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The Effect of STEM Application on Learning History and Culture based on Photo-Documents in Museums

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Abstract

This study aims to reveal the effect of examining photos/documents in museums with traditional and STEM approach on students' success in history lesson, interest, attitude, national value and historical awareness. A control group pretest-posttest trial model, which is one of the quantitative research methods, was used in the research. The study group of the research is 2nd year secondary school students. The study was carried out with a total of 60 students, 30 students in the experimental group and 30 students in the control group. The application of the study was carried out in a secondary school and museums in Almaty (Kazakhstan). In the research, four different measurement tools were applied to determine the effect of museum visit and STEM approach, which are independent variables, on students' success in history lesson, attitude, interest and national value and consciousness level. Whether there is a difference between the achievement, attitude, interest, national values and consciousness levels of the experimental and control groups was analyzed with the "Independent t test". According to the findings obtained from the research, it was determined that the museum tour and STEM application studies were more effective in increasing the success, attitudes and interests of the students in the history lesson than the classical narrative-based tour in the museum with the control group. It was observed that both methods were effective in students' national values and historical awareness.

Introduction

Throughout their long and rich history, museums have functioned as mediators of culture and relations between the world of science and the everyday world of society (Pedretti & Iannini, 2020). Amodio (2013), Friedman (2010) and McManus (1992) argued that museums should be handled effectively in the educational processes as a way of understanding the historical evolution, roles, social and cultural purposes of these institutions. According to the International Council of Museums (ICOM) (2018), a museum is at the service of society, where tangible and intangible cultural heritage is collected, preserved, exhibited for scientific and educational purposes, research is carried out, the data obtained is transferred to future generations, and the data is transferred to the next generations. It is a public institution based on continuity in its development. The objects they exhibit became

spaces that embody a certain identity through the regulations they apply for these objects and the codes of conduct they envisage and apply. Museums, which are social engineering tools, have instilled certain values, living standards, etiquette and tastes in individuals and masses (Shaw, 2004) and have made positive contributions to the quality of life of individuals.

Traditionally, museums have emphasized cultural heritage through objects with intrinsic value (Caulton, 2006; Friedman, 2010; Rennie & McClafferty, 1996). Private museum spaces, which were usually recreated in the homes of wealthy men in the early days, came to the forefront as a medium used to display "rare" private collections of all kinds (Friedman, 2010) and symbolized social status in a way in the past. These first-generation museums, which Cameron (1971) calls the "temple" metaphor, functioned as places where objects were displayed and visitors observed in a quiet, passive and respectful manner. This first generation also includes the proliferation of natural history and cultural museums in the seventeenth, eighteenth and nineteenth centuries. Designed to educate what was then seen as ordinary audiences, the primary purpose of these institutions (and their exhibitions) was to contribute to scientific and cultural knowledge by creating object-rich exhibits with curated pieces from the research collection (McManus, 1992, p. 160). Amodio (2013) describes these first-generation museums as one based on the look-but-touch principle, a principle still used by nature and culture museums around the world today.

In the past, museums tended to be the places where the social and cultural identity of local, regıonal or natıonal culture was most brıghtly and expressıvely reflected. The main functions of museums were to collect, preserve and display local, regional or national hıstory and culture for future generations. Today, it has become a tool for the modernization of individuals and society, far beyond the purpose of exhibiting and protecting, by gathering together the cultural and artistic values of nations according to a certain system (Buyurgan, 2002; Williams, 2007). Today, the access of societies to the collections in museums and museum-based education gain importance in museology. It has become more important to make the museum and the collections in it materially easier and more accessible to the public, and to make the museum collections and exhibition subjects more understandable for non-expert visitors. Museums have collections of cultural value. They are institutions that serve to protect, examine, evaluate, exhibit these collections with various scientific methods, and to make them popular by contributing to education. With this definition, the functions of museums can be examined under the headings of collecting, documenting, protecting, exhibiting and education. Conservationism, education and promotion are the common points that unite in the definition of museum that reflects human life, culture and works from the past to the present in a scientific, technical and artistic way, as well as to the future (Amirbekova, Kussaiyn, & Narbaev, 2022; Kholdorjonqizi, 2021; Yücel, 1999).

Museums are undeniably important culturally, symbolically, objectively and subjectively (Origet du Cluzeau, Tobelem, 2009). According to UNESCO, the museum industry is usually classified as a creative industry, which is known to have a beneficial effect on visitors, allowing them to satisfy both cognitive, spiritual and emotional, informational needs. Participation in art, culture and history through museums quenches individuals' thirst for knowledge, aesthetics and self-actualization. They can also develop one's ability to appreciate art, culture, and aesthetics. Also, participation refers to the participation of a person in an action or event. Although there are solid

studies of the effectiveness of participation in arts and culture in the West, studies in the East are still limited (Lee, Lin & Hung, 2021).

It is likely to talk about the use of two types of sources in historiography: primary source and secondary source. Primary sources are "original textual (letters, diaries, speeches) and non-textual (photographs, drawings) sources available to learn more about a time period, person, or specific event" (Morgan & Rasinski, 2012). Secondary sources are sources created by making use of primary sources, these sources are sources such as history books, textbooks, movies, which history is indirectly transferred and the historian's interpretation is written about, and what historians write about the past (Vella, 1999). Primary sources can be manuscripts, first-person diaries, oral history, letters, interviews, photographs, maps, films, sound recordings, pieces of music and history, as well as places and people (Veccia, 2004) as "art and literary works, surveys and fieldwork, studies, books, magazines and newspaper articles, advertisements, public opinion surveys, original documents (birth certificates, property documents) and research data such as census statistics, official and unofficial evidence of government agencies, patents, reports, scientific journal articles reporting experimental research results, e-mail, blogs, list servers, internet communication in newsgroups".

The use of primary sources in the classroom environment in history teaching and the acquisition of cultural values may contribute to the students' inferences, but it should not be forgotten that prior knowledge is required for this. Because these resources are different from textbooks. Using primary sources requires important research and critical thinking skills, unlike working with other teaching materials. Museums, which adopt the understanding of contemporary museology, establish museum-school cooperation and establish education departments that will program the education to be carried out by communicating with the society and schools (Hubbard & Odebiyi, 2021). According to the modern understanding of education, the museum a) forces people to think, establishes relationships by making observations, b) teaches people how to improve their knowledge, c) gives them the habit of comparing this information, d) shows the opposites and brings them to a conclusion with a certain interpretation, e) contributes to the formation and development of imagination and sense of taste, observation, creativity and logic, f) reveals the past, compares the past with the present, shows the developments up to the present day, g) shows that development at the same time is inevitable and the future will be different from today, h) raises awareness of the right history (Marston & Wolfer, 2017). Museums can carry out educational activities both inside and outside the museum. The results of the research revealed strong evidence that the development of students' knowledge and understanding of scientific concepts takes place in a variety of settings - both in and out of school - and that such knowledge and understanding accumulates over time through exposure.

