Postmodern Openings

ISSN: 2068-0236 | e-ISSN: 2069-9387

Covered in: Web of Science (WOS); EBSCO; ERIH+; Google Scholar; Index Copernicus; Ideas RePeC; Econpapers; Socionet; CEEOL; Ulrich ProQuest; Cabell, Journalseek; Scipio; Philpapers; SHERPA/RoMEO repositories; KVK; WorldCat; CrossRef; CrossCheck

2020, Volume 11, Issue 3, pages: 73-94 | <https://doi.org/10.18662/po/11.3/200>

The Effect of Geography Teaching Curriculum Enriched with Virtual Reality Applications on Teacher Candidates' Interest for the Course, Achievement and the Tendencies to Utilise Information Technologies

Cigdem HURSEN¹, Doğuş
BEYOĞLU²

¹ Division of Curriculum and
Instruction, Near East University,
Nicosia, Cyprus,
cigdem.hursen@neu.edu.tr
² Social Sciences Teaching, Near East
University, Nicosia, Cyprus,
dogus.beyoglu@neu.edu.tr

Abstract: In this study, the effect of the geography curriculum enriched with virtual reality applications on the teacher candidates' interest towards the course, academic achievement and tendency to use information technologies were examined. In the study in which both face-to-face and online learning environments were employed, in-class activities were conducted with virtual reality (VR) applications, and extracurricular activities were carried out with Google Classroom. In the study designed with single group pretest-posttest experimental design, a mixed-method approach in which quantitative and qualitative methods are used together was adopted. A total of 27 teacher candidates participated in the study that lasted for six weeks. The results obtained from the study revealed that the curriculum created a significant difference in teacher candidates' interest in the course, their academic success and their tendencies to use information technologies in their future classes. Teacher candidates stated that they were satisfied with the activities carried out with virtual reality and Google Classroom applications and that the geography curriculum supported by technology is effective in their learning processes.

Keywords: *geography teaching; online learning environments; google classroom; blended learning implementations; teacher training curricula; VR.*

How to cite: Hursen, C., & Beyoğlu, D. (2020). The Effect of Geography Teaching Curriculum Enriched with Virtual Reality Applications on Teacher Candidates' Interest for the Course, Achievement and the Tendencies to Utilise Information Technologies. *Postmodern Openings*, 11(3), 73-94.
<https://doi.org/10.18662/po/11.3/200>

1. Introduction

Individuals, having been introduced to technological devices since early childhood, possess these devices over time, and access information through these devices in any environment inside and outside the school (Nuhoglu Kibar & Akkoyunlu, 2018; Turan et al., 2018). As for the traditional curriculum; it is thought to be insufficient to meet the needs of the new generation, who are defined by Prensky (2001) as digital natives and referred to as the generation Z (Prensky, 2001; Somyürek, 2014). Knowledge-based societies for which the 21st century skills gain significance; the idea of creating a qualified teaching environment gains emphasis and the necessity to reflect the innovations on education that will increase the performance of teachers and students is expressed (Yazıcı, 2015). In this context, integration of new technologies into education and training programmes is seen as an essential need (Somyürek, 2014; Stošić, 2015). The ever-changing living conditions, personal and social needs of today's world have not been taken into consideration sufficiently, and innovations in science and technology have not been reflected, particularly on geography teaching curricula (Akengin, 2008). In a similar line, the research reveals that conventional teaching methodologies are widely employed in geography teaching and the course is perceived as a hard and boring one because of methodologies based on rote learning (Akengin, 2008; Akinoğlu, 2004; Saban, 2005). Geography is a convenient course for the use of visual and interactive materials in terms of subject and content and the use of these materials will make the course more efficient (Alım & Siyamoğlu, 2017; Demiralp, 2007). In a similar line, in their study İnel and Sezer (2017), concluded that the use of materials in geography teaching positively affected academic success.

In geography teaching curricula, it is recommended that subjects are supported with visual materials such as figures, pictures, graphics in teaching content related to physical geography in particular (Yazıcı, 2015). Turan et al. (2018) state that the use of mobile augmented reality applications in geography teaching provides a positive improvement in students' academic success. Likewise, Avcı et al. (2019) emphasise the positive effect of augmented reality and virtual reality on learning success. In the studies conducted on the use of virtual and augmented reality in different disciplines and grade levels, it is revealed that these applications not only increase the interest in the course and academic success but also contribute to the instruction process positively (Baykara et al., 2017; Ferguson et al., 2020;

İmamoğlu & İmamoğlu, 2018; Kırıkkaya & Şentürk, 2018; Law et al., 2019; Wang et al., 2009). Although the use of educational technologies in face-to-face education offers many benefits, it is also a fact that it is often limited to class hours. One of the most effective ways to minimise this limitation is to organise blended learning environments (Uysal, 2016; Dikmenli & Ünalı, 2013). Blended learning; is a hybrid approach that combines face-to-face learning and online distance learning methods and aims at obtaining the maximum benefit from the instruction process through minimising the limitations of both teaching techniques and integrating their strengths (Batdı, 2014; Dikmenli & Ünalı, 2013; Eryılmaz & Karakaya, 2018; Kazu & Demirkol, 2014; Korkmaz & Karakuş, 2009; Kurt, 2017; Kurt et al., 2018; Mitchell & Forer, 2010; Sarıtepeci & Çakır, 2015; Yang et al., 2019). Studies; shows that blended learning positively increases the interest, participation and academic success in the course (Al-qahtani & Higgins, 2012; Balaman, 2016; Batdı, 2014; Cavicchia et al., 2018; Kazu & Demirkol, 2014; Kurt et al., 2018; Sarıtepeci & Yıldız, 2014). Korkmaz and Karakuş (2009) state that blended learning positively increases students' attitude and critical thinking tendencies towards geography course. Research results show that new technologies and approaches are effective in geography teaching as well as in various disciplines. Similarly, in this study, the significance of using new technologies and approaches instead of conventional methods is emphasised in the teaching of geography courses which consist of rich content. In the study, the effects of the use of new technologies and approaches in geography instruction on the cognitive and affective development of teacher candidates were tested and answers to the following questions were sought:

