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THE EFFECT OF MUSEUM EDUCATION PRACTICES INTEGRATED WITH VIRTUAL TEACHING ENVIRONMENTS ON ACHIEVEMENT LEVELS OF PRESCHOOL TEACHER CANDIDATES DURING THE PANDEMIC

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The Effect of Museum Education Practices Integrated with Virtual Teaching Environments on Achievement Levels of Preschool Teacher Candidates during the Pandemic

Didem ISLEK¹

Abstract

In this study, the effectiveness of museum education practices integrated with virtual teaching environments during the pandemic on the achievement levels of pre-school teacher candidates was evaluated. The research was carried out using a mixed method. In the quantitative dimension, the success levels of teacher candidates for museum education practices were evaluated with the achievement test, and the data related to the qualitative dimension were evaluated with content analysis. Preschool teacher candidates (n = 30) participated in the study. In the research, for 5 weeks, museum education activities were carried out using virtual tour and second life museum applications in Vordun, Louvre and Art Nouveau virtual museums with the teacher candidates. The results obtained revealed that these activities increased the success level of teacher candidates regarding the practices. In addition, the results showed that the teacher candidates found the museum education practices integrated with virtual teaching environments highly effective. In addition, teacher candidates stated that an active teaching process can be created with virtual museum applications in museum education practices, and that learning can be embodied more easily.

Keywords: pandemic, virtual museums, second life, museum education, pre-school teacher candidates, success level, social development.

Introduction

In line with the curriculum of developed countries, it is emphasized in relevant studies that out-of-school education activities play an important role in both creating permanent learning and carrying the teaching out of the classroom (Aynal,

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2013; Preston, 2014; Price, 2015). It is seen that lesson-oriented teaching activities can be carried out in educational environments such as in museums, archaeological sites, art galleries and historical places by using out-of-school activities (Waren *et al.*, 2014). At this point, Acar (2014), Harun & Salamuddin (2010) and Mirrahimi, Tawil, Abdullah, Surat & Usman (2011) point out that active learning can be gained by doing and living, and abstract learning can be more easily embodied, especially with the activities carried out in the museum environment. In addition, Gray & Martin (2012) and Moffett (2011) state that activities which can be carried out in the museum environment, can be applied within the scope of education programs in fields such as science, social sciences, language education and visual arts education. However, studies in the literature revealed that there were some difficulties in the implementation of the teaching activities related to the lessons in museum environments. Studies indicate that not being able to easily obtain permissions for museum visits and the time consuming and costly museum visits pose an obstacle to the realization of out-of-school teaching activities in the museum environment (Carvalho, Dong & Maton, 2015; Eguz & Kesten, 2012; Karatas *et al.*, 2016)

However, considering that the worldwide Covid-19 virus affects all areas of societies and forces education systems to transform, the usability of virtual environments in education emerges as an important advantage (Espino Diaz *et al.*, 2020; Gutowski & Adamkiewicz Klos, 2020). At this point, although it is not a new concept, it is seen that virtual museums have started to come to the agenda more with the pandemic process, and they reveal significant solutions in the sustainability of museum education (Gutowski & Adamkiewicz Klos, 2020). In this process, where museum visits were limited, collections in many countries were modeled in three dimensions using 360 degree panoramic photographs and transferred to digital media, thereby enabling online access. In addition, digital projects were developed in the virtual environment, and activities such as screening programs, learning events, speeches, and work promotions were carried out in the process (Kahn, 2020; Karagöz, 2020). In some museums, Augmented Reality and mobile games applications have also started to be implemented through virtual environments (McCoy, 2020).

In this context, as mentioned above, it is believed that benefiting from virtual museums in the realization of out-of-school teaching activities in the museum environment can eliminate the difficulties experienced, especially the pandemic process can be overcome with the least damage (Ulusoy, 2010; Zaharias, Machael & Chrysanthou, 2013; Kahn, 2020; Karagöz, 2020). It is seen that virtual museum environments facilitate the promotion of the cultural heritage of societies, provide permanent access and allow large collections to be transferred to digital platforms. Virtual museums, which enable the use of digital technology in teaching activities in museums, also provide opportunities for individuals to learn more easily and permanently with different technological applications (Aladag, Akkaya & Sensoz, 2014; Bozkus, 2014; Daniela, 2020). At this point, it is thought that the