In particular, it is aimed to present the exhibitions for educational purposes by making all kinds of displays of the objects exhibited in the contemporary museum education approach, using multimedia and technologies, from a static participation to an active participation. While achieving these goals, communication design methods and information visualization techniques are used. Museums are out-of-school learning spaces that are of great importance for the teaching of many courses, especially history, social studies and fine arts. Learning the basic concepts of history, developing high-level thinking skills, problem solving and analytical thinking, evaluating the evidence, seeing how change occurs, developing creativity, connecting the past with the present, gaining the habit

of protecting the historical environment, developing an empathetic perspective through museum visits. It is stated in the relevant literature that it is possible to realize some gains that are considered very important for today's museum history lessons, such as being tolerant and tolerant (Ariese, 2019; Demircioğlu, 2010; MacPherson, Hammerness & Gupta, 2019). However, the results of the studies show that museum visits are not/cannot be made at the desired level and quality. The reasons such as the absence of a museum in the region, the large number of students, the difficulty of providing security, the lack of time (Uslu, 2008), difficulties in transportation, not established partnerships between the museum and educational institutions. Therefore, the importance of clarifying the roles of schools and museums in creating successful partnerships from the perspectives of both teachers and museums (DeWitt & Osborne, 2007; Gupta, Adams, Kisiel, & Dewitt, 2010; Kisiel, 2003; Tran, 2007).

The cultural, educational, scientific focus of museums will allow for group classes, where participants can develop both social skills, and measure their creativity by using initiative. STEM education in museums is handled at all levels of education, including early childhood. Students accumulate knowledge and skills related to many fields such as natural sciences, humanities, health sciences, educational sciences in their cognitive schema, even if they cannot make sense of them until the abstract operational stage, even if they do not present them in a proper composition. This accumulation follows a path similar to the scientific knowledge accumulation process of human beings (Hartono & Ozturk, 2022; Kibici, 2022). Students can produce their own prototypes by reinforcing the theoretical knowledge gained through formal education with practical experiences in museums, workshops and classrooms, by being inspired by real models, by seeing and touching them. Objects embodied in multidimensional designs can be developed by taking advantage of STEM opportunities. STEAM museums are the source of inspiration for these projects and at the same time the inspiration for these applications. With all these aspects, the integration of museum education and STEM practices into schools is very important. Preparing students for the age of talent, raising their awareness and revealing their potential are the main goals of my museums. It is essential for individuals to transform knowledge into skills by absorbing new strategies that will increase their national and international success with experiential practices, and to gain value and awareness simultaneously. In recent years, disciplines such as literature, art and social sciences have been integrated into STEM education. In this framework, the concept of SETAM has emerged by integrating art into STEM education. With the concept of STEAM, it is aimed to benefit from the aesthetics of art in innovative approaches of STEM education (Fishman et al., 2013; Macalalag et al., 2022; MacPherson, Hammerness & Gupta, 2019; Özrili, 2021; Sadykova, 2013; Yerzhanova, 2013).

STEAM enables individuals to identify problems and produce practical and accurate solutions to these problems with an interdisciplinary approach from preschool to higher education by bringing together the disciplines of Science/Technology, Engineering, Mathematics and Art. It is a targeted educational approach. This approach prioritizes learning based on research and inquiry, by emphasizing the feelings of curiosity that exist in individuals but dulled over time. It is expected that individuals will be able to transform the knowledge they have learned into products and solve problems by stimulating their sense of curiosity. Again, the production of original ideas, the acquisition of different and critical thinking skills, and the incorporation of STEAM education with museums are among the goals (Aguilera & Ortiz-Revilla, 2021; Land, 2013; Kuo, Tseng & Yang, 2019; Park et al., 2012). In the literature, there are sample studies that provide the integration of new technologies regarding STEAM

education, where STEM and art dimension are added. In these studies, in the technology dimension of STEM or STEAM education, virtual reality technologies (Keefe & Laidlaw, 2013), educational robotics and coding (Eguchi & Uribe, 2017; Mataric, Koenig & Feil-Seifer, 2007; Stergiopoulou, Karatrantou & Panagiotakopoulos, 2016) and educational software is included. No activity related to the integration of museums into STEM or STEAM education could be found. In this context, with the study carried out, an example course material about the design of STEAM activities in museum education was tried to be presented. Today, museums are used effectively, especially in education and training via computer. It is possible to organize virtual museum tours by making use of the web pages of various museums around the world. In this context, the effect of teaching photos/documents in museums on the basis of traditional and STEM approaches on students' success, interest, attitude, national value and historical consciousness was examined. Within the framework of this aim of the research, answers to the following questions were sought:

- Is there a significant difference between the achievement test, attitude scale, interest inventory, national value and consciousness scale mean scores of the experimental (museum tour + STEM-based activities) and control group (traditional museum tour) students before the experimental procedure?"
- Is there a significant difference between the success of the experimental and control group students after the experimental procedure?
- Is there a significant difference between the experimental and control group students' interest in history and museums after the experimental procedure?
- Is there a significant difference between the mean attitudes of the students in the experimental and control groups after the experimental procedure?
- Is there a significant difference between the national values and historical consciousness levels of the experimental and control group students after the experimental procedure?

Method

In this section, the subjects of the research, the experimental procedure applied, the data collection tools, the statistical procedures and techniques used in the analysis of the data are explained. This research is an experimental study in which the effect of the "Program on the basis of the Traditional and STEM Approach of Photographs/Documents in Museums", prepared by the researcher, on the students' success in history lesson, interest, attitude, national value and historical awareness. Care was taken to determine the determination of the priority. The success of the second-year secondary school students in the academic and history courses were examined. Then, an experiment and a control group of 30 people were formed randomly among 60 students whose academic success and history course success were equal. In this study, a special type of mixed designs, which are frequently used in the field of educational sciences, "split plot" experimental design with pretest-posttest control group was used. Since the main purpose of this research is to test whether the examination of photos/documents in museums with a traditional and STEM approach increases student achievement, interest, attitude, national value and historical awareness, the independent variable of the research is "STEM Based Museum Education" applied to the experimental group between the pre-test and post-test in "Traditional Museum Education" programs. The dependent variable of the research is interest, attitude, national value and historical awareness towards the course. The formation of the experimental design is shown in Table 1.