1. Does the geography curriculum enriched with virtual reality applications create a significant difference in teacher candidates';
 - 1.1. affective interest levels for the course,
 - 1.2. cognitive interest levels for the course,
 - 1.3. overall interest levels for the course?
2. Does the geography curriculum enriched with virtual reality applications create a significant difference in the academic success levels of teacher candidates?
3. To what extent does the geography curriculum enriched with virtual reality applications affect the tendency of the teacher candidates to use information technologies?
4. What are the views of the teacher candidates about the effectiveness of the geography curriculum enriched with virtual reality applications?

2. Method

In this study designed with a single group pretest-posttest experimental design, a quantitative and qualitative mixed method was employed. The study was conducted during a geography lesson in which the subjects of Turkey's geography and geopolitics were taught with the participation of a total of 27 teacher candidates, 20 (74.1%) of whom are female and 7 (25.9%) are male studying at a private university. The research pattern adopted in the study is presented in Table 1. The academic success levels of teacher candidates for the course were measured by a multiple choice test consisting of 25 items prepared by the researchers. The success test, in which cognitive behaviours were assessed, was evaluated over 100 points, and the benchmark score of the test was determined as 60. In the multiple-choice test consisting of 5 options, there is only 1 correct answer, while the remaining 4 options are distracters. In order to reduce the chance success, attention has also been paid to the fact that the distracters are relevant to the subject.

At the end of the 6-week application, in order to determine whether there was a significant difference in the interest levels of the teacher candidates for the lesson "student interest scale" was employed. The student interest scale, developed by Mazer (2013) and adapted to Turkish by Akın et al. (2015), consists of 16 items. The scale, consisting of 2 sub-dimensions as cognitive and affective interest, is a 5-point Likert type and scored from 1 (I do not agree) to 5 (I totally agree). Cronbach's Alpha reliability coefficient of the scale's cognitive interest sub-dimension was calculated as 0.89, and the reliability coefficient of the affective interest sub-dimension was calculated as 0.90. This finding demonstrates that the quantitative data obtained from the scale is reliable. In the study, in which the teacher candidates' tendency to use information technologies was also examined, the "scale of teacher candidates' tendency to use information technologies in their future classes" developed by Baydas and Goktas (2016) was employed. Cronbach's Alpha reliability coefficient of the scale consisting of 30 items was calculated as 0.88. The obtained value reveals that the reliability of the scale is high.

The assessment regarding the effectiveness of the geography curriculum supported by new technologies was interpreted with qualitative data. The semi-structured interview form prepared by the researchers and consisting of 4 questions was created in order to identify the teacher candidates' views about the activities. Face-to-face interviews with only

volunteering teacher candidates (n=23) lasted for 20-25 minutes. Interviews were recorded with a voice recorder to prevent data loss.

Table 1. Research design

Study Group		Pretest (Quantitative Data)	Experimental Process	Posttest (Quantitative and Qualitative Data)
Teacher candidates (n=27)	➤	Achievement test	The activities	➤ Achievement test
	➤	Student interest scale	are supported	➤ Student interest scale
	➤	Tendency to use information technologies scale	with virtual reality applications and Google Classroom learning environment for 6 weeks	➤ Tendency to use information technologies scale
				➤ Semi-structured interview form

Source: The table is created by the author.

2.1. Implementation

The course lecture was given by one of the researchers, 3 hours a week and the course subjects included physical geography subjects such as Turkey's geological structure and landforms. During the course that lasted for six weeks, the subjects also included other topics along with Turkey's geological structure; Turkey's mountains, plateaus, plains, rivers (fluvial) topography, Turkey's karstic topography, glacial topography, volcanic topography and coastal topography. In the study in which blended learning applications were adopted, while face-to-face learning activities in the classroom were carried out with mobile virtual reality applications, activities outside the classroom were carried out with Google Classroom, one of the online learning environments (Google, n.d.a);

3D virtual reality applications were preferred for the teaching of theoretical and abstract content. The landforms from different regions of Turkey were visualised and the content was enriched with these. In the study, "Sites in 3D", developed by Gigi (2017) was utilised. The applications, in which the content is concretised and which aims for permanent learning, were employed following obtaining the necessary permission from the researcher (Gigi, 2017). Sites in 3D VR consists of various landforms in

Turkey's geography and can be downloaded for free from Google Play (Gigi, 2017).

In the study, Google Classroom environment was used to keep the teacher candidates' attention. Google Classroom was preferred because of its features such as ease of use, saving time, being accessible by everyone and mobile (Poyraz & Özkul, 2019). The practicality of the application increased since Google Classroom is a free application (Google, n.d.a).