use of virtual tour technologies and second life applications in virtual museum environments will be effective in providing active learning, increasing motivation and creating concrete learning (Bontempi & Nash, 2012; Carvalho *et al.*, 2015). Especially with the second life applications in virtual museum environments that have become widespread in recent years; It is stated in related studies that a learner-centered teaching is offered, that the individual can learn by doing and living, online activities can be done, and cooperative learning can be achieved through avatars representing learners (Daniela, 2020; Esgin, Pamukcu & Ergul, 2012; Sookhanaphibarn & Thawonmas, 2009; Urban, Marty, & Twidale, 2007). With the advanced visuals presented in Second Life applications, it is seen that the individual can do educational and entertaining activities by connecting with the real world, and social development can be achieved through group work (Uzun & Aydin, 2012). In addition, with virtual tours and second life applications, different museum environments in different countries can be reached, activities related to the artifacts in these museums can be carried out, museum hunts and works of different civilizations can be examined, as well as activities on the purpose of use of the works, production materials, volume and form relations (Vosinakis & Tsakonas, 2016).

In this context, Kampouroupoulou, Fokiali, Efstathiou, and Stefos (2013) emphasize that conducting teaching activities in virtual museum environments from preschool years can be more effective in children's development of museum education. In related studies, it is stated that with the activities carried out in museums and virtual museum environments, the development of high-level thinking skills such as observation, analysis, synthesis and creative thinking can be achieved, and their aesthetic sensitivity regarding the works exhibited in the museum can be improved (Akman *et al.*, 2015; Buyurgan & Mercin, 2005). It is understood that teachers have important responsibilities in the development of the aforementioned skills starting from the preschool period of children. At this point, it is thought that the training of teachers about the activities to be carried out in the museum in the pre-service period during which they receive postgraduate education may be more effective in improving the knowledge of pre-school teacher candidates on this subject. It is considered important in the studies that pre-service teachers lead children to research, create active learning environments that will develop their critical thoughts, and develop children's skills such as problem solving, exploration, and analysis by using out-of-school educational places such as museums (Akman *et al.*, 2015; Daniela, 2020; Tutkun & Acer, 2015).

In the literature review, it was revealed that the studies conducted with pre-school teacher candidates were mostly based on the evaluation of their views on museum visits. In these studies, it is understood that the importance of museum education in preschool education is mentioned and the views of teacher candidates on the use of museums as an educational environment are examined (Akman *et al.*, 2015; Cildir & Karadeniz, 2017; Dagal & Bayindir, 2016; Dilli, 2017; Tutkun & Acer, 2015). As a result of these findings obtained from the literature review, it

has been determined that there is no research in which museum education practices are integrated with virtual teaching environments. However, there is no study in which virtual tour and second life applications in virtual museums were integrated into museum education and applied to pre-school teacher candidates, and also evaluated the effectiveness of the application. In this context, it is thought that conducting a scientific research on museum education practices in which virtual teaching environments are integrated will be effective in increasing the knowledge and success levels of pre-school teacher candidates about museum education. In addition, it is believed that with the development of the knowledge and skills of teacher candidates regarding museum education practices, significant contributions will be made to the development of museum awareness of children in preschool institutions.

Methodology

The research was carried out with a mixed method, both qualitative and quantitative. In the quantitative dimension, while determining the success levels of the pre-service teachers, the views of the teacher candidates about the application carried out in a qualitative dimension were evaluated.

The purpose of the study

In this study, it is aimed to realize museum education practices and apply to pre-school teacher candidates by using virtual tours and second life museum environments in Vordun, Louvre and Art Nouveau virtual museums. In the study, it was aimed to evaluate the effectiveness of museum education practices according to the opinions of teacher candidates. In this direction, the answers to the following questions were sought in the study.

1. Are museum education practices integrated with virtual teaching environments effective on the success levels of pre-school teacher candidates?
2. What are the views of pre-service teachers about museum education practices integrated with virtual teaching environments?

Participants

The teacher candidates studying in the preschool teaching department participated in the study. The research data were obtained from the views of 30 teacher candidates. Information about the demographic characteristics of the teacher candidates was given in *Table 1*.