Table 1. Experimental Design Applied in the Study

Groups	Pre-test	Experimental Process	Post-test
G1	$T1_{1234}$	STEM-based Museum Education	$T2_{1234}$
K	$T1_{1234}$	Traditional Museum Education	$T2_{1234}$

In the study, the G1 Experiment group; K represents the control group. A pre-test was applied to both groups before the experimental procedure. As a pre-test, a scale of interest, attitude and historical awareness was applied to the subjects. The same tests were applied to the groups as a posttest at the end of the experimental procedure (T2).

Pretests applied to the subjects according to the table above:

- $T1_1$ ⟶ History lesson achievement test
- $T1_2$ ⟶ Attitude Scale towards History lesson
- $T1_3$ ⟶ Interest inventory for History lesson
- $T1_4$ ⟶ National value and historical awareness scale

The variables of the study are shown in Figure 1.

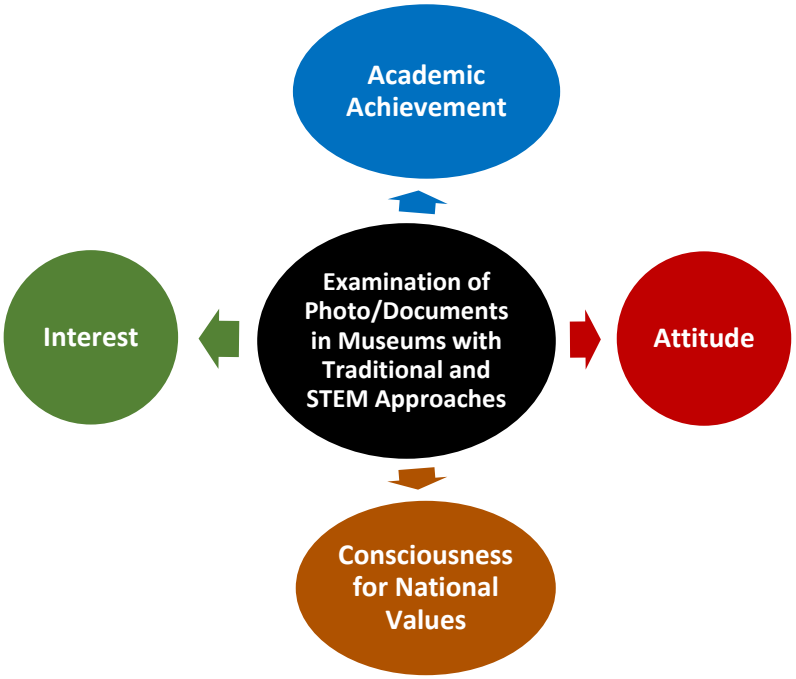

Figure 1. Research Variables

The study was carried out on 2nd year students studying in a secondary school in Almaty, Kazakhstan, in the 2021-2022 academic year. In order to determine the experimental and control groups of the research, the academic achievement scores of the 4 classes in the mentioned secondary school were examined. Two classes with equal academic achievement scores were included in the study. These classes were then randomly assigned to the experimental and control groups.

Experimental Process

All procedures performed in the research are given below:

1. Written and visual materials were prepared from lecture notes and source books to be used in the research.
2. Before starting the research, the training used in that group was applied as an example for 2 lesson hours (90 minutes) in the experimental and control groups in order to familiarize the subjects with STEM and museum education practices. At this stage, explanations were made about the trainings to be applied to the students and additional examples were shown.
3. The history lesson achievement, interest, attitude and national values and consciousness scales prepared for all students in the Experimental and Control groups were applied as a pre-test.
4. In the experimental and control groups, practices were conducted on the topic "Kazakh Traditional Culture" based on photo-documentary materials (see Figure 2).

CMK NVF. 5289/11.1899 год. Photo. A yurt near Pavlodar. From the funds of the Central State Museum of the Republic of Kazakhstan, Almaty

Photo. The interior of the Kazakh yurt. (Central State Museum of the Republic of Kazakhstan, Almaty)

CMK NVF. 5289/17«г». S. Dudın. Photo. Family in the yurt. 1899. From the funds of the Central State Museum of the Republic of Kazakhstan, Almaty

Photo. The interior of the Kazakh yurt. (Central State Museum of the Republic of Kazakhstan, Almaty)

Figure 2. Traditional Culture of the Kazakhs (housing, clothing, household, crafts, art, customs)

The Impact of Historical Changes on the Culture and Traditions of the Kazakh People

In this study, a training program was prepared for the experimental group, as it was made for the purpose of teaching historical documents and photographs in museums with the STEM approach. This program is an 8-hour training program implemented over 4 weeks (see Figure 3). The content and subject of the training given within the scope of the program are planned. The study was carried out by obtaining the necessary permissions from the relevant units for these processes. While determining the content given within the scope of the experimental process, the historical events of the period, related photographs, documents and artifacts were examined in detail (Dudin, 1921; Melkov, 1929; Rezvan, 2010; Prishchepova, 201; Janibekov, 1982).

Figure 3. Participants of the Experimental Group during Test Classes at the Central State Museum of the Republic of Kazakhstan

Among these photographic works, it was preferred to choose the ones that will have the most impact on students in terms of STEM activities and are easy to understand. Within the scope of the plan determined in the first stage of my education program, a museum tour was carried out with the students, and historical paintings and artifacts in these places were introduced. The second stage of the application in the experimental group was carried out in the classroom with the STEM approach. At this stage, students prepared video and visual supported presentations of the works by using information technologies individually and in groups.

In this context, they studied the events and phenomena that took place in the example of photographs, documents and works of the period and the different perspectives of the authors. Using online resources and materials, as well as the internet and the library, students visually narrated their photographs and works of the period in a chronological flow (the mathematical and technological aspect of STEM). During the narration, they performed face-to-face activities. In addition, the students examined and discussed different photographs of the period.

In the control group, traditional museum visits and activities were carried out:

5. History lesson interest, attitude, national value and historical awareness scales were applied to all groups as a post-test.

Data Collection Tool

In this study, 'History Course Achievement Test', 'Attitude Scale towards Course', 'National Value and Historical Consciousness Scale' and 'Inventory of Interest for Museum and Historical Facts' were used to collect data.