Prior to the implementation, it is checked whether the teacher candidates had Google accounts or not and they were provided with a one-hour introductory seminar on the features of the learning environment by the researcher. After the teacher candidates downloaded the Google Classroom application (Apps) on their smartphones, they logged in to the environment with the given classroom codes. All videos, printed materials, and assignments related to the course were shared with teacher candidates via the Google Classroom environment, and it was ensured that the teacher candidates could follow the course via their mobile devices at any time they like. In the study, online quizzes were employed in order to determine how much of the content transferred to the teacher candidates, and activities to eliminate the identified learning gaps were planned accordingly. Online Quizzes were created through Google Forms that works in sync with Google Classroom (Google, n.d.b).

2.2. Data Analysis

The quantitative data obtained from the academic achievement test, student interest scale and the tendency to use information technology scale prior to and following the experimental process were analysed with SPSS package program. In order to determine the analysis techniques to be employed in data analysis, Kolmogorov-Smirnov and Shapiro-Wilk values for normal distribution are analysed. Since the group was less than 30 participants, Shapiro-Wilk values were taken into consideration in the scope of the study. The findings obtained from the academic achievement test and the student interest scale revealed that the quantitative data did not present a normal distribution. In this context, the data obtained from the scale of academic achievement and student interest scale were analysed using the Related Samples Wilcoxon Signed Ranks test among non-parametric tests. In order to identify the effect size of the results obtained from the analyses ($r = z / \sqrt{n}$) formula was used (Field, 2013). As the data obtained from the tendency to use information technology scale demonstrated a normal distribution, the Paired Sample t-test analysis technique was carried out. Quantitative values obtained from the research were interpreted with 0.05

significance level. The views of teacher candidates regarding the effectiveness of the curriculum were identified with the qualitative data obtained from the semi-structured interview form. For content analysis, themes and codes were determined and frequency tables were created. In addition, qualitative data were supported by direct quotations from teacher candidates' views. For the statement of the quotations, the names of the teacher candidates were kept confidential and their names were expressed as the participant (P).

3. Results

Findings regarding the data obtained in accordance with the sub objectives of the research are provided in detail below.

Findings in relation to the teacher candidates' interest levels for the geography course before and after the experimental process

Wilcoxon analysis technique was carried out to reveal if the geography curriculum, in which virtual reality applications were carried out and activities outside the classroom were supported with Google Classroom, was effective on the interest levels of the teacher candidates. Findings obtained from the analysis are presented in Table 2.

Table 2. The pretest - posttest average scores from the student interest scale before and after the experiment

Post test – Pre test	Groups	N	$\bar{x}$ rank	Σ rank	z	p	r effect size
Affective Interest	Negative rank	6	4.92	29.50	-3.710	.000	0.50
	Positive rank	20	16.08	321.50			
	Same rank	1					
	Total	27					
Cognitive Interest	Negative rank	3	7.00	21.00	-3.816	.000	0.51
	Positive rank	22	13.82	304.00			
	Same rank	2					
	Total	27					
Interest for	Negative rank	6	5.50	33.00	-3.749	.000	0.51
	Positive	21	16.43	345.00			

the Course	rank	
	Same rank	0
	Total	27

Source: The table is created by the author.

There was a significant difference in pre-test and post-test affective interest levels of teacher candidates in favour of posttest in the direction of positive ranks between rank averages and rank totals ($z = -3.710$, $< .05$, $r = 0.50$). When the effect size of this difference was calculated ($r = / \sqrt{n}$), ($r = 0.50$), a high degree of effect was revealed in the affective interest levels of teacher candidates ($r \geq .05$). Similarly, a significant difference was identified in pre-test and post-test cognitive interest levels of teacher candidates in favour of posttest in the direction of positive ranks between rank averages and rank totals before and after the implementation ($z = -3.816$, $< .05$, $r = 0.51$). When the effect size of the obtained value was calculated ($r = / \sqrt{n}$), ($r = 0.51$) the curriculum was found to be effective in increasing the cognitive interests of teacher candidates ($r \geq .05$). When the total score of the student interest scale was analysed, it is revealed that there was a significant difference in pre-test and post-test interest levels of teacher candidates in favour of post-test in the direction of positive ranks before and after the implementation ($z = -3.749$, $< .05$, $r = 0.51$). When the effect size of the obtained value was calculated ($r = / \sqrt{n}$), ($r = 0.51$), it was found that the geography curriculum provided a positive increase in teacher candidates' level of interest for the lesson ($r \geq .05$). In this context, it can be stated that the geography curriculum enriched with virtual reality applications has a positive effect on the teacher candidates' interest in the course.

Findings in relation to the teacher candidates' academic achievement levels before and after the experimental process

In this study, the effect of geography curriculum supported by virtual reality applications on the academic achievement levels of prospective teachers was also investigated. Whether there was a significant difference in pre-test and post-test academic achievement levels of prospective teachers was tested by Wilcoxon analysis technique. The results obtained are presented in Table 3.

Table 3. Wilcoxon analysis results for teacher candidates' pretest - posttest academic achievement scores

Post test – Pre test	Groups	N	$\bar{X}$ rank	Σ rank	z	p	r effect size
Achievement	Negative rank	10	9.15	91.50	-2.344	.019	0.31
	Positive rank	17	16.85	286.50			
	Same rank	0					
	Total	27					

Source: The table is created by the author.

