

Formation of digital competencies of future teachers of biology in a blended learning environment

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Abstract

The purpose of this research is to get the opinions of future biology teachers on the creation of digital competencies in a blended learning environment. This research was created with the qualitative research method. The study group of the research consists of 80 biology teacher candidates studying in biology teaching departments at various universities in Kazakhstan. The data collection tool of the research is the semi-structured interview form developed by the researchers. The descriptive analysis method was used in the analysis of the research data. As a result of the research, it has been determined that the vast majority of future biology teachers find blended learning environments useful. In addition, the majority of pre-service teachers stated that they found their digital competencies somewhat sufficient. The majority of biology teacher candidates participating in the research stated gaining the ability to use digital technologies, gaining competencies in using digital tools, preparing applications that will enable the student to reinforce the subject in the digital environment and gaining the habit of following the innovations in digital technology as their expectations regarding the digital competencies to be created in relation to the blended learning environment.

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1. Introduction

Rapid developments and changes in digital technologies have led to various developments and changes in the field of education (Savaneviciene & Statnicke, 2020; Saule et al., 2022). This situation has led to the emergence of various learning and teaching environments in the education process, and one of them is the blended learning environment that contains a series of methods (Gipal, Carrillo, & Mallonga, 2022; Uzunboylu & Tuncay, 2010).

1.1. Theoretical and conceptual framework

Blended learning is defined as the combination of web-based learning and classroom learning, bringing together the advantages and strengths of both environments (Shivetts, 2011; Smith & Hill, 2019). When creating a blended learning environment, the characteristics of the users should also be taken into account. In other words, the fact that users have different personal characteristics, different learning styles and prior knowledge causes their learning needs to differ while using this environment (Anthonysamy, Koo, & Hew, 2020; Park and Shea, 2020; Torrisi-Steele & Drew, 2013).

It has become possible to design and develop adaptive learning environments that take into account the differences among those using blended learning environments and differentiate according to the personal needs of each user (Brusilovsky, 2003; Galvis, 2018). In addition, blended learning is used to describe learning that combines various event-based activities such as self-paced learning, live e-learning and face-to-face classroom learning (Alonso, López, Manrique, & Viñes, 2005). Additionally, it enriches the quality and content by providing a technologically rich teaching environment (Albiladi & Alshareef, 2019).

Although there are limitations to teaching only in face-to-face or online environments, these limitations disappear when the superior aspects of the two teaching environments complement each other and a better teaching environment is created in a blended teaching environment (Nortvig, Petersen, & Balle, 2018; Smith, Hayes, & Shea, 2017). However, there is no single and definitive method on how to use time and technology in the integration of face-to-face and online teaching (Wang, Han, & Yang, 2015). Many variables such as the topics, types and techniques used in face-to-face and online environments differ according to practitioners and participants (Bliuc, Goodyear, & Ellis, 2007). Therefore, the best aspect of blended teaching is that it provides students with an effective, interactive and flexible learning opportunity by using the strengths of face-to-face and online teaching (Arbaugh, Desai, Rau, & Sridhar, 2010).

In the literature, conceptualisations of digital competence are associated with many features such as information, media and communication studies, education and information sciences/systems (Elmira et al., 2022; Murawski & Bick, 2017; Oberlander, Beinicke, & Bipp, 2020). Digital competence is all the knowledge, skills and attitudes that an individual employs in the process of accessing, understanding and using information in different formats in various digital environments (Bianco, Giacconi, Gison, D'Angelo, & Capellini, 2021). With the increase in online learning opportunities, digital competencies are among the prominent concepts recently and among the most important skills specified by experts in the fields of policy, education and science (Alamer et al., 2022).

The development of digital competencies is not only limited to education but is closely linked to many dimensions, especially economic, political and sociocultural, where the contact between education and education is very strong (Blayone et al., 2018), so much so that possessing digital competencies has been linked to employability (Lissitsa & Chachashvili-Bolotin, 2019).

1.2. Related research

It has been determined that there are studies in the field to increase the digital competencies of teacher candidates and to gain digital literacy identity (Campbell, 2016; Svensson & Baelo, 2015).

Wetzel, Buss, Foulger, and Lindsey (2014) in their research revealed that pre-service teachers' access to information, their ability to control the reliability of the information they reach and their ability to use this information within the framework of ethical rules will broaden the student's horizons and support their educational life. In this direction, it was emphasised that teacher candidates should have digital competence and use digital resources.