Achievement Test

In line with the purpose of the research, the 19th and 20th Century Kazakh History Achievement Test was developed to measure the knowledge of the students in the study group about Kazakh culture. Achievement tests are the tests developed and used to determine the academic development of the students in terms of knowledge, concept and understanding at the end of the teaching activities carried out on the basis of a specific program. The achievement test used in this research was developed in order to determine the effect of students' interest, attitude and historical awareness as a result of the "Our National Culture" theme in the Secondary School 2nd Grade History Course Curriculum, "Photo/Documents in Museums with Traditional and STEM Approach. The process was followed. Within the scope of the research, a multiple choice achievement test consisting of 20 questions, with 5 options, was developed. The opinions of subject area and assessment and evaluation experts were consulted in the development of the achievement test. The questions in the achievement test were prepared in relation to the achievements of the course. To calculate the validity and reliability of the achievement test. The test was applied to a secondary school second year student in the fall semester of 2021-2022. The results were analyzed with the "ITEMAN" program. According to the results obtained, the item discrimination coefficients of the item difficulty coefficients of the items in the test were between 0.40 and 0.65. It was understood that e took values between 0.38 and 0.65. Then, item analysis was performed again. The average difficulty coefficient of the items in the final test was calculated as 0.47 and the average discrimination coefficient as 0.38. The KR-20 reliability coefficient of the final test was calculated as 0.78.

National Value and Historical Consciousness Scale

In line with the purpose of the research, the national value and history consciousness scale prepared by Özkartal (2009) was used to determine how the traditional and STEM Approach activities of photo/documents in museums affect the students' national values and historical awareness levels. The scale, which is a five-point Likert type, consists of 26 items. The scale has six dimensions: religious values, genetic (racial) values, political values, cultural values and moral values. Of the 26 items in the scale, 12 items are negative and 14 items are positive. High scores obtained from the scale can be interpreted as positive attitudes towards national values. The validity of the scale was examined by exploratory factor analysis. It was stated that the factor loads of the scale items ranged from 0.55 to 0.82. In order to examine the discriminant validity of the scale, the mean of each dimension of the lower and upper 27% groups were compared and it was stated that the scale was successful in distinguishing the lower and upper 27% groups. The Cronbach Alpha internal consistency coefficient for the overall scale was reported as 0.88 (Özkartal, 2009, p. 112).

Attitude Scale towards History Curriculum

Based on a survey conducted among secondary school students, the attitude scale developed by Andrews, McGlynn & Mycock (2009) and adapted into Kazakh by the researcher was used to reveal young people's attitudes towards the history curriculum and how they relate to their ethnic, The analyzes carried out on the Kazakh form revealed that the scale has a one-dimensional Likert form structure. Cronbach Alpha analysis. It revealed a

reliability coefficient of 89 level. It has been observed that the scale has appropriate validity and high reliability in terms of attitudes towards the national history course and curriculum.

Interest Inventory for Museums and Historical Facts

Finally, the interest inventory for museums and historical facts developed by the researcher was used in the research. It is thought that determining whether the activities carried out change students' interest in the lesson and museums will contribute to increasing the quality of this research. For this purpose, an item pool of 20 questions was created to create the interest inventory items. The 20 questions in the item pool were reduced to 10 questions by taking expert opinion on the subject area. A draft inventory form was created by considering 10 questions. 7 items in the scale are positive and 3 items are negative. These items were scaled in 5 categories as “strongly agree”, “agree”, “undecided”, “disagree” and “strongly disagree”.

The validity of the 10-item draft form of the inventory was examined by exploratory factor analysis (EFA). Before performing the EFA, the necessary assumptions for the factor analysis were checked. For this, sample size and multivariate normal distribution assumptions were examined. To examine the size of the sample, the Kaiser-Meyer-Olkin (KMO) coefficient was calculated and the KMO coefficient was found to be 0.95. It can be said that the data obtained from the KMO is perfect as it approaches 1, and unacceptable if it is below 0.50 (Yılmaz & Sünbül, 2009). Accordingly, it can be said that the KMO value obtained is quite close to the perfect level. In the next step, the assumption of multivariate normal distribution is examined. For this, the Bartlett test coefficient was calculated and it was seen that the obtained coefficient was significant ($\chi 2=1920.16$; $p<0.001$). According to this result, it was understood that the multivariate normal distribution assumption was also met.

In the next step, EFA was performed. As a result of the EFA, it was understood that the factor load was above 0.40 and the eigenvalue of 10 items was gathered under a single factor greater than 1. In the light of this information, it was decided that the scale would be one-factorial by taking expert opinion. EFA was performed again as a single factor. The Cronbach Alpha internal consistency coefficient of the scale was calculated as 0.94. High scores obtained from the scale indicate that the interest in museums and historical facts is positive. The Cronbach Alpha reliability coefficient of the scale was calculated as .93.

Data Analysis

In line with the purpose of the study, parametric tests were used to compare the scores of the students in the experimental and control groups in the study group. Before the data obtained from the measurement tools were analyzed, whether the data showed normal distribution according to each independent variable to be compared was examined using the Shapiro-Wilk normality test. In cases where the normality assumption is met, parametric tests were used, since parametric tests were used in the study (Yurt, 2011). Data were analyzed using SPSS 25.0 statistical package program. Analysis results were considered at 95% confidence level and $p<0.05$ values were considered statistically significant.

Findings

The first sub-problem of the study was: "Is there a significant difference between the experimental and control group students' mean scores on achievement test, attitude scale, interest inventory, national value and history consciousness scale before the experimental procedure?" In order to find an answer to this sub-problem, the achievement test, scale and inventory pre-test results of the groups were compared with the independent sample t-test. The obtained results are shown in Table 2.

According to Table 2, 0.128 t value between the achievement test pretest averages of the experimental and control groups, 0.45 t value in the pretest attitude point averages, 0.643 t value in the pretest interest inventory point averages, and 1.224 t value in the national value and consciousness point averages. values have been calculated. According to these findings, there is no significant difference between the pretest achievement, attitude and inventory scores of the students in the experimental and control groups ($p>0.05$). Before the experimental procedure, it was understood that the knowledge levels of the students in the experimental and control groups, their attitudes towards the history lesson, their interest in museums and history, and their national values and historical awareness levels were quite close and equivalent to each other.

The second sub-problem of the research was: “Is there a significant difference between the students in the experimental and control groups after the experimental procedure in the History Lesson Achievement test score averages?” In order to find an answer to this sub-problem, the achievement test results of the groups were compared with the independent sample t-test. The obtained results are shown in Table 3.