When Table 3 is analysed, it is revealed that there was a significant difference in pre-test and post-test achievement levels of teacher candidates in favour of posttest in the direction of positive ranks between rank averages and rank totals before and after the implementation ($z = -2.344$, $< .05$, $r = 0.31$). In this context, it can be stated that virtual reality applications positively affect academic achievement for geography course. However, when the effect size of the significant difference in favour of the posttest was calculated ($r = / \sqrt{n}$), ($r = 0.31$), it was identified that the curriculum enriched with virtual reality applications had a moderate effect on the level of academic achievement for the geography course ($.05 > r > .03$).

While the geography curriculum supported by virtual reality applications has a moderate effect on the academic achievement levels of teacher candidates for the geography course, it has a high degree of influence particularly on the affective and cognitive interests for the course. In this context, it can be stated that virtual reality applications are effective particularly in increasing the interest of the learners for the course.

Findings in relation to the teacher candidates' tendency to use information technologies before and after the experimental process

In the study, the effect of virtual reality and Google Classroom applications in geography teaching on the tendency of teacher candidates to use information technologies was analysed. The results of Paired Sample t-test analysis carried out in order to identify whether there is a significant

difference in teacher candidates' tendency to use information technologies following the implementation are presented in Table 4.

Table 4. Paired sample t-test analysis results of teacher candidates' tendency to use information technologies before and after experimental process

	Groups	N	$\bar{x}$	sd	$Sh_{\bar{x}}$	t Test		
						t	df	p
Tendency to Use Information Technologies	Pre-test	27	100.00	17.322	3.333	-3.959	26	.001
	Post-test	27	114.81	15.918	3.063			

Source: The table is created by the author.

The findings obtained from the study reveal that there is a significant difference in teacher candidates' tendency to use information technologies in favour of post-test ($t=-3.959$; $P < .05$). In this context, it can be stated that virtual reality and Google Classroom applications in geography teaching have a positive effect on teacher candidates' tendency to use information technologies. Findings reveal that the majority of teacher candidates prefer to use information technologies effectively particularly in the process of organising their instructional experiences when they start performing their profession.

The views of the teacher candidates in relation to the effectiveness of the geography curriculum that is enriched with virtual reality applications

The study also aims to identify the views of the teacher candidates about the geography teaching activities in which they participated for 6 weeks. In the study, in which face-to-face interviews were conducted, the views of teacher candidates regarding the effectiveness of the geography curriculum were asked. The satisfaction levels of teacher candidates for the curriculum are presented in Table 5.

Table 5. Teacher candidates' satisfaction for the geography curriculum supported by virtual reality applications

Themes	Codes	f
Satisfaction with the implemented curriculum	I am satisfied	22
	Indecisive	1

	I am not satisfied	0
--	--------------------	---

Source: The table is created by the author.

During the interviews attended by 23 volunteer teacher candidates, the participants were asked: "Are you satisfied with the implemented geography curriculum?" The vast majority of teacher candidates who participated in the interview stated that they found the curriculum effective and that they were satisfied ($n = 22$). Only one teacher candidates stated that she was intimidated by the fact that the curriculum was supported by technology and she did not feel competent on the use of technology:

Yes, an effective instruction was carried out (P1)

Yes, I was satisfied. It attracted my attention and I am satisfied because it was a way of instruction other than the direct instruction technique (P4)

I had the chance to gain different experiences (P15)

I was extremely satisfied with the curriculum. It was fun to follow the lesson and do homework from a technological environment that I didn't know (P17)

It was an interesting course (P23)

The views of teacher candidates on virtual reality and Google Classroom applications are presented in Table 6.

Table 6. Preference of teacher candidates regarding the applications that support the geography curriculum

Themes	Codes	<i>f</i>
The most liked applications during the instructional activities	Virtual reality	10
	Google Classroom and virtual reality	8
	Google Classroom	4

Source: The table is created by the author.

Teacher candidates were asked about which application they liked the most during the course period. While the majority of the teacher candidates stated that they liked virtual reality applications the most ($n = 10$), some stated that they liked both virtual reality and Google Classroom

application (n = 8). A total of four teacher candidates stated that they liked the Google Classroom environment only:

Both applications are new to me and I like both applications very much (P3)

I liked the virtual reality application more because I could make realistic observations with virtual reality glasses. The lessons were enjoyable for me (P4)

Virtual reality and Google Classroom (P7)

It was great to examine animations with virtual reality glasses (P10)

Both applications helped us prepare for the teaching profession in the best way” (P15)

Having quizzes after the topics covered in Google Classroom was effective in eliminating the gaps in our learning (P20)

The views of teacher candidates on the strengths of the geography curriculum are presented in Table 7.

Table 7. Strengths of geography curriculum according to the views of teacher candidates

Themes	Codes	<i>f</i>
The strengths of the curriculum	Accessibility	8
	Permanence in learning	6
	Ease of use	4
	Facilitating the learning	3
	Technological support	3
	Reality	2
	Active participation	2
	Interesting	1
	Efficiency	1
	Indecisive	1

Source: The table is created by the author.

