this reason, policies are developed to make more use of technology in education. In this respect, digital literacy levels of pre-service teachers which is one of the most important elements of the teaching-learning process are quietly important. The purpose of the current study is to determine the effects of the variables of grade level, gender, the state of having a social media account and the time spent on various technological tools on pre-service science teachers' level of digital literacy. The study was conducted on 110 first and fourth-year students attending the department of science teaching. As the data collection tool, the 10-item Digital Literacy Scale was used. The cronbach-alpha reliability coefficient was calculated 0.86 for the original of the scale, the cronbach alpha reliability coefficient was calculated was found 0.88 on the research data. As the data showed a normal distribution, it was decided to use parametric statistical methods. The findings have revealed that the arithmetic mean score of the pre-service teachers' digital literacy was found to be 3.82 out of 5. This value shows that the pre-service teachers' level of digital literacy is good. Moreover, the pre-service teachers' level of digital literacy was found to be varying significantly depending on grade level in favour of the fourth-year students while it was found to be not varying significantly depending on gender, the state of having a social media account and the time spent on various technological tools. It is suggested which students starting their undergraduate education should be provided with activities and applications that will enhance their level of digital literacy.

Keywords

Pre-service teacher
Digital literacy
Gender
Grade level

About the article

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Introduction

Technology has been developing since the early days of humanity. The process starting with the invention of the wheel, for example, has proceeded with the development of two-wheeled carts and then with today's four-wheeled cars equipped with technology. While the development of many technological products continues, the importance of technology in many fields such as education, communication and social and cultural areas is increasing. The reason why technology has become an indispensable or integral part of human life is the fact that it facilitates human life. According to the Turkish Language Association [Türk Dil Kurumu, TDK] (2019), technology is all the tools and equipments developed by humans to control and change the material environment and all the related knowledge produced. Another definition of the concept of technology is that it is learning how anything is produced (AAAS, 1993). On the basis of the existing definitions of technology, it can be said that technology is continuously developing in order to make our lives easier and to increase our living standards.

Those who can transfer technology to their lives are one step ahead of other communities (Gündüz and Odabaşı, 2004). It is an undeniable fact that as long as technology is in our life, it will affect education. Many studies reported in the literature have emphasized that one of the objectives of science education is to ensure interaction between technology and science education (AAAS, 1993; Bybee, 1999; Collette & Chiappetta, 1989; Hughes, 1997; Hurd, 1998; Murphy, 2001; NRC, 1996; YÖK, 1997).

In this context, some competencies that students will need in their business and social environments have been added to the 2018 Science Curriculum. One of these is digital competence. Through the inculcation of digital competence in students, it is aimed to make it possible for them to actively use information and communication technologies in their daily lives as well as business, social and cultural lives (MEB, 2018a). In order to use digital technologies as daily life skills, individuals should have sufficient level of digital literacy (Bacanak, Karamustafaoğlu and Köse, 2003) because only with adequate digital literacy, it is possible to know how to use digital technology in the most beneficial way, how to use technological products according to their aims, and to make meaningful and reliable use of digital technologies (Hague and Payton, 2010; Polat and Odabaş, 2008). On the other hand, it is known that great importance is attached to the integration of technology into education within the scope of 2023 Education vision (MEB, 2018b). For this reason, it is believed that inculcation of digital competencies targeted by the 2018 Science Curriculum in students, and the integration of technology into education within the scope of the 2023 education vision depend to some extent on the training of pre-service science teachers as digitally literate individuals because teachers or pre-service teachers are in a very important position in terms of meeting the needs of students in the learning process with the advantages offered by developing technology (Bacanak et al., 2003). It is thought that important roles should be fulfilled by pre-service science teachers as one of the stakeholders for the success of science education in terms of educating individuals as competent in digital technologies (MEB, 2005; MEB 2013). The purpose of the current study is to determine the effect of grade level, gender, the state of having a social media account and the time spent in the internet on the pre-service science teachers' level of digital literacy.

To this end, answers to the following questions were sought.

1. What is the pre-service science teachers' level of digital literacy?
2. Does the pre-service science teachers' level of digital literacy vary significantly depending on grade level, gender, the state of having a social media account and the time spent in the internet?

Method

The current study employed the survey model, one of the quantitative research approaches. The survey model is a research design attempting to quantitatively or numerically define the tendencies, attitudes and opinions of a population by collecting data from a sample selected from the population (Creswell and Clark, 2015).

Sample

The sample of the current study is comprised of 110 (40 first-year; 70 fourth-year) pre-service science teachers enrolled in the Education Faculty of Muğla Sıtkı Koçman University in the spring term of the 2018-2019 academic year. Detailed information about the distribution of the demographic features of the participants is given in Table 1.

Table 1. The distribution of the participants in terms of gender and grade levels

| Gender | N | % |
|----------------------|----|----|
| Female | 75 | 68 |
| Male | 35 | 32 |
| Grade Level | N | % |
| 1 st year | 40 | 36 |
| 4 th year | 70 | 64 |

Data Collection Tool

In the current study, the 5-point Likert-Type Digital Literacy Scale developed by Üstündağ, Güneş and Bahçivan (2017) was used as the data collection tool. This is a one dimensional scale consisted of 10 items and its Cronbach alpha reliability coefficient was calculated to be 0.86. The explained variance of the scale is 40%. In the current study, the reliability coefficient was found to be 0.88.