Table 1. Information about the Demographic Characteristics of the Teacher Candidates

Demographic Characteristics	f	%
Gender		
Female	17	56.6
Male	13	43.3
Museum Education Practices Lesson		
First Time	25	83.3
Taken before	5	16.6
The Frequency of Using		
Never	19	63.3
Once a month	5	16.6
Once a year	6	20.0

When *Table 1* was examined, it was understood that the majority of the teacher candidates participating in the study are female (56.6%). In addition, it is seen that the majority (83.3%) of the teacher candidates took the museum education practices course for the first time. On the other hand, it is understood that the majority of the teacher candidates (63.3%) do not benefit from virtual environments, and those who do not practice frequently enough.

Data Instruments

In this study, the effectiveness of museum education practices integrated with virtual teaching environments was evaluated. Within the scope of the study, virtual tours in Vordun, Louvre and Art Nouveau virtual museums and museum education practices were carried out using second life museum environments. In this context, the effect of the application on pre-service teachers' achievement levels were evaluated with the multiple-choice achievement test. In addition, teacher candidate views on the effectiveness of the application were analysed with a semi-structured interview form.

Research Process

A literature review was conducted to determine whether there is a need to evaluate the effectiveness of integrated museum education practices. As a result of the literature review, it was found out that there was no research prepared on the matter. After this, stages of museum education applications integrated with virtual teaching environments were created, and virtual museum tours and second life museum environments to be used in applications were determined.

In addition, the stages of the implementation were revised in line with the views of the experts (education program expert (n = 5), museum education expert (n = 3) and measurement and evaluation expert (n = 2)), and rearranged in line with the recommendations. After this stage, second life museum environments were arranged with edpuzzle and audio recordings and quiz questions were added to the videos. Thus, general information about the works to be examined in the second life museum environments was given by using the drama method and voicing the works.

Among the sample recordings, there are expressions such as "Hello, I am a three-dimensional sculpture exhibited in the Art Nouveau Museum. My production material is stone". "Hello, I am an oil painting on display at the Vordun Museum. "My most used colour tones are red, yellow and dark blue". The added quiz questions were prepared in order to improve the pre-service teachers' awareness and knowledge of the work in the museum environment. There are questions about the works such as "What shape and production material is the work made of?" "Which cold and warm colours are mostly used in the paintings in the virtual museum?"

Second life museum environments and virtual museum tours, which were made ready after these stages, were shared on the Moodle platform. In the next stage, the applications were implemented. Museum education practices integrated with virtual teaching environments were carried out for 5 weeks. Practices carried out by establishing interactive connections in the classroom for four hours a week which were 20 hours in total. In the study in which a single group experimental design was used, a multiple-choice achievement test (pre-test) was applied to determine the success levels of pre-service teachers for the applications before the implementation. In line with the needs of pre-school teacher candidates, teaching activities including "using virtual teaching environments", "designing activities for out-of-school activities in the virtual environment", "determining questions for the work exhibited in the virtual museum environment", "designing museum hunt activities using the virtual museum environment" were carried out, and cooperative learning, critical Teaching techniques such as thinking, discussion and brainstorming were used.

In practice, firstly, virtual museum tours and second life museum environments in Vordun, Art Nouveau and Louvre museums were introduced to pre-service teachers. A short-term training was provided on how to use these environments. Then, information was given on how to progress in virtual museum tours, and how to select and use avatars in second life museum environments. In the next stage, teacher candidates reached virtual museum tours and second life applications related to museums using the Moodle platform. In these applications performed interactively in the classroom environment; Pre-service teachers were first asked to examine real artifacts in museums through virtual tours.

Based on their own views, the pre-service teachers took notes about the features, and forms of the works and paintings, their production materials, their purposes

and colours. Thus, with these applications, real artifacts in virtual museums were introduced by virtual tours, and the readiness level of the pre-service teachers regarding the subject was increased. In the following applications, pre-service teachers were asked to reach the second life museum environments on the Moodle platform and determine the avatars they would use in the application. During these stages, the candidates were presented with working papers containing questions about the artifacts and exploration reports they would use for the museum hunt activity.