Table 2. Comparison of Achievement, Attitude, Interest, National Value and Consciousness Scale Pre-Test Scores of Experimental and Control Group Students

Pre-Test	Group	N	Mean	Std. Deviation	t	p
Achievement	Experimental	30	5.83	1.93	-0.128	0.898
	Control	30	5.90	2.09		
Attitude	Experimental	30	3.65	0.46	-0.456	0.650
	Control	30	3.71	0.55		
Interest	Experimental	30	3.93	0.50	0.643	0.523
	Control	30	3.85	0.36		
National Value and Historical Awareness	Experimental	30	3.75	0.55	-1.224	0.226
	Control	30	3.89	0.31		

According to Table 3, there is a significant difference between the achievement test post-test averages of the experimental ($\bar{X}$ = 11.80) and control ($\bar{X}$ = 10.13) groups, in favor of the experimental group ($t=3.185$; $p<0.05$).). After the experimental procedure, the achievement test averages of the students in the experimental group were significantly higher than the achievement test averages of the students in the control group. This result showed that the activities applied in the experimental group were more effective in increasing the students' knowledge of History lesson than the activities performed in the control group.

Table 3. Comparison of Achievement Test Post-Test Scores of Experimental and Control Group Students

Post-Test	Group	N	Mean	Std. Deviation	t	p
Achievement	Experimental	30	11.80	1.95	3.185	0.002
	Control	30	10.13	2.10		

The third sub-problem of the research was: “Is there a significant difference between the students in the experimental and control groups, after the experimental procedure, in the mean scores of the History Lesson Attitude Scale?” In order to find an answer to this sub-problem, the groups' attitude scale post-test results were compared with the independent sample t-test. The obtained results are shown in Table 4.

Table 4. Comparison of Attitude Scale Post-Test Scores of Experimental and Control Group Students

Post-Test	Group	N	Mean	Std. Deviation	t	p
Attitude	Experimental	30	4.35	0.54	2.578	0.012
	Control	30	3.95	0.66		

According to Table 4, there is a significant difference between the attitude scale post-test averages of the experimental ($\bar{X}$= 4.35) and control ($\bar{X}$= 3.95) groups, in favor of the experimental group (t=2.578; p< 0.05). After the experimental procedure, the achievement test averages of the students in the experimental group were significantly higher than the achievement test averages of the students in the control group. This result showed that museum visit + STEM-based activities in the experimental group were more effective in the attitudes of the students to the History lesson than the activities carried out in the control group.

The fourth sub-problem of the study was: "Is there a significant difference between the students in the experimental and control groups, after the experimental procedure, in the history lesson interest inventory point averages?" In order to find an answer to this sub-problem, the groups' affinity inventory post-test results were compared with the independent sample t-test. The obtained results are shown in Table 5.

Table 5. Comparison of Interest Inventory Post-Test Scores of Experimental and Control Group Students

Post-Test	Group	N	Mean	Std. Deviation	t	p
Interest	Experimental	30	4.60	0.35	3.503	0.001
	Control	30	4.20	0.52		

According to Table 5, there is a significant difference between the interest inventory post-test averages of the experimental ($\bar{X}$= 4.60) and control ($\bar{X}$= 4.20) groups, in favor of the experimental group (t=3.50, p<0 .05). After the experimental procedure, the interest inventory mean scores of the students in the experimental group were significantly higher than the mean scores of the students in the control group. This result showed that museum tour + STEM-based activities in the experimental group were more effective on students' interest in history lessons and museums than the activities carried out in the control group.

The fifth sub-problem of the study was: "Is there a significant difference between the national value and historical consciousness scale mean scores of the experimental and control group students after the experimental procedure?" In order to find an answer to this sub-problem, the National Value and Consciousness Scale post-test results of the groups were compared with the independent sample t-test. The obtained results are shown in Table 6.

Table 6. Comparison of National Value and Consciousness Scale Post-Test Scores of Experimental and Control Group Students

Post-Test	Group	N	Mean	Std. Deviation	t	p
National Value and	Experimental	30	4.58	0.41	1.171	0.246
Historical Awareness	Control	30	4.45	0.42		

According to Table 6, no significant difference was found between the national value and consciousness scale post-test averages of the experimental ($\bar{X}$= 4.58) and control ($\bar{X}$= 4.45) groups (t=1,171; p>0.05). After the experimental procedure, it was observed that the national value and consciousness point averages of the students in the experimental and control groups increased at a similar level. Compared to the pretest scores of the two groups, a very high increase was found in the posttest national value and history awareness scores. This result showed that there was a significant increase in the national values and historical awareness of both the museum tour + STEM-based activities and the students in the control group who only took a museum tour.

Discussion

Significant results were obtained in the experimental research, in which the effects of museum visits and STEM applications on the history lesson knowledge, attitude, interest in activities and national value and consciousness level of secondary school students were examined. According to the research findings, the students in the experimental group, in which the museum tour and STEM applications in the classroom were carried out together, achieved significantly higher course success compared to the students in the control group, who visited the traditional museum. These findings are similar to the research findings of Craver (1996), Eamon (2006), and Nichol (1996). The application of an evidence-based approach in history teaching, together with a museum tour, has a positive effect on students' level of knowledge and gaining competencies in understanding what historians do, partially or completely, doing what the historian did, and continuing their own history studies (Nichol, 1996). Eamon (2006) also argues that in the STEM-based, evidence and observation-based teaching method, the student rather than the teacher works effectively. Working with STEM-based evidence for the student contributes to active learning and understanding. Craver (1999) examining the primary sources related to the history lesson both in the museum environment and in the classroom environment provides important contributions to students in reaching the truth. It helps to discover the truth about people, events and problems. They provide an instantaneous representation of events, these sources create an environment that makes reading exciting even after the fact. In this context, reinforcing the subjects in the classroom with STEM and similar methods after the museum visit in order to make the gains realized in the museum environment more permanent, to clarify the necessary points, to develop creative thoughts, and to assimilate knowledge and experiences provides a high level of learning (Alakuş,

2009). In a study conducted by Kampouropoulou, Fokiali, Efstathiou, Koutris, and Stefos (2015: 2) with Greek high school students in 1st, 2nd and 3rd grades, students asked, "Can a virtual museum realized in a school environment help you get to know the culture of a place better?" by 41%, "Do you believe that a virtual museum will help you learn about the culture of a place?" 38% to the question "Do you believe that a virtual museum about the past of a place will help you better understand the history of that place?" 45% of the respondents gave a positive answer to the question. In the same study (Kampouropoulou, Fokiali, Efstathiou, Koutris, & Stefos, 2015: 3), students asked, "Do you think it would be interesting to visit a virtual museum?" They answered the question positively by 44% and negative by 23%.