The majority of teacher candidates stated that the strongest feature of the geography curriculum was accessibility (n=10). A total of six teacher candidates stated that the curriculum provided permanence in learning and that this feature is the strongest aspect of the curriculum. While four teacher candidates who expressed their views mentioned the ease of use of the programme, three teacher candidates stated that the curriculum facilitates learning. 3 teacher candidates, who emphasise technological support, stated that they found the curriculum strong with this feature. A total of two

teacher candidates, who stated that they had the chance to see many sites that are far away through use of virtual reality applications, explained that the activities were realistic. While 2 teacher candidates stated that the programme ensured the active participation of in the learning-teaching process, the other teacher candidates mentioned that the curriculum was interesting (n=1) and efficient (n=1). Only one teacher candidate stated that she was indecisive:

The curriculum has activities to make the content easier to understand (P3)

The visual elements used in the lesson were interesting (P10)

The instruction was carried out with technology. It was an efficient lesson (P12)

Having a technology-supported curriculum eliminated the limitations of time and space (P16)

The technology-supported curriculum ensured the permanence of the information (P19)

Having accessible lesson resources" (P23)

I don't know. I have no idea about this" (P13)

The weaknesses of the geography curriculum according to the views of teacher candidates are presented in Table 8.

Table 8. The weaknesses of geography curriculum

Themes	Codes	<i>f</i>
The weaknesses of the curriculum	None	10
	Issues related with the internet connection	8
	Incompetence in technology use	1

Source: The table is created by the author.

As it is revealed in Table 8, the majority of teacher candidates stated that the curriculum did not have any shortcomings. However, eight of the teacher candidates stated that the curriculum was supported by technology and that they sometimes experienced issues related to internet connection particularly during logging into Google Classroom environment. One

teacher candidate stated that she did not use technology effectively and the fact that the curriculum was supported by technology increased her level of anxiety:

The limitation of the curriculum is the fact that there are sometimes issues related to the internet connection (P8)

Not being able to use applications off-line (P14)

I think it does not have any shortcomings (P18)

It is considered that the qualitative data obtained from the study supports quantitative data. The fact that the majority of teacher candidates have positive views about the geography curriculum supported by technology can be accepted as an indicator that the curriculum is effective.

4. Discussion

In this study, the effect of geography curriculum supported by virtual reality applications on the teacher candidates', interest for the course, academic achievement and tendency to use information technologies were investigated. The quantitative results obtained from the study revealed that the technology supported geography curriculum had a positive effect on the teacher candidates' cognitive and affective interest levels. Qualitative data obtained from the study also supports these results and in the study and it was identified that the teacher candidates were satisfied with the implementation. The majority of teacher candidates stated that the activities and practices carried out were interesting. In the study carried out by Dikmenli and Ünalı (2013) on blended learning and virtual classrooms, it was concluded that the applications increased interest in the course and the course's efficiency. The conclusion Sarıtepeci and Yıldız (2014) reached in their study that the blended learning activities increase the participation to the course demonstrates parallelism with the conclusion obtained from this study that there is an increase in the level of interest in the course. In their study with teacher candidates, Uluyol and Karadeniz (2009) concluded that blended learning practices increase interest in the course. This finding is similar to the findings obtained from teacher candidates within the scope of this study.

In the study, it is concluded that the technology supported geography curriculum provides a significant increase in the academic achievement levels of teacher candidates and resulted in a moderate effect. It

is identified that the academic achievement levels of learners increase positively in various discipline fields where virtual reality, augmented reality and blended learning applications are employed (Al-qahtani & Higgins, 2012; Batdı, 2014; Cavicchia et al., 2018; Ferguson et al., 2020; Gün & Atasoy, 2017; Kazu & Demirkol, 2014; Korucu, Gençtürk & Sezer, 2016; Kurt et al., 2018; Yang et al., 2019). In a similar line, in their study in Turan et al. (2018), concluded that the physical geography course supported by augmented reality practices is effective on the academic achievement levels of teacher candidates.

The results reveal that the geography curriculum enriched with virtual reality applications also makes a significant difference in teacher candidates' tendency to use information technologies. Turan et al. (2013) emphasise the importance of technology integration in education and state that both teachers and academicians who train them should use technologies in the best way. Similarly, Ratheeswari (2018), states that information communication technologies (ICT), which are effective in various professional fields, business, education, entertainment and many more, affect every aspect of human life. Ratheeswari (2018), who state that the use of ICT in the classroom acquires the learners with the 21st-century skills to the learners, explains that these technologies make teaching interesting and facilitates the learning of the learners. Stating that ICT and instruction are interconnected, Oyeleke Oyediran and Dick (2017) point out that in order for a teacher to be effective, he/she should be competent in ICT. Researchers emphasise that particularly young teachers have great potential in using ICT in the teaching profession, but there are many problems affecting the use of ICT (Oyeleke Oyediran & Dick, 2017). Stating that the 21st century is the age of information and communication technologies, Chhabra (2014) points out that teachers and students should have access to technology in order to improve learning and states that there is a tendency to use ICT in the learning-teaching process in the world. The results obtained from this study revealed that the teacher candidates' tendency to use information technologies is positive. It can be said that the studies in the literature support the results obtained from this study. However, while the strengths of the geography curriculum supported by new technologies are revealed, teacher candidates expressed the issues related to the internet connection as the biggest limitation of the program. In this context, it is recommended to pay particular attention to the internet connection and take necessary precautions when designing environments where technology-supported implementations will be carried out.

5. Conclusion

Referring to the importance of innovative educational technologies to prepare teacher candidates for ever-evolving classrooms, Jacka (2015) emphasises conducting research to promote, develop and support virtual worlds in teacher education. In a similar line, in this study, it is suggested that teacher education should be supported by new technologies. In addition, the integration of virtual reality and Google Classroom applications, which have been found to be effective in geography teaching, to teacher training programs is considered to be important particularly in terms of training teachers with 21st-century skills.