In addition, when the research in the field in addition to digital competencies is examined, it is seen that there are studies that evaluate the opinions of pre-service teachers on the effectiveness of the blended learning environment (Alhan, 2020). Dziuban (2001) compares the academic achievement of students who receive blended learning environment, distance education and face-to-face education. The results of the research reveal that the academic achievement of the students studying in the blended learning environment is higher than those studying face-to-face or via distance education.

Rovai and Jordan (2004) examined the connectedness and learning levels of graduate students working as teachers in face-to-face, distance and blended learning environments. The results of the research reveal that the highest level of connectedness and learning occurs in a blended learning environment. Ogunleye (2010) used a questionnaire as a data collection tool in his study in which he examined a course prepared in the blended learning model at the university level according to the views of the learners. This questionnaire consists of four parts. These are the learning environment, personal characteristics, pedagogical strategies and the learning process. As a result of the research, it was found that gender and age had a significant effect on online learning, but the profession did not.

Tanner's (2007) case study of the challenges faced by adult students enrolled in an online blended named distance learning programme. He gave a special education course prepared in the blended learning model to two groups of adult students and examined the blended learning model with a case study. According to the results of the research, adult students need clear and understandable communication in situations such as online learning where social communication is low. Learning remains in the background until technological competencies are achieved.

1.3. Purpose of the research

The purpose of this research is to get the opinions of future biology teachers on the creation of digital competencies in a blended learning environment. In this direction, the following sub-objectives have been determined:

1. What are the views of pre-service biology teachers about the blended learning environment?
2. What are the views of pre-service biology teachers about their digital competencies?
3. What are the expectations of biology teacher candidates regarding the digital competencies to be created with the blended learning environment?

2. Methods and materials

This part of the research is the part where the research method, the study group of the research, the data collection tool, the data collection process and the evaluation of the data are described.

2.1. Research method

This research was created with the qualitative research method. Qualitative data collection techniques such as observation, interview, document and speech analysis are generally used in qualitative research. In addition, qualitative research, in which perceptions and events related to human beings are examined in depth in social reality and natural environment, also has a holistic perspective that combines different disciplines (Fossey, Harvey, McDermott, & Davidson, 2002). The

views of future biology teachers participating in this research on the creation of digital competencies in a blended learning environment were evaluated in line with the qualitative research method.

2.2. Participants

The study group of the research consists of 80 biology teacher candidates studying in biology teaching departments at various universities in Kazakhstan. The study group of the research consists of biology teacher candidates who voluntarily agreed to participate in the research. Demographic characteristics of the biology teacher candidates are given in Table 1.

Table 1. Demographic characteristics of biology teacher candidates

| Experience | Gender | | Sum |
|------------|--------|------|-----|
| | Female | Male | |
| 1st year | 12 | 13 | 25 |
| 2nd year | 19 | 5 | 24 |
| 3rd year | 10 | 4 | 14 |
| 4th year | 6 | 11 | 17 |
| Total | 47 | 33 | 80 |

In Table 1, the gender and class distributions of the biology teacher candidates participating in the research are given. Twenty-five biology teacher candidates are in the 1st year, 24 are in the 2nd year, 14 are in the 3rd year and 17 are in the 4th year. 47 teacher candidates are female and 33 are male.

2.3. Data collection tools

The data collection tool of the research is the semi-structured interview form developed by the researchers. While creating the semi-structured interview form, a literature review was conducted. In order to evaluate whether the questions in the semi-structured interview form created as a result of the literature review were suitable for the content of the research, the opinions of two experts were consulted. Various corrections were made in the semi-structured opinion form in line with expert opinions. The final form of the semi-structured interview form is given in Table 2.

Table 2. Semi-structured interview form

| Demographic Information | | | | |
|--|--------------|--------------|--------------|--------------|
| Your gender: | Female: () | | Male () | |
| Class you are studying: | 1. class () | 2. class () | 3. class () | 4. class () |
| Questions on blended learning and digital competences | | | | |
| What is your view on the blended learning environment? Choose one of the options below. | | | | |
| I find it very useful | () | | | |
| I find it useful | () | | | |
| I find it somewhat useful | () | | | |
| I don't find it helpful | () | | | |
| I don't find it helpful at all | () | | | |
| What is your view of your digital competence? | | | | |
| I find it very sufficient | () | | | |
| I find it sufficient | () | | | |
| I find a little enough | () | | | |
| I find it insufficient | () | | | |
| I find it very inadequate | () | | | |

What are your expectations regarding the digital competencies that will be created with the blended learning environment?