In another finding of the study, the students in the experimental group, in which the museum visit and STEM applications in the classroom were carried out together, had a significantly higher level of attitude and interest towards the lesson compared to the students in the control group, who visited the traditional museum. When the pretest-posttest mean scores of the groups were examined, it was seen that the students in both groups showed an increase in their attitudes towards the history lesson, their interest in the lessons and museum visits. This finding is based on Antonaci, Ott, and Pozzi (2013), Kampouropoulou, Fokiali, Efstathiou, Koutris and Stefos (2015), Maccario (2002), Seidel and Hudson (2005), Turgut (2015), Ulusoy (2010)), are similar to the findings of studies by Yi and Hwang (2003). According to Maccario (2002), the environment that museums offer provides a learning environment that will create interest in the outside world related to the subject in question, that is real, that gives pleasure, and that offers the opportunity to practice on various subjects. When museums are redesigned in schools with a technology-supported approach, they can become an entertaining, interesting and socially functional place in the eyes of students. Perceived ease of use is also positively affected when users find information systems personally enjoyable (Yi & Hwang, 2003). In the study by Turgut (2015), as well as real museum visits, in the lessons where virtual museums are used and active teaching techniques are used at school, students also add their emotions to learning, they empathize with some people through objects, they feel like they are in a real museum, they are more active and willing in lessons. It has been revealed that they are careful and careful, they have the opportunity to research, compare, make predictions, they can learn by seeing, and learning becomes easier and permanent due to the use of different sense organs. Besides, students' course attitudes have also changed positively. Along with the education applied at school, education in museums allows it to have a complementary effect by increasing the quality of education, making it richer and more supportive. Museum education can provide practical skills, a critical look at a subject, as well as the development of empathy and curiosity (Seidel & Hudson, 1999). Both this research and other research results reveal that students find STEM supported virtual museum trips useful and interesting in the school environment. For this reason, STEM supported virtual museum applications can be used in accordance with the subject and achievements within the scope of history lessons.

The last finding of the study is about the effect of museum education on the level of national value and historical consciousness. According to the research findings, it was observed that the national values and historical consciousness averages of the students in the experimental and control groups increased at a similar level. Especially compared to the pretest scores of the two groups, a very high increase was found in the posttest national value and consciousness scores. This result showed that there was a significant increase in the national values and consciousness of both the museum tour + STEM-based activities and the control group students who only visited

the museum. These findings are supported by the results of studies conducted by Penna (2007), Süzen (2005), and Ustaoğlu (2012). Museums have collections of cultural value. Examining, evaluating, exhibiting these collections with various scientific methods, and making students like them by contributing to education also make important contributions to the formation of national value and historical awareness. Therefore, the use of museums for educational purposes should not be limited to real museum trips, but should be supported with STEM, computer-assisted virtual museums and art galleries in the classroom.

Today, teachers are trying to find ways to keep student interest and learning alive and to develop new methods. Historical places are common areas where educators and experts reach and care about their students and each other with great superiority. Introducing students to historical events, facts and places as real remains of the past, with STEM activities and museum visits in the lessons, not only establishes an emotional connection with the past, opens mental doors by arousing curiosity, but also provides an understanding of past events and people. This situation provides important contributions to the formation of national values and consciousness of students. In this research, students examined, discussed and evaluated the STEM practices and the observations they made during museum visits, their experiences with the customs, traditions and traditions of the past, and the multifaceted causes and consequences of the events that occurred at that time. Students have the opportunity to examine the elements that make up Kazakh culture and history and their historical roots in the culture and heritage learning area included in the history curriculum. In addition, by understanding the cultural elements that have an important place in the formation of national consciousness and their development processes, they have gained sensitivity on the protection and development of cultural heritage. In addition to museum visits in history lessons, tools such as photographs, maps, films, CD-ROMs, history and social studies documentary programs, multimedia and hypermedia were used within the scope of STEM applications and were employed as a part of the lesson. In addition, it has been observed that making virtual field trips to the places where the tour cannot be organized, with the help of the internet, has important effects in terms of the students' national value gains.

Conclusion

In this study, the findings of the experimental research showed that the museum tour and STEM applications on this basis had positive effects on the history lesson knowledge, attitude, interest in activities, and national values and consciousness levels of secondary school students. In this context, it has been seen that the use of museums with an interdisciplinary approach in history lessons, with contemporary approaches such as STEM in the education process, has very positive effects on course gains, attitudes and interests, understanding of history, and raising individuals who are conscious of national and cultural values. In this way, the museum, historical-archaeological and ethno-cultural elements that make up the socio-cultural texture of the Kazakh society should be given different perspectives to the students, and the national cultural heritage should be embraced and protected, the past should be interpreted and the present should be tried to be understood as a priority in the curricula.

Based on the findings of this research, it is recommended to give history lesson teachers in-service training on museum visits and STEM practices. Museums that can be used according to subjects and acquisitions in history

teaching programs can be emphasized in more detail. History teacher candidates can be given training on museum visits, STEM applications and virtual museum use during their undergraduate education, and current teachers through in-service training seminars. In addition, in the future research, the effects of museum visits and STEM applications with mixed and qualitative research methods on the course outcomes of students studying at different education levels can be investigated.

Note

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References

Aguilera, D. & Ortiz-Revilla, J. (2021). STEM vs. STEAM Education and Student Creativity: A Systematic Literature Review. *Education Sciences, 11*(7), 331. https://doi.org/10.3390/educsci11070331

Alakuş, A. O. (2002). *The application of graphic design subjects in the 6th grade painting-business curriculum of primary schools with the multi-field art education method and in an environment organized according to this method.* (PhD Thesis). Gazi University Institute of Educational Sciences. Ankara.

Amirbekova, D., Kussaiyn, M., & Narbaev, T. (2022). Scientific Production and Science Policy in Kazakhstan: A Survey. In O. Noroozi & I. Sahin (Eds.), *Studies on Education, Science, and Technology 2022* (pp. 223-240). ISTES Organization.

Amodio, L. (2013). *Science centres and science events*. Milano: Springer; Science communication at glance; pp. 27–46.