There were questions in the worksheets like “What form do you think the sculptures in the Louvre and Art Nouveau museums have?” “Can you draw the work you like the most in these museums in two dimensions?”, “Can you circle the three-dimensional works exhibited in these museums with the second life application?” What do you think about main-intermediate colours, cold-warm colours)?” In the discovery report created for the museum hunt activity, there were questions like “What is the name of the work?”, “What is the date of creation?”, “For what purpose?”, “For what purpose is it used today?” “What are their similarities with today’s works?”, “What are the differences that distinguish them from today’s works?”

In the applications, pre-service teachers were asked to access the works by using avatars in the second life museum environment and to answer the questions on the worksheets. Thus, the pre-service teachers answered the questions by adding their own views, and conveyed their impressions and knowledge of the works. After these activities, the responses given to the worksheets were evaluated under the guidance of the researcher and necessary feedbacks were given. In the following applications, teacher candidates were given the opportunity to perform the museum hunt activity using the avatars they chose. In these activities, candidates were asked to access the works, whose pictures were given in the discovery report, by using their avatars and to answer the questions in the minutes. The preservice teachers, who reached the works, acquired the information about the production history of the works, the type of the work and its features by using the audio-visual method of the work. In the Discovery Record; “What are their similarities with today’s works?”, “What are their differences from today’s works?” They answered such questions by brainstorming and using cooperative learning methods. At the end of these applications, open-ended quiz questions aiming to consolidate the information about the works and pictures in the second life museum environments were included. Pre-service teachers were asked to answer these questions and reinforce their knowledge. At the end of the application, the multiple-choice achievement test (post-test) was re-administered. In addition, face-to-face interviews were held in order to evaluate the effectiveness of the application.

Museum Education Applications Achievement Test

The multiple-choice achievement test (pre-test - post-test) was developed by the researcher in order to determine the effectiveness of museum education practices integrated with virtual teaching environments on the success levels of teacher candidates. The test, which was created by taking expert opinion, consisted of 42 items. After the pilot application, the KR-20 reliability coefficient of the test was calculated as 0.85. Büyüköztürk (2013) stated that the tests with a KR-20 value of 0.70 and above have a reliable structure, and the reliability of the test increases as it approaches 1. In this context, it can be stated that the developed multiple-choice achievement test is reliable. The mean item difficulty index of the test was calculated as 0.59, and items with an item difficulty index between 0.40 and 0.80 were excluded from the test. In addition, the item discrimination index of the test was accepted as 0.30, and items below 0.30 were also excluded from the test. The test was finalized with a total of 20 items.

Semi-Structured Interview Form for Museum Education Practices Integrated with Virtual Teaching Environments

A semi-structured interview form was developed to determine the effectiveness of museum education practices integrated with virtual teaching environments. While creating the questions to be included in the interview form, the literature was reviewed for the use of virtual teaching environments in museum education practices and the questions were determined. In the next stage, necessary arrangements were made by referring to expert opinion ($n = 5$). The final form was created after it was examined by linguists ($n = 2$) and surveying experts ($n = 3$). In the interview form, the question "What are your views on museum education practices integrated with virtual teaching environments?" was asked. After the implementation phase, interviews with the pre-service teachers lasted between 10-15 minutes. Before the interview, it was especially stated that their participation in the research will be on a voluntary basis and their names will not be mentioned during the research process. Thus, the preservice teachers were assured about the confidentiality of the research. Then, the interviews were recorded in line with the permissions received from the pre-service teachers.

Data Analysis

Percentage, mean, standard deviation, and paired samples test analysis techniques were used to analyse the quantitative data of the study. In addition, quantitative data were interpreted with a significance level of 0.05. Content analysis was used to analyse qualitative data. In the content analysis phase, first of all, interviews with pre-service teachers were recorded. The interviews were transcribed and the accuracy of the computer transcripts was examined by an expert. In the second

stage, they were coded separately by the researchers, taking into account the word groups expressed by the participants. Considering the relationships between the codes, the coded data were collected in categories according to their content. At this point, categories were created by making groupings according to the similarity of the expressions. Thus, the codes were categorized under themes. In addition, a code number was given to the pre-service teachers whose opinions were consulted in the analyses.