Submit your opinion :

The semi-structured interview form developed to collect research data is presented in Table 2. In the semi-structured interview form, there are two questions to learn the gender and class distribution of future biology teachers. There are two closed-ended questions and one open-ended question on blended learning and digital competencies.

2.4. Data collection process

Research data were collected in face-to-face interviews with future biology teachers participating in the research. Interviews with teacher candidates were collected in a university setting. During the interviews, the pre-service teachers had the opportunity to ask the researchers about the parts that were not understood while filling out the semi-structured interview forms. It took approximately 25–30 minutes for the pre-service teachers to fill in the semi-structured interview forms. It took about 1 month to complete the interviews with all of the teacher candidates participating in the research.

2.5. Data collection analysis

Descriptive analysis method was used in the analysis of the research data. It has been stated that descriptive analysis is a frequently used method for researchers to obtain summary information about different phenomena and events they want to study. The main purpose of descriptive analysis is to reach concepts and relationships that can explain the collected data. Descriptive analysis consists of four stages: creating a framework for descriptive analysis; processing the data according to the thematic framework; defining the findings; and interpreting the findings (Eysenbach & Köhler, 2002). By following these steps, the answers of the future biology teacher candidates participating in the research to the questions in the semi-structured interview form were analysed by the descriptive analysis method.

3. Results

In this section, the answers given by the biology teacher candidates participating in the research to the questions in the semi-structured interview form are given in the tables as frequency and percentage.

In Table 3, the views of the biology teacher candidates participating in the research on the blended learning environment were evaluated.

Table 3. Biology teacher candidates' views on the blended learning environment

| Category | F | % |
|--------------------------------|----|-------|
| I find it very useful | 16 | 20 |
| I find it useful | 51 | 63.75 |
| I find it somewhat useful | 9 | 11.25 |
| I do not find it useful | 3 | 3.75 |
| I don't find it helpful at all | 1 | 1.25 |
| Total | 80 | 100 |

In Table 3, the views of future biology teachers participating in the research on the blended learning environment are categorised. 20% of the pre-service teachers answered 'I find it very useful', 63.75% answered 'I find it useful', 11.25% answered 'I find it somewhat useful', 3.75% answered 'I do not find it useful' and 1.25% answered 'I do not find it useful at all'. From this point of view, it is possible to say that the majority of future biology teachers participating in the research find blended learning environments useful.

In Table 4, the views of pre-service biology teachers participating in the research on their digital competencies were evaluated.

Table 4. Biology teacher candidates' views on their digital competencies

| Category | F | % |
|---|----|-------|
| I find it very sufficient | 6 | 7.5 |
| I find it sufficient | 10 | 12.5 |
| I find a little enough | 44 | 55 |
| I do not find it insufficient | 11 | 13.75 |
| I don't find it very inadequate. | 9 | 11.25 |
| Total | 80 | 100 |

In Table 4, the views of pre-service biology teachers participating in the research on their digital competencies are categorised. 7.5% of the prospective teachers answered 'I find them very sufficient', 12.5% answered 'I find them sufficient', 55% answered 'I find them somewhat sufficient', 13.75% answered 'I find them insufficient' and 11.25% answered 'I find them very inadequate'. From this point of view, it is possible to say that the majority of biology teacher candidates participating in the research find their digital competencies somewhat sufficient.

In Table 5, the expectations of the biology teacher candidates participating in the research regarding the digital competencies to be created related to the blended learning environment were evaluated.

Table 5. Biology teacher candidates' expectations regarding the digital competencies to be created in the blended learning environment

| Category | F | % |
|--|----|-------|
| Gaining the ability to use digital technologies | 66 | 85.5 |
| Gaining competencies in using digital tools | 50 | 62.5 |
| To be able to prepare applications that will enable the student to reinforce the subject in the digital environment | 45 | 56.25 |
| Gaining the habit of following innovations in digital technology | 41 | 51.25 |
| To be able to prepare digital materials for students with different learning skills | 29 | 36.25 |
| Being able to prepare exams with digital resources | 26 | 32.5 |
| To be able to carry out evaluation studies appropriate to the level of the student in the digital environment | 20 | 25 |
| Gaining the ability to use digital books while teaching | 13 | 16.25 |
| To be able to store my lecture in digital environment | 11 | 13.75 |
| Gain knowledge of using digital applications | 8 | 10 |
| Gaining the ability to inform students about the use of digital resources | 5 | 6.25 |