Andrews, R., McGlynn, C. & Mycock, A. (2009) Students' attitudes towards history: does self-identity matter?, *Educational Research, 51*(3), 365-377, DOI: 10.1080/00131880903156948

Antonaci, A., Ott, M. & Pozzi, F. (2013). Virtual museums, cultural heritage education and 21st century skills. *ATEE-SIREM Winter Conference Proceedings, Learning & Teaching with Media & Technology* (7-9 March 2013, Genoa, Italy) (185-195). Retrieved from https://atee1.org/wp-content/uploads/2016/06/2013-Winter-ConferenceProceedings.pdf

Ariese, C.E. (2019). *Amsterdam Museum(s): In Search of a History, an Identity, and a Future*. Amsterdam Museum Report, Amsterdam: ECHOES

Buyurgan, S. (2002). A Scheduled Museum Visit and Application Example Afterwards Gazi University. *1st Art Education Symposium Proceedings*, Ankara: Gazi University Publications.

Cameron, D. (1971). The museum, a temple or the forum. In: Anderson G, editor. *Reinventing the museum*. New York: Altamira Press; pp. 61–73.

Caulton, T. (2006). *Hands-on exhibitions: Managing interactive museums and science centres*. New York:

Craver, K. (1999). *Using internet primary sources to teach critical thinking skills in history*. Westport, CT: Greenwood Publishing Group.

Demircioğlu, İ. H. (2010). *Student-centered approaches in history teaching*. Ankara: Anı Publications.

DeWitt J. & Osborne J. (2007). Supporting teachers on science-focused school trips: Towards an integrated framework of theory and practice. *International Journal of Science Education, 29*(6), 685–710. 10.1080/09500690600802254

Dudin S.M. (1921). Photography on ethnographic trips. *Kazan Museum Bulletin*. No: 1-2. pp. 31-51.

Eamon, M. (2006). A "Genuine Relationship with the Actual": New Perspectives on Primary Sources, History and the Internet in the Classroom. *The History Teacher, 39*(3), 297-314. https://doi.org/10.2307/30036799

Eguchi, A. & Uribe, L. (2017, March). Robotics to promote STEM learning: Educational robotics unit for 4th grade science. In *2017 IEEE Integrated STEM Education Conference* (ISEC) (pp. 186-194). IEEE.

Fishman, B., Konstantopoulos, S., Kubitskey, B. W., Vath, R., Park, G., Johnson, H. & Edelson, D. C. (2013). Comparing the impact of online and face-to-face professional development in the context of curriculum implementation. *Journal of Teacher Education, 64*(5), 426-438.

Friedman, A.J. (2010). The evolution of the science museum. *Physics Today, 63*(10), 45–51.

Gupta, P., Adams, J., Kisiel, J., & Dewitt, J. (2010). Examining the complexities of school-museum partnerships. *Cultural Studies of Science Education, 5*(3), 685–699. 10.1007/s11422-010-9264-8

Hartono, R. & Ozturk, O. T. (Eds.). (2022). *Studies on Social and Education Sciences 2021*. ISTES Organization.

Hubbard, J. & Odebiyi, O.M. (2021) Examining elementary social studies preservice teachers' dispositional thinking about museum pedagogy. *The Journal of Social Studies Research, 45*(4), 227-239.

International Council of Museums ICOM. (2018). *What is museum?* Retrieved from http://icom.museum/thevision/museum-definition/

Janibekov, U.D. (1982). *The culture of Kazakh craft*. Alma-Ata: Oner Publication

Kampouropoulou, M., Fokiali, P., Efstathiou I., Koutris, T. & Stefos, E. (2015). Students' views on the use of a virtual educational museum. *Review of European Studies, 7*(11). 1-6.

Keefe, D. F. & Laidlaw, D. H. (2013). Virtual reality data visualization for team-based STEAM education: Tools, methods, and lessons learned. In *International Conference on Virtual, Augmented and Mixed Reality* (pp. 179-187). Springer, Berlin, Heidelberg. Mataric, M. J., Koenig, N. P. & Feil-Seifer, D. (2007, March). Material

Kholdorjonqizi, M. F. (2021). The state museum of history and culture of namangan region past and today. sian *Journal of Multidimensional Research, 10*(8), 84-89.

Kibici, V. B. (2022). Effects of Online Constructivist 5E Instructional Model on Secondary School Music Lessons. *International Journal of Technology in Education (IJTE), 5*(1), 117-131. https://doi.org/10.46328/ijte.241

Kisiel, J. F. (2003). Teachers, museums and worksheets: A closer look at learning experience. *Journal of Science Teacher Education, 14*(1), 3–21. 10.1023/A:1022991222494

Kuo, H.C., Tseng, Y.C. & Yang, Y.T.C. (2019). Promoting college student's learning motivation and creativity through a STEM interdisciplinary PBL human-computer interaction system design and development course. *Think. Ski. Creat. 31*, 1–10.

Land, M.H. (2013). Full STEAM ahead: The benefits of integrating the arts into STEM. *Procedia Comput. Sci. 20*, 547–552.

Lee, C.W. & Lin, LC. & Hung, H.C. (2021). Art and Cultural Participation and Life Satisfaction in Adults: The

Role of Physical Health, Mental Health, and Interpersonal Relationships. *Front Public Health, 21*(8), 582342. doi: 10.3389/fpubh.2020.582342. PMID: 33558844; PMCID: PMC7864897.

Li, Y.Y. (1984). *A Study on Kaohsiung Citizens' Cultural Needs and Participation*. KA, Taiwan: Research, Development and Evaluation Commission.

Macalalag, A. Z., Sahin, I., Johnson, J., & Bicer, A. (Eds.). (2022). *Internalization of STEM Education*. ISTES Organization.

Maccario, N. K. (2002). The use of museums as an educational environment. *Uludag University Journal of Education Faculty*, 15, 1, 275-285.

MacPherson, A., Hammerness, K. & Gupta, P. (2019) Developing a Set of Guidelines for Rigorous Evaluations at a Natural History Museum. *Journal of Museum Education*, *44*(3), 277-285, DOI: 10.1080/10598650.2019.1585172

MacPherson, A., Hammerness, K., & Gupta, P. (2019). Developing a set of guidelines for rigorous evaluations at a natural history museum. *Journal of Museum Education, 44*(3), 277-285.

Marston, C. & Wolfer, J. (2017). Projecting computing history: A hybrid live-virtual visit to the national museum of computing, *2017 IEEE Global Engineering Education Conference (EDUCON)*, 2017, pp. 1438-1442, doi: 10.1109/EDUCON.2017.7943037.