In the third stage, the themes determined by the researcher were compared by the museum education experts ($n = 2$) and education program specialists ($n = 2$), and it was confirmed whether the codes represented the conceptual themes or not. At this stage, the codes with “Consensus” and “Disagreement” were determined. The reliability calculation of qualitative data was performed with Miles and Huberman’s (1994) formula [Agreement Percentage = $\text{Consensus} / (\text{Consensus} + \text{Disagreement}) \times 100$]. As a result of this research, 14 of the 16 codes determined by the researcher were approved, and 87.5% of consensus was achieved on the suitability of the codes. Having a consensus of 80% as a result of the content analysis of a person other than the researcher and the comparison of the results indicates that the reliability of the coding is high (Miles & Huberman, 1994). The result obtained reveals that the coding performed is reliable.

It was aimed to ensure the reliability of the coding processes and themes of the data obtained from the semi-structured interview form by taking expert opinions during the interpretation of qualitative data. In addition, sample quotations from the preservice teachers’ views were also included in the scope of the study in order to increase the reliability. While expressing the quotations, the views of the pre-service teachers were coded with the letter “PT (Pre-service Teachers)” and a number. The data were reported by including the quotations taken from the preservice teachers’ views.

In addition, some measures were taken to ensure the validity and reliability of the study. In this context, interviews obtained from qualitative data were recorded in audio recording in order to ensure internal validity, and the recordings were transferred to the text exactly without any changes. In addition, the views of the teachers mentioned in the study were expressed by making direct quotations without any comments. In the internal reliability of the research; The data were coded separately by the researcher and then compared in line with the expert opinions. For the external validity, the method of the research, the study group, the collection of the data, the analysis and interpretation of the data, and the research findings were stated in detail. In terms of external reliability, the research process was presented in detail, avoiding the guidance of the participants during the interviews. Thus, it was aimed to ensure the validity and reliability of qualitative findings with the measures taken.

Results

In this section, the success levels and opinions of pre-service teachers about museum education practices integrated with virtual teaching environments were included. Findings obtained in line with the aims of the research were presented below.

The Effect of Museum Education Practices Integrated with Virtual Teaching Environments on Success Levels of Pre-service Teachers

Paired Simple T Test was applied to determine whether there is a significant difference between the pre-test scores of the pre-service teachers and the post-test scores after the application. Experimental group pre-test and post-test score distributions were given in *Table 2*.

Table 2. Comparison of Experimental Group Pre-Test and Post-Test Scores

	N	M	Ss	T	P
Pre-Test	40	45.20	12.450	22.740	.000
Post-Test	40	80.35	8.909		

* *Significant at the .05 level of confidence*

As seen in *Table 2*, the pre-test scores of the teacher candidates before the application were ($M = 45.20$, $S = 12.450$) and their post-test scores were determined as ($M = 80.35$, $S = 8.909$). Among the obtained findings, a significant difference was found between pre-test and post-test success scores of the pre-service teachers in favour of post-test achievement scores ($t = 22.740$, $p < 0.05$). The findings obtained from the research show that the academic success of the pre-service teachers increased after the application. In this context, it can be said that museum education practices integrated with virtual teaching environments positively affect the success levels. Besides, designing an application in this direction also enabled pre-service teachers to be more successful in their pre-service professional experiences. In this context, it is thought that there will be positive improvements in the success levels of students if pre-school teachers use museum education practices integrated with virtual teaching environments in their professional lives.

Pre-service Teachers' Views on Museum Education Practices Integrated with Virtual Teaching Environments

The question "What are your views on museum education practices integrated with virtual teaching environments?" was asked to the pre-service teachers. The findings obtained from the views of the teachers were presented in *Table 3*.

As seen in *Table 3*, the codes were created by categorizing the pre-service teachers' views on the effectiveness of the museum education practices integrated with virtual teaching environments. It has been categorized into three themes: "The Contribution of Museum Education Practices Integrated with Virtual Teaching Environments to Teaching", "Effective Teaching" and "Learner-Centered Museum Education Practices Integrated with Virtual Teaching Environments".