References

- Akengin, H. (2008). Coğrafya Öğretmenlerinin Yenilenen Lise Coğrafya Öğretim Programı Hakkındaki Görüşleri [Geography Teachers' Views on the Revised High School Geography Curriculum]. *Marmara Coğrafya Dergisi*, 18, 1–20. <http://hdl.handle.net/11424/2544>
- Akın, A., Uğur, E., & Akın, Ü. (2015). Derse İlgi Ölçeğinin Türkçeye Uyarlanması: Geçerlik ve Güvenirlik Çalışması [The Validity and Reliability of Turkish Version of the Student Interest Scale]. *Kastamonu Eğitim Dergisi*, 23(4), 1471–1480. <https://dergipark.org.tr/en/download/article-file/209801>
- Akinoğlu, O. (2004). Yapılandırmacı Öğrenme ve Coğrafya Öğretimi [Constructivist Learning and Geography Teaching]. *Marmara Coğrafya Dergisi*, 10, 73–94. <http://dspace.marmara.edu.tr/handle/11424/2475>
- Alım, M., & Siyamoğlu, S. (2017). Coğrafya Öğretmeni Adaylarının Akıllı Cihazlarda Coğrafi Bilgi ve Beceri Kazandırabilecek Uygulamaları Kullanmalarına Yönelik Görüşleri [Opinions of Prospective Geography Teachers on the Use of Applications on Smart Devices that Bring in Knowledge and Skills about Geography]. *Eastern Geographical Review*, 22(38), 251–274. <https://doi.org/10.17295/ataunidcd.298825>
- Al-qahatani, A.A.Y., & Higgins, S.E. (2012). Effects of Traditional, Blended and E-learning on Students' Achievement in Higher Education. *Journal of Computer Assisted Learning*, (29), 220–234. <https://doi.org/10.1111/j.1365-2729.2012.00490.x>
- Avcı, Ş.K., Çoklar, A.N., & İstanbullu, A. (2019). Üç Boyutlu Sanal Ortamlar ve Artırılmış Gerçeklik Uygulamalarının Öğrenme Başarısı Üzerindeki Etkisi: Bir Meta-Analiz Çalışması [The Effect of Three Dimensional Virtual Environments and Augmented Reality Applications on the Learning Achievement: A Meta-Analysis Study]. *Education and Science*, 44(198), 149–182. <https://doi.org/10.15390/EB.2019.7969>

- Balaman, F. (2016). Bir Dersin Harmanlanmış Öğrenme Yöntemiyle İşlenmesinin Öğrencilerin Akademik Güdülenmelerine Etkisi [The Effect of Teaching a Course by Using the Method as Blended Learning upon the Academic Motivation Levels of Students]. *Uşak Üniversitesi Sosyal Bilimler Dergisi*, 9(1), 225–241.
<https://dergipark.org.tr/en/pub/usaksosbil/issue/21662/233035>
- Batdı, V. (2014). Harmanlanmış Öğrenme Ortamlarının Öğrencilerin Akademik Başarılarına Etkisi: Bir Meta-Analiz Çalışması [The Effect of Blended Learning Environments on Students' Academic Achievement: A Meta-Analysis Study]. *Journal of the Institute of Social Sciences Cankiri Karatekin University*, 5(1), 287–302.
<https://dergipark.org.tr/tr/pub/jiss/issue/25892/272867>
- Baydas, O., & Goktas, Y. (2016). Influential Factors on Preservice Teachers' Intentions to Use ICT in Future Lessons. *Computers in Human Behavior*, 56, 170-178. <https://doi.org/10.1016/j.chb.2015.11.030>
- Baykara, M., Gürtürk, U., Atasoy, B., & Perçin, İ. (2017). Okul Öncesi Eğitimde Artırılmış Gerçeklik Tabanlı Mobil Öğrenme Sistemi Tasarımı [Augmented Reality Based Mobile Learning System Design in Preschool Education]. *2017 International Conference on Computer Science and Engineering (UBMK)* (pp. 72-77), Antalya. <https://doi.org/10.1109/UBMK.2017.8093560>
- Cavicchia, M.L., Cusumano, A.M., & Bottino, D.V. (2018). Problem-Based Learning Implementation in a Health Sciences Blended-Learning Program in Argentina. *International Journal of Medical Education*, (9), 45–47.
<https://doi.org/10.5116/ijme.5a7e.d85c>
- Chhabra, A. (2014). Information and Communication Technology (ICT): A Paradigm shift in Teacher Education. *Scholarly Research Journal for Humanity Science & English Language*, 1(3), 308-317.
- Demiralp, N. (2007). Coğrafya Eğitiminde Materyaller ve 2005 Coğrafya Dersi Öğretim Programı [Materials in Geography Education and the Geography Curriculum 2005]. *Kastamonu Education Journal*, 15(1), 373–384.
<https://dergipark.org.tr/en/download/article-file/819275>
- Dikmenli, Y., & Ünalı, Ü. E. (2013). Harmanlanmış Öğrenme ve Sanal Sınıfa Dönük Öğrenci Görüşleri [Students' Views on Blended Learning and Virtual Classrooms]. *Amasya Üniversitesi Eğitim Fakültesi Dergisi*, 2(2), 326–347. <https://dergipark.org.tr/tr/download/article-file/19618>
- Eryılmaz, M., & Karakaya, M. (2018). Harmanlanmış Öğrenme Ortamlarında Sosyal Medya Kullanımının Öğrenci Doyumu Üzerine Etkisi [The Impact of Using Social Media in Blended Learning Environments on Student Satisfaction]. *YYU Journal of Education Faculty*, 15(1), 106–129.
<https://dx.doi.org/10.23891/efdyu.2018.63>