Data Analysis

It was decided whether the data showed a normal distribution by looking at both skewness (-0,124; S:0.230)-Kurtosis (-0.275; S:0.457) coefficients and kolmogorov-smirnov coefficient. As the skewness and Kurtosis coefficients are between +1 and -1 and the kolmogorov smirnov coefficient is higher than 0.05, it was decided that the data showed a normal distribution. Thus, the data were analysed using parametric analysis tests (Çokluk, Şekercioğlu and Büyüköztürk, 2012). In this connection, the pre-service teachers' level of digital literacy was analyzed with descriptive statistics, the effect of gender and grade level was tested with independent samples t-test and the effect of the state of having a digital media account and the time spent in the internet was tested with one-way variance analysis. The pre-service science teachers' level of digital literacy was evaluated on a five-point Likert scale by using descriptive statistics. The evaluation on the five-point scale is given in Table 2.

Table 2. Evaluation of five-point Likert scale

| Total Score | Evaluation |
|-------------|------------|
| 1,0-1,7 | Very Low |
| 1,8-2,5 | Low |
| 2,6-3,3 | Medium |
| 3,4-4,1 | High |
| 4,2-5,0 | Very High |

Findings

Pre-service science teachers' level of digital literacy

The results of the analysis are given in Table 3.

Table 3. Results of the descriptive statistics related to the pre-service science teachers' level of digital literacy

| | N | \bar{X} | S |
|------------------|-----|-----------|------|
| Digital literacy | 110 | 3,82 | 0,66 |

As can be seen in Table 3, the mean score of the pre-service teachers' level of digital literacy was found to be 3.82 out of 5. This value shows that the pre-service science teachers' level of digital literacy is at the good level.

The effect of the grade level variable on the level of digital literacy

Within the context of the second sub-problem of the study, it was investigated whether the pre-service teachers' level of digital literacy varied significantly depending on grade level. For this purpose, independent samples t-test was conducted to determine whether the pre-service science teachers' level of digital literacy varies significantly depending on grade level. The results of the analysis are presented in Table 4.

Table 4. Results of the analysis conducted to determine the effect of grade level on the pre-service science teachers' level of digital literacy

| | Grade Level | N | \bar{x} | S | df | t | p |
|-------------------------|----------------------|----|-----------|------|-----|-------|------|
| Digital literacy | 1 st year | 40 | 3,60 | 0,61 | 108 | -2,76 | 0,00 |
| | 4 th year | 70 | 3,95 | 0,65 | | | |

As can be seen in Table 4, the pre-service science teachers' level of digital literacy varies significantly depending on grade level [$t_{(108)} = -2,76$, $p < .05$]. While the mean digital literacy score of the fourth-year students was found to be 3.95, that of the first-year students was found to be 3.60. In light of these findings, it can be argued that the mean digital literacy score of the fourth-year students is higher than that of the first-year students.

The effect of gender on the level of digital literacy

Within the context of the third sub-problem of the study, it was investigated whether the pre-service teachers' level of digital literacy varied significantly depending on gender. In this connection, the effect of gender on the pre-service science teachers' level of digital literacy was tested with independent samples t-test and the results of the analysis are presented in Table 5.

Table 5. Results of the analysis conducted to determine the effect of gender on the pre-service science teachers' level of digital literacy

| | Gender | N | \bar{x} | S | sd | t | p |
|-------------------------|--------|----|-----------|------|-----|------|------|
| Digital literacy | Female | 75 | 3,84 | 0,67 | 108 | 0,43 | 0,67 |
| | Male | 35 | 3,78 | 0,65 | | | |

As can be seen in Table 5, the pre-service science teachers' level of digital literacy does not vary significantly depending on gender [$t_{(108)} = 0,43$, $p > .05$]. In other words, it can be argued that gender does not have any significant effect on the pre-service teachers' level of digital literacy.

The effect of the state of having a digital media account on the level of digital literacy

Within the context of the fourth sub-problem, it was investigated whether the pre-service science teachers' level of digital literacy varied significantly depending on the state of having a media account by using independent samples t-test and the results of the analysis are presented in Table 6.

Table 6. Results of the analysis conducted to determine the effect of the state of having a media account on the pre-service science teachers' level of digital literacy

| | Have a social media account | N | \bar{x} | S | sd | t | p |
|-------------------------|-----------------------------|-----|-----------|------|-----|------|------|
| Digital literacy | Yes | 105 | 3,84 | 0,65 | 108 | 1,05 | 0,29 |
| | No | 5 | 3,52 | 0,79 | | | |

As can be seen in Table 5, the pre-service science teachers' level of digital literacy does not vary significantly depending on the state of having a social media account [$t_{(108)} = 1,051$, $p > .05$]. In other words, the state of having a social media account does not have any significant effect on the pre-service science teachers' level of digital literacy.