Table 3. Pre-Service Teachers' Views on Museum Education Practices Integrated with Virtual Teaching Environments

Theme	Code	f
The Contribution of Museum Education Practices Integrated with Virtual Teaching Environments to Teaching	Concepts can be embodied	13
	Ability to organize various activities with the use of different virtual museum tours and second life museum environments	7
	The ability to design an effective teaching using second life museum environments without going to the museum environment	5
	Creating an inquiry-centered environment with the use of second life museum environment and virtual tours	3
	Creating a visually rich environment by using the second life museum environment	2
Effective Teaching	Easy and permanent learning	12
	Learning is more motivating and enjoyable	8
	To be able to have detailed information about the works	5
	To be able to establish a relationship between events	3
	To be able to observe	2
Museum Education Applications Integrated with Virtual Teaching Environments Being Learner-Centered	Active learning environment	10
	Cooperative learning	9
	The learner learns from their own lives by doing and living	8
	Development of cognitive and psychomotor skills with second life museum practices	3

Most of the pre-service teachers who gave their views within the framework of the first theme stated that virtual teaching environments are effective in concretizing abstract concepts related to the subjects (n = 13). This view revealed that pre-service teachers think that virtual museum environments are an effective practice in teaching concepts more effectively.

“Sometimes there are difficulties in teaching the concepts related to the subjects. I believe that I can more easily embody abstract concepts by using museum education applications integrated with virtual teaching environments with the education I received” (TC, 6).

“I think that the education I received on second life museum environments will be effective for preschool students to embody abstract concepts more easily” (TC, 12).

Within the scope of the first theme, some of the pre-service teachers stated that they could benefit from different virtual museum visits and second life museum environments with the applications performed and thus, they could organize various activities (n = 7). This view revealed that the teachers plan to organize activities by using not only one museum environment but more than one museum environment through virtual museum tours and second life museum applications. In addition, this finding obtained from teacher candidates also points out that they found the practices implemented effective, and also believed that diversity in teaching was provided in the realization of their activities. Sample statements regarding the views of the pre-service teachers were presented below.

“By using museum education applications integrated with virtual teaching environments, I can access more than one virtual museum environment and design different teaching activities” (TC, 30).

“With virtual museum tours and second life museum environments, I will be able to design various teaching activities for students and perform a more effective teaching” (TC, 4).

However, some of the pre-service teachers stated that they could design an effective teaching using second life museum environments without going to the museum environment (n = 5). This finding reveals that teachers have a positive view on using second life museum environments.

“In our practices, we designed impressive activities without going to the museum environment by using second life museum environments. I think these activities will have a positive impact on students” (TC, 18).

“This is the first time I’ve used second life museum environments thanks to these applications. I believe these environments can also be effective in preschool” (TC, 27).

Some of the pre-service teachers stated that an inquiry-centered environment could be created with the use of second life museum environment and virtual tours (n = 3).

“We can teach in an inquiry-centered environment by doing activities from the second life environment and using virtual navigation environments” (TC, 19).

“Our activities and using virtual tours in the second life environment can be effective in improving students’ inquiry skills” (TC, 11).

Moreover, some of the preservice teachers stated that a visually rich environment can be created (n = 2) by using the second life museum environment.

“The second life application was a very rich environment. Everything in the museum was very realistic” (TC, 4).

“I think second life applications can be effective in the development of students’ visual sensitivity” (TC, 27).

Within the scope of the second theme, most of the pre-service teachers stated that permanent learning can be achieved more easily by using virtual environments in teaching (n = 12). This view revealed that teacher candidates found museum education activities integrated with virtual teaching environments effective in providing permanent learning.

“Using virtual museum tours and second life museum environments in our professional life will be effective in consolidating the information about the subjects we will teach” (TC, 7).

“With the use of these environments in education, we will be able to provide a more effective and permanent education to our future students” (TC, 4).

In addition, some pre-service teachers emphasized that they found this kind of teaching and learning effective in increasing the motivation of both themselves and their future students by creating a pleasant teaching environment (n = 8). This view of the teachers shows that they see virtual museum visits and second life museum environments as important in increasing their and students’ interest in the subjects.

“I believe that museum education practices integrated with virtual environments will increase students’ motivation and provide a pleasant teaching environment” (TC, 2).

“I think I will definitely apply these applications to my future students. With these practices, we were more motivated to learn” (TC, 11).