- Ferguson, C., van den Broek, E.L., & van Oostendorp, H. (2020). On the Role of Interaction Mode and Story Structure in Virtual Reality Serious Games. *Computers & Education*, 143, 103671. <https://doi.org/10.1016/j.compedu.2019.103671>
- Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics*. Sage Publications
- Gigi, E. (2017). Sites in 3D [/VR]. *Google Play Store*. <https://play.google.com/store/apps/details?id=air.com.ercangigi.sitesin3d&hl=tr>
- Gün, E.T., & Atasoy, B. (2017). Artırılmış Gerçeklik Uygulamalarının İlköğretim Öğrencilerinin Uzamsal Yeteneklerine ve Akademik Başarılarına Etkisi [The Effects of Augmented Reality on Elementary School Students' Spatial Ability and Academic Achievement]. *Education and Science*, 42(191), 31–51. <http://dx.doi.org/10.15390/EB.2017.7140>
- Google. (n.d.a). Classroom Apps Google for Education. *Google Play Store*. <https://play.google.com/store/apps/details?id=com.google.android.apps.classroom&hl=tr>
- Google (n.d.b). *Google Forms. About*. <https://www.google.com/forms/about/>
- İmamoğlu, A., & İmamoğlu, M. (2018). Coğrafya Eğitiminde Artırılmış Gerçeklik Uygulamaları [Augmented Reality Applications in Geography Education]. *International Geography Education Symposium*, 480–485. https://www.researchgate.net/publication/330313838_COGRAFYA_EGITIMINDE_ARTIRILMIS_GERCEKLIK_UYGULAMALARI_-_Augmented_Reality_Applications_in_Geography_Education
- İnel, Y., & Sezer, A. (2017). Coğrafya Konuların Öğretiminde Materyal Kullanımının Öğrenci Başarısına Etkisi: Bir Meta Analiz Çalışması [The Effect of the Usage of Instructional Materials on Student Achievement in Teaching Geography: A Meta-analytic Study]. *Journal of History Culture and Art Research*, 6(3), 473-491. <http://dx.doi.org/10.7596/taksad.v6i3.913>
- Jacka, L. (2015). *Virtual Worlds in Pre-Service Teacher Education: The Introduction of Virtual Worlds in Pre-Service Teacher Education to Foster Innovative Teaching-Learning Processes* [Unpublished PhD Thesis]. Southern Cross University, Lismore, NSW.
- Kazu, I.Y., & Demirkol, M. (2014). Effect of Blended Learning Environment Model on High School Students' Academic Achievement. *The Turkish Online Journal of Educational Technology*, 13(1), 78–87. <https://eric.ed.gov/?id=EJ1018177>
- Kırıkkaya, E.B., & Şentürk, M. (2018). Güneş Sistemi ve Ötesi Ünitesinde Artırılmış Gerçeklik Teknolojisi Kullanılmasının Öğrenci Akademik Başarısına Etkisi [The Impact of Using Augmented Reality Technology in the Solar System and Beyond Unit on the Academic Achievement of the Students].

- Kastamonu Education Journal*, 26(1), 181–189.
<https://doi.org/10.24106/kefdergi.375861>
- Korkmaz, Ö., & Karakuş, U. (2009). The Impact of Blended Learning Model on Student Attitudes towards Geography Course and Their Critical Thinking. *The Turkish Online Journal of Educational Technology*, 8(4), 51–63.
<https://files.eric.ed.gov/fulltext/EJ859497.pdf>
- Korucu, A.T., Gençtürk, T., & Sezer, C. (2016). Artırılmış Gerçeklik Uygulamalarının Öğrenci Başarı ve Tutumlarına Etkisi [The Effect of Augmented Reality Applications on Students' Success and Attitudes].
<https://ab.org.tr/ab16/bildiri/274.pdf>
- Kurt, S.Ç. (2017). Bir Harmanlanmış Öğrenme Deneyimi [A Blended Learning Experience]. *Elementary Education Online*, 16(2), 860–886.
<https://doi.org/10.17051/ilkonline.2017.304740>
- Kurt, S.Ç., Yıldırım, İ., & Cüçük, E. (2018). Harmanlanmış Öğrenmenin Akademik Başarı Üzerine Etkisi: Bir Meta-Analiz Çalışması [The Effects of Blended Learning on Student Achievement: A Metaanalysis Study]. *H.U. Journal of Education*, 33(3), 776–802. <https://doi.org/10.16986/HUJE.2017034685>
- Law, K.M., Geng, S., & Li, T. (2019). Student Enrolment, Motivation and Learning Performance in a Blended Learning Environment: The Mediating Effects of Social, Teaching, and Cognitive Presence. *Computers & Education*, 136, 1–12. <https://doi.org/10.1016/j.compedu.2019.02.021>
- Mazer, J.P. (2013). Validity of the Student Interest and Engagement Scales: Associations with Student Learning Outcomes. *Communication Studies*, 64(2), 125–140. <https://doi.org/10.1080/10510974.2012.727943>
- Mitchell, P., & Forer, P. (2010). Blended Learning : The Perceptions of First-year Geography Students. *Journal of Geography in Higher Education*, 34(1), 77–89.
<https://doi.org/10.1080/03098260902982484>
- Nuhoğlu Kibar, P., & Akkoyunlu, B. (2018). Modelling of Infographic Generation Process as a Learning Strategy at the Secondary School Level Based on the Educational Design Research Method. *Eğitim ve Bilim*, 43(196), 97–123.
<https://doi.org/10.15390/EB.2018.7592>
- Oyeleke Oyediran, W., & Dick, T.T. (2017). Use of Information Communication Technology (ICT) in Teaching Profession in Ogun State, Nigeria. *International Journal for e-Learning Security (IJeLS)*, 7(1), 549–555.
<https://infonomics-society.org/wp-content/uploads/ijels/published-papers/volume-7-2017/Use-of-Information-Communication-Technology-ICT.pdf>
- Tekyn Poyraz, G., & Özkul, A.E. (2019). Bir Öğrenme Ortamı Olarak Google Sınıf'ın İncelenmesi [An Examination of Google Classroom as a Learning Environment]. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, 5(3), 8–27.
<https://dergipark.org.tr/tr/download/article-file/853587>