Mataric, M. J., Koenig, N. P. & Feil-Seifer, D. (2007, March). Materials for Enabling Hands-On Robotics and STEM Education. *In AAAI spring symposium: Semantic Scientific Knowledge Integration* (pp. 99- 102).

McManus, P.M. (1992). Topics in museums and science education. *Studies in Science Education*, 20, 157–182.

Melkov, A.L. (1929). *Program for the study of the life of the Kazakhs*. Almatı: Kazizdat Pubilcation.

Morgan, D. & Rasinski, T. (2012). The power and potential of primary sources. *The Reading Teacher*, *65*(8), 584-594.

Nichol, J. (1996). *Tarih öğretimi.* (Yay. Haz. Mustafa Safran). Ankara: Gazi Publication

Origet du Cluzeau, C. & Tobelem J.M. (2009). *Culture, tourisme et développement. Les voies d'un rapprochement*. L'Harmattan; Paris:

Özkartal, M. (2009). *The effect of the epic of dede Korkut on the acquisition of national values in the primary school art activities lesson*. (PhD Thesis). Gazi University, Ankara.

Özrili, Y. (2021). Educational Applications with Stem + a Examples of Museums. MECMUA - *International Journal of Social Sciences*, *6*(11), 230-257

Park, H.; Kim, Y.; Nho, S.; Lee, J.; Jung, J.; Choi, Y.; Han, H.; Baek, Y. (2012). Components of 4C-STEAM education and a checklist for the instructional design. *J. Learn. Cent. Curric. Instr., 12*, 533–557.

Pedretti E,& Iannini A.M.N. (2021). Towards Fourth-Generation Science Museums: Changing Goals, Changing Roles. *Can. J. Sci. Math. Techn. Educ., 20*(4), 700–14. doi: 10.1007/s42330-020-00128-0. Epub 2021 Jan 23. PMCID: PMC7826151.

Penna, S. L. (2007). *Beyond Planning a Field Trip: A Case Study of The Effect a Historical Site's Educational Resources Have on the Practices of Four Urban Eight Grade Social Studies Teachers*. Massachusetts Lowell University.

Prishchepova, V.A. (2011). *Illustrative collections on the peoples of Central Asia in the second half of the 19th - early 20th centuries in the collections of the Kunstkamera*. St. Petersburg: Nauka.

Rennie, L.J. & McClafferty, T.P. (1996). Science centres and science learning. *Studies in Science Education*,

27(1), 53–98.

Rezvan, E.A. (2010). *Samuel Dudin – photographer, artist, ethnographer (materials of expeditions to Kazakhstan in 1899 and 2010)*. Saint-Petersburg: Peter the Great Museum of Anthropology and Ethnography

Sadykova, G.T. (2013). Kazakh Traditional Musical Culture: Worldview Universals. *Middle-East Journal of Scientific Research. 16*(11), 1470-1475, 2013. IDOSI Publications/ISSN1990-9233.

Santiago Canyon College. (2021). Santiago Canyon College. Retrieved from https://sccollege.edu/Library/Pages/primarysources.aspx

Seidel, S, Hudson, K. (1999). *Museum Education and Cultural Identity.*

Shaw, W. (2004). *Osmanlı müzeciliği, müzeler, arkeoloji ve tarihin görselleştirilmesi*. (E. Soğancılar Çev.). İstanbul: İletişim

Stergiopoulou, M., Karatrantou, A. & Panagiotakopoulos, C. (2016, November). Educational robotics and STEM education in primary education: a pilot study using the H&S electronic systems platform. In *International Conference EduRobotics*, pp. 88-103. Springer, Cham

Süzen, H. N. (2005). *İlköğretim Okullarında Görevli Yöneticilerin Resim-ĠĢ Öğretmenlerinin Müze ve Sanat Galerilerinin Görsel Sanatlar (Resim-ĠĢ) Eğitimi Amaçlı Kullanılmasına ilişkin Görüşleri*. Thesis, Gazi University.

Tran, L. U. (2007). Teaching science in museums: The pedagogy and goals of museum educators. *Science Education, 91*(2), 278–297. 10.1002/(ISSN)1098-237X

Turgut, G. (2015). *Sosyal bilgiler dersinde bir eğitim aracı olarak sanal müzelerden yararlanma*. Thesis, Adnan Menderes University, Aydın.

Uslu, Ö. (2008). *Carrying out education in an interactive environment with the museum in visual arts lessons in the second level of primary education* (PhD Thesis). Gazi University, Ankara.

Ustaoğlu, A. (2012). *Ilköğretim 7. Sınıf Sosyal Bilgiler Dersi Türk Tarihine Yolculuk Ünitesinde Sanal Müzelerin Kullanımının Öğrenci BaĢarısına Etkisi.* Thesis, Gazi University, Ankara.

Veccia, S. H. (2004). *Uncovering our history: Teaching with primary sources*. American Library Association

Vella, Y. (1999). Using historical sources with primary school children. *Education, 5*, 3-5.

White, J.M. (2018). Improving Museum Field Trips' Contributions to Experiential Education for STEM Disciplines. *NACTA Journal, 62*(2), 104-114.

Williams, P. (2007) *Memorial Museums: The Global Rush to Commemorate Atrocities*. Oxford; New York: Berg Publisher.

Yerzhanova, F.M., Sadykova G.T., Zhandykeev G.E., Amrebayeva Zh.T. (2013). Concepts of "Faith" and "Knowledge" in the spiritual-ethical and religious paradigm. *EJSaT – European Journal of Science and Theology, 13*(3), 149-161 (ISSN18410464).

Yi, M. Y. ve Hwang, Y. (2003). Predictingthe Use of Web-Based Information Systems: SelfEfficacy, Enjoyment, Learning Goal Orientation, and the Technology Acceptance Model. *International Journal of Human-Computer Studies, 59*(4), 431–449.

Yılmaz, E. & Sünbül, A. M.. (2009). Developing Scale of University Students Entrepreneurship. *Selçuk University, Journal of Social Sciences, 21*, 193-202.

Yücel, E. (1999). *Museum Studies in Turkey*. İstanbul: Archeology and Art Publications

Yurt, E. (2011). *Sanal ortam ve somut nesneler kullanılarak gerçekleştirilen modellemeye dayalı etkinliklerin*

uzamsal düşünme ve zihinsel çevirme becerilerine etkisi (The effect of modeling-based activities using virtual environment and concrete objects on spatial thinking and mental translation skills). PhD Thesis, Selçuk University.

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