Also, some of the pre-service teachers stated that they could obtain detailed information about the works and carry out activities with the museum teaching

activities carried out in virtual environments (n = 5). This view reveals that teachers can obtain information about the works through virtual museums without going to the real museum environment and they can design museum teaching activities for this. At this point, the statements regarding the views of the teachers were given below:

“Thanks to museum education applications integrated with virtual museum environments, I can have information about the works without going to the museum environment and I can design teaching activities related to this”(TC, 17).

“I never thought that I would be able to get detailed information about the works using virtual applications without going to the museum before. Thanks to this application, I will now be able to learn the artifacts of the museum more easily and organize activities”(TC, 5).

In addition, pre-service teachers also expressed views (n = 3) about the possibility of establishing a relationship between museum education practices carried out in a virtual environment and events.

“Virtual tours and second life applications made it easier for us to comprehend the relationships between events” (TC, 13).

“Especially in second life applications, using avatars to realize museum applications enabled us to establish a relationship between events and to complete the activities effectively” (TC, 9).

In addition, teacher candidates stated that realizing museum education practices in virtual environments enables observation. At this point, it is seen that teacher candidates think that the applied activities are effective in the development of their observation skills.

“We organized activities using Second life applications and virtual tour environments. During this period, we learned how to make observations in the museum environment”(TC, 1).

“We carried out activities by observing the works in the museum. It was very entertaining” (TC, 19).

Within the scope of the third theme, most of the pre-service teachers stated that they found museum education practices integrated with virtual teaching environments effective in creating active learning environments (n = 10). At this point, it is seen that the virtual museum visits and the museum education activities held in the second life museum environment were positively effective on the views of the teacher candidates in this direction. Sample views were given below:

“I believe that museum education practices integrated with virtual museums will activate my future students. We also carried out an active teaching in practice” (TC, 23).

“We took an active part in all the applications realized. Active learning has opened up new horizons for us. All applications were very impressive” (TC, 29).

In addition, it is understood that the teacher candidates stated that museum education practices carried out with virtual teaching environments enable cooperative learning (n = 9). The opinions revealed that the teachers can learn collaboratively by doing group work in virtual environments.

“We did group work on museum education using second life applications and avatars” (TC, 3).

“We organized activities in cooperation with other groups using virtual museum tours. We also directed questions to each other in these applications. We created an effective environment” (TC, 21).

In addition, it was determined that some of the pre-service teachers found museum education practices integrated with virtual teaching environments effective in learning by doing and experiencing (n = 8). At this point, it can be said that pre-service teachers see the practice as learner-centered and think to use it in preschool education.

“Most of the activities we did throughout the application enabled us to learn by doing and experiencing. I believe these practices will facilitate preschool teaching” (TC, 1).

“As a pre-service teacher who will start my career, I found it very impressive that such an application should be done by doing and living. I aim to make similar practices in preschool” (TC, 12).

Some of the pre-service teachers stated that cognitive and psychomotor skills can be improved with second life museum practices (n = 3). These views reveal that the applications carried out in virtual environments were effective in the development of both cognitive and psychomotor skills.

“Our second life applications have developed both our cognitive and psychomotor skills” (TC, 22).

“The museum education activities we held with avatars in the second life environment improved our psychomotor skills. The fact that the activities also included mental processes was also effective in the development of cognitive skills” (TC, 2).

Of all the results obtained, it was understood that they found museum education practices integrated with virtual teaching environments effective and applicable. In addition, most of the pre-service teachers use virtual museum tours and museum education practices integrated with second life museum environments. It was also determined that they found virtual museum teaching and learning effective and sufficient in concretizing the concepts, in easy and permanent learning, and in creating active teaching environments.

Discussion

In this research, museum education practices integrated with virtual teaching environments' effect on pre-school teacher candidates' academic achievement was evaluated. In addition, it was aimed to determine the views of the teacher candidates about the applications in the study.

The quantitative data obtained from the research revealed that museum education practices integrated with virtual teaching environments made a significant difference in the academic success of teacher candidates. In addition, the results obtained showed that there was an increase in the academic success of the teacher candidates at the end of the application process. Similar results have been obtained within the scope of some studies in the literature. In the studies of Cukurbasi and Karamete (2017), it is pointed out that second life applications integrated with virtual teaching environments are important in creating an effective teaching environment, and virtual applications affect the success levels of students. In the research of Zaharias *et al.* (2013), it was stated that museum education practices integrated with virtual teaching environments would have a positive effect on the academic success of teachers who will enter their professional life. In the studies of Bezir and Baran (2014), Gregory & Masters (2012), Wang, Song, Xia & Yan (2009), it was stated that the use of virtual environments in education increases the quality of education. In these studies, it is stated that the activities carried out with second life applications can be effective both in reinforcing the knowledge of students and increasing permanent learning. As can be seen, these findings obtained from studies in the literature coincide with the findings of the study.