- Prensky, M. (2001). Digital Natives, Digital Immigrants. *From on the Horizon*, MCB University Press, 9(5), 1-6. <https://marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf>
- Ratheeswari, K. (2018). Information Communication Technology in Education. *Journal of Applied and Advanced Research*, 3(Suppl. 1), 45–47. <http://dx.doi.org/10.21839/jaar.2018.v3iS1.169>
- Saban, A. (2005). *Çoklu Zekâ Teorisi ve Eğitim [Multiple Intelligence Theory and Education]* (5. Baskı). Nobel Yayıncılık.
- Sarıtepeci, M., & Çakır, H. (2015). The Effect of Blended Learning Environments on Student's Academic Achievement and Student Engagement: A Study on Social Studies Course. *Education and Science*, 40(177), 203–216. <https://doi.org/10.15390/EB.2015.2592>
- Sarıtepeci, M., & Yıldız, H. (2014). Harmanlanmış Öğrenme Ortamlarının Öğrencilerin Derse Katılım ve Derse Karşı Motivasyonları Üzerine Etkisinin İncelenmesi [The Effect of Blended Learning Environments on Students' Engagement to Course and Motivation toward the Course]. *Abi Ervan Üniversitesi Karşehir Eğitim Fakültesi Dergisi (KEFAD)*, 15(1), 211–223. <https://doi.org/10.9779/PUJE635>
- Somyürek, S. (2014). Öğretim Sürecinde Z Kuşağının Dikkatini Çekme: Artırılmış Gerçeklik [Gaining the Attention of Generation Z in Learning Process: Augmented Reality]. *Educational Technology Theory and Practice*, 4(1), 63-80. <http://dergipark.org.tr/en/pub/etku/issue/6268/84211>
- Stošić, L. (2015). The Importance of Educational Technology in Teaching. *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, 3(1), 111–114. <https://cyberleninka.ru/article/n/the-importance-of-educational-technology-in-teaching/viewer>
- Turan, Z., Küçük, S., & Gündoğdu, K. (2013). Öğretmen Eğitiminde Bilişim Teknolojilerinin Kullanımı: Mevcut ve Beklenen Durum [Use of Information Technology in Teacher Education: Current and Expected Status]. *Journal of Educational Sciences*, 4(1), 1-9. <http://adudspace.adu.edu.tr:8080/xmlui/handle/11607/2780>
- Turan, Z., Meral, E., & Sahin, I.F. (2018). The Impact of Mobile Augmented Reality in Geography Education: Achievements, Cognitive Loads and Views of University Students. *Journal of Geography in Higher Education*, 42(3), 427–441. <https://doi.org/10.1080/03098265.2018.1455174>
- Uluyol, Ç., & Karadeniz, Ş. (2009). Bir Harmanlanmış Öğrenme Ortamı Örneği: Öğrenci Başarısı ve Görüşleri [An Example on Blended Learning Environment: Student Achievement and Perceptions]. *Yüzüncü Yıl Üniversitesi, Eğitim Fakültesi Dergisi*, 6(1), 60–84. http://efdergi.yyu.edu.tr/makaleler/cilt_VI/haziran/s_karadeniz.pdf

- Uysal, Ö. (2016). Harmanlanmış öğrenme ortamında proje tabanlı öğrenmenin gerçekleştirilmesi [Realizing Project-Based Learning in Blended Learning Environment]. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, 2(2), 89–113. <https://dergipark.org.tr/tr/download/article-file/401903>
- Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The Impact of Mobile Learning on Students' Learning Behaviours and Performance: Report from a Large Blended Classroom. *British Journal of Educational Technology*, 40(4), 673–695. <https://doi.org/10.1111/j.1467-8535.2008.00846.x>
- Yang, J., Yu, H., & Chen, N.S. (2019). Using Blended Synchronous Classroom Approach to Promote Learning Performance in Rural Area. *Computers & Education*, 141, 1–13. <https://doi.org/10.1016/j.compedu.2019.103619>
- Yazıcı, Ö. (2015). Coğrafya Bölümü Öğrencilerinin Üç Boyutlu Görsel Materyal Geliştirmelerine Yönelik Deneyimleri: Karabük Üniversitesi Örneği [Experience of Geography Department Students towards Three Dimensional Material Development: The Case of Karabuk University]. *Marmara Coğrafya Dergisi*, 31, 98–131. <http://hdl.handle.net/11424/3937>