In Table 5, the expectations of the biology teacher candidates participating in the research regarding the digital competencies to be created related to the blended learning environment are categorised. The expectations of teacher candidates are categorised as follows: to gain the ability to use digital technologies (85.5%); to gain competencies in using digital tools (62.5%); to be able to prepare applications that will enable the student to reinforce the subject in the digital environment (56.25%); to gain the habit of following the innovations in digital technology (51.25%); to be able to prepare digital materials for students with different learning skills (36.25%); to be able to prepare exams with digital resources (32.5%); to be able to carry out evaluation studies suitable for the level of students in the digital environment (25%); to gain the ability to use digital books while teaching(16.25%); to be able to store my lecture in digital environment (13.75%); to gain knowledge of using digital

applications (10%); and to gain the ability to inform my students about the use of digital resources (6.25%).

4. Discussion

The vast majority of future biology teachers who participated in the study stated that they found blended learning environments beneficial. When the research conducted by Uluyol and Karadeniz (2009) was examined, it was seen that they were satisfied with the blended learning applications and made suggestions that they should be used in other courses. In another study, a study on a course designed for face-to-face, online learning and blended learning environments only, it was concluded that blended learning applications contributed more significantly than only face-to-face and only online learning environments (Rovai & Jordan, 2004). Akyol and Garrison (2011) examined the cognitive presence levels and learning outcomes of research communities in online and blended learning environments. The results of the research show that students in both online and blended courses are able to achieve high levels of cognitive presence and learning outcomes.

The majority of biology teacher candidates participating in the research stated that they found their digital competencies a bit sufficient. When the researches in the field are examined, it is seen that there are studies that point to the importance of high digital literacy of teacher candidates (Khalid, Slættalíð, Parveen, & Hossain, 2015). In addition, it is stated in the literature that high digital literacy skills of teacher candidates are important in terms of professional development. However, it is stated that digital literacy should be included in the teacher education programme as a basis and that teacher candidates are insufficient in using digital literacy as an educational tool (Svensson & Baelo, 2015). In the study conducted by Gasaymeh, Al-Tawel, Al-Moghrabi, and Al-Ghonmein (2017), it is stated that university students have a positive attitude towards digital technologies.

The majority of biology teacher candidates participating in the research stated gaining the ability to use digital technologies, gaining competence in using digital tools, preparing applications that will enable the student to reinforce the subject in the digital environment and gaining the habit of following the innovations in digital technology as their expectations regarding the digital competencies to be created in relation to the blended learning environment.

Teachers' ability to use appropriate and innovative pedagogical tools plays an important role in developing the skills their students need for the future. It was stated that making use of innovative pedagogical tools can help re-engage students who tend to fail or need more time to learn when traditional teaching methods are used. Teachers' digital competencies are important for their students' capacity to make the most of new technologies (ElSayary, Mohebi, & Meda, 2022).

5. Conclusion

Digital competencies are one of the most important skills of the 21st century. It is important for teachers to have digital skills in order to use the classroom environment more efficiently with digital resources. Digital competencies should be included in teacher education programmes in the context of many positive effects that they will provide to students in the classroom and in the following years. Thus, pre-service teachers' digital skills can be improved. Blended learning environments are created by using face-to-face and online learning environments together. The use of blended learning environments enables both students and teachers to take advantage of face-to-face and online learning environments. Therefore, in this research regarding the blended learning environment, it is aimed to get the opinions of future biology teachers on the creation of digital competencies. As a result of the research, it has been determined that the vast majority of future biology teachers find blended learning environments beneficial. In addition, the majority of pre-service teachers stated that they found their digital competencies somewhat sufficient. The majority of biology teacher candidates participating in the research stated gaining the ability to use digital

technologies, gaining competence in using digital tools, preparing applications that will enable the student to reinforce the subject in the digital environment and gaining the habit of following the innovations in digital technology as their expectations regarding the digital competencies to be created in relation to the blended learning environment.

6. Recommendations

When the results of this research, in which the opinions of future biology teachers on the creation of digital competencies in a blended learning environment, were evaluated, the following suggestions were developed:

1. The blended learning environment should be utilised in the creation of the digital competencies of future biology teachers, and accordingly, courses enriched with appropriate course contents should be added to the education programmes.
2. It is important to have academicians in universities who are equipped to use the blended learning environment in the development of the digital competencies of future biology teachers.
3. This study was carried out with future biology teachers, and it can be carried out with prospective teachers studying in different departments in the education faculty or students studying in different faculties.

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