In addition to this, the teacher candidates gave views in three themes regarding the practices. The pre-service teachers under the theme of the contribution of museum education practices integrated with virtual teaching environments to teaching stated that concepts can be understood better, various activities can be carried out with virtual museum tours and second life applications, effective teaching can be designed without going to the museum environment using second life museum environments, an inquiry-centered environment can be created with virtual environments and a visually rich environment can be created by making use of the second life museum environment. Similarly, in the study prepared by Martini, Librelotto, & Henriques (2016), revealed that teaching environments

integrated with virtual teaching environments are effective in concretizing learning. In the study conducted by Kiourt, Koutsoudis, Markantonatou and Pavlidis (2016), indicated that different virtual museum environments and museum education activities can be designed. In Baker, Wentz, and Woods (2009) research, it was pointed out that second life museum environments are effective in realizing different teaching activities. In Morgon's (2013) research, it was emphasized that effective teaching can be achieved by using second life museum environments. In the studies of Jacobson, Taylor, and Richards (2016), it was pointed out that inquiry-centered learning can be achieved by using virtual environments. In the research of Kalinci (2015), it was mentioned that virtual environments can be effective in creating a visually rich environment. As can be seen, the above-mentioned studies support the findings obtained from this study.

In addition, within the scope of the second theme of Effective Teaching, pre-service teachers stated that it can be effective in learning permanently, increasing motivation and creating a pleasant teaching environment, obtaining detailed information about the works, establishing relationships between events and making observations. In the studies conducted by Caliskan, Onal, and Yazici (2016) and Iqbala, Kankaanranta and Neittaanmaki (2010), it was emphasized that using virtual museum environments in teaching can be effective in increasing students' permanent learning, increasing their motivation and creating a pleasant education environment. Similarly, in the research of Kiourt *et al.* (2016), it was stated that virtual environments can be effective in learning detailed information about the works by creating an interactive teaching environment, and they can also provide permanent learning by increasing motivation. In the studies of Vosinakis and Tsakonas (2016), it was emphasized that the use of virtual environments can be effective in establishing relationships between events and phenomena. In the studies of Panciroli, Russo and Macaуда (2017), it was mentioned that using virtual museums can improve the observation skills of individuals. As can be understood, other studies in the literature and the findings obtained from the research support each other.

In addition, the pre-service teachers stated that the practices carried out in the third theme of Museum Education Practices Integrated with Virtual Teaching Environments are learner-centered and enabled learning by providing an active learning environment and by living. In addition, in this theme, the pre-service teachers have also given their views on cooperative learning and second life applications and the development of cognitive and affective skills.

Thus, in the studies conducted by Roussou (2004) and Kluge and Riley (2008), it was pointed out that virtual teaching environments provide an active environment and enable learning by doing, thereby make teaching more effective.

Conclusion

In the studies of Ho, Nelson, and Wittig (2011), it was mentioned that virtual museum environments are important in gaining cooperative learning. Khidzir, Daud, and Ibrahim (2016) and Daniela (2020) also point out that the use of virtual environments in education can be effective in the development of individuals' cognitive and psychomotor skills. As can be seen, the findings of the studies coincide with the findings of this study. All the results obtained revealed that the applications carried out had a positive effect on the views of the teacher candidates, and the virtual environments created awareness in increasing the knowledge level of the candidates on the subject. In this context, it can be said that the virtual applications carried out within the scope of the research have a positive effect on the views of the pre-service teachers.

Recommendations

It is recommended to implement museum education practices integrated with virtual teaching environments for the training needs of teachers and teacher candidates in different disciplines within the scope of future researches. Thus, the effectiveness of the developed practices can be evaluated according to the views of teachers and pre-service teachers in other branches. In addition, it is recommended to develop different virtual teaching environment applications in which students can actively participate and to make applications for different disciplines.

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