The effect of the time spent in the internet on the level of digital literacy

It was tested whether the pre-service science teachers' level of digital literacy varied significantly depending on the time spent in the internet by using one-way variance analysis. The results of the analysis are presented in Table 7.

Table 7. Results of the analysis conducted to determine the effect of the time spent in the internet on the pre-service science teachers' level of digital literacy

| Time spent | N | \bar{x} | S |
|------------------|----|-----------|------|
| 0-1 hour | 17 | 3,79 | 0,63 |
| 1-2 hours | 38 | 3,84 | 0,69 |
| 2-3 hours | 45 | 3,88 | 0,71 |
| 3 hours and more | 10 | 3,77 | 0,60 |

As can be seen in Table 7, the digital literacy mean score of the pre-service teachers spending 0-1 hour in the internet is 3,79; that of the pre-service teachers spending 1-2 hours in the internet is 3,84; that of the pre-service teachers spending 2-3 hours in the internet is 3,88 and that of the pre-service teachers spending 3 hours and more is 3,77. One-way variance analysis was used to test whether there is a significant difference between the values.

Table 8. Results of ANOVA conducted to determine the effect of the time spent in the internet on the level of digital literacy

| | Source of the variance | Sum of squares | sd | Mean of squares | F | p |
|-------------------------|------------------------|----------------|-----|-----------------|------|------|
| Digital literacy | Between-Groups | 0,25 | 2 | 0,12 | 0,27 | 0,76 |
| | Within-Groups | 47,14 | 107 | 0,44 | | |
| | Total | 47,39 | 109 | 0,56 | | |

As can be seen in Table 8, the pre-service teachers' level of digital literacy does not vary significantly depending on the time spent in the internet [$F_{(2-107)} = 0,272$, $p > 0,05$]. In other words, the time spent in the internet does not have any positive or negative effect on the pre-service science teachers' level of digital literacy.

Discussion, Results and Suggestions

In the current study, the effect of grade level, gender, the state of having a social media account and the time spent in the internet on the pre-service science teachers' level of digital literacy was investigated.

The descriptive results of the study have revealed that the pre-service science teachers' level of literacy is good. In other words, the pre-service teachers are good at adopting newly emerging technologies, using these technologies and bringing these technologies to their future educational-instructional environments and can serve as the leaders of technology for their prospective students. This is believed to enable them to impart some competencies (digital competence, math competence and basic competences in science/technology) stated in the 2018 Science Curriculum to their students in the future. Üstündağ, Güneş and Bahçivan (2017) found that the digital literacy of 979 third-year and fourth-year classroom pre-service teachers is at the good level. Similarly, Dedeşali (2019) concluded that pre-service teachers' level of digital literacy is adequate. The findings of these studies conducted to determine whether educational-instructional practitioners are qualified enough to use many technological tools integrated into schools in recent years (Karamustafaoğlu, Köse and Bilen, 2003) concur with the findings of the current study.

The second finding of the current study is that the increasing grade level from first-year towards fourth-year makes positive contributions to their digital literacy. Thus, it can be contended that the four-year undergraduate education of the pre-service science teachers develops them in terms of digital literacy. This is a highly important finding given that the students who will be in their classrooms will be highly interested in technology. In the literature, it is seen that results similar to the ones found in the current study have been reported (Kozan and Bulut Özek, 2019). However, it is possible to see some studies reporting different findings. Özerbaş and Kuralbayeva (2018) found no

significant difference between the digital literacy levels of the third-year and fourth-year pre-service science teachers. This might be because the time gap between these two grade levels is not remarkable.

The third important finding of the current study is that the pre-service science teachers' level of digital literacy does not vary significantly depending on gender. This showed that gender is not a variable influential on the development of digital literacy. Parallel to the findings of the current study, Kozan and Bulut Özek (2019) and Dede (2019) concluded that the gender variable does not have any significant effect on the pre-service teachers' level of digital literacy. In the literature, there are some studies reporting results different from the ones found in the current study. In a study conducted by Özerbaş and Kuralbayeva (2018), the digital literacy level of the male pre-service teachers was found to be higher than that of the female pre-service teachers.

Another finding of the current study is that the pre-service teachers' state of having a social media account does not affect their level of digital literacy. In the literature, it was reported that the pre-service teachers' frequency of using the internet in a purposeful manner affects their perception of competence in technology yet that having a social media account does not affect their digital literacy (Menzi, Çalışkan and Çetin, 2012).

The fifth finding of the current study is that the time spent in the internet does not affect the pre-service teachers' digital literacy. Bahar, Uludağ and Kaplan (2009); on the other hand, found that the frequency of using the internet affects digital literacy. This finding does not support the finding of the current study.

In general, in the current study it was concluded that while the pre-service teachers' level of digital literacy increases with increasing grade level, gender, the state of having a social media account and the time spent in the internet do not have any significant effect on their level of digital literacy.

In light of the findings, following suggestions can be made:

- Students starting their undergraduate education should be provided with activities and applications that will enhance their level of digital literacy.
- The current study is limited to first-year and fourth year students attending Muğla Sıtkı Koçman University. Similar studies may be conducted on larger samples to increase the generalizability of the results

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