The Effect of Computer-Assisted Instruction on Piano Education: An Experimental Study with Pre-service Music Teachers

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Article Info	Abstract
	This study investigated the effect of computer assisted teaching practices in piano courses in Department of Music Education of Faculty of Education on students' success, piano playing skills and to what extent they provided permanent learning. The research was carried out with the pre-test/post-test research design with a control group, one of quasi experimental designs. In the study, the experimental group was provided computer-assisted piano instruction, while the control group received the regular curriculum instruction. There were 7 female and 6 male students in the control group and 6 male and 7 female students in the experimental group. A computer-assisted piano instruction program was developed for the experimental group. Instruction in the experimental and control groups lasted for 10 lessons. Piano Achievement Test and Piano Observation Form were used as data collection tools. Mann Whitney U test was used to test permanent learning and the success and piano skills of the groups. The results of the research show that computer assisted piano instruction applied in the experimental group is more effective than the regular curriculum instruction in increasing students' course success and permanent learning. However, no significant difference was found between the post-test levels of the experimental and control groups in terms of piano skills.

Introduction

Insufficient traditional education has led to the research and application of new approaches by music educators because the "information society" demands alternative approaches to traditional teaching (Altakhyneh & Abumusa, 2020; Elliston, 2020; Perdana, Jumadi, & Rosana, 2019; Wallace-Spurgin, 2018). In the century we live, the accuracy of information changes in a very short time. In order to keep up with this change, it is necessary to raise individuals who think creatively rather than individuals who think in stereotypes (Mason & Moniz, 2005; Watson, 2006). There is also a question of individual differences in education. The way each student acquires musical knowledge and skills may differ. For this reason, it is recommended to use modern technologies, different methods and techniques in music education (Cain, 2004; Dorfman, 2006). Computer-assisted instruction (CAI) is a teaching method in which computer is used as an environment and strengthens the teaching process and student motivation; it is a combination of self-learning principles with computer technology which the student can benefit according to their own learning speed. CAI can be defined as the activities in which students interact with the courses programmed on the computer, the teacher is the guide and the computer is a learning environment (Abdullah & Mustafa, 2019; Soparat, Arnold & Klaysom, 2015; Sünbül, Gündüz, & Yılmaz, 2002).

In today's world where the impact and importance of computers and computer products in learning and teaching processes are constantly increasing, it is believed that it is important to train teachers who are key in the system as people who change and improve their behavior so that these technologies can be used correctly in the education system and their possible benefits are realized at a high level (Apeanti, 2016; Aşkar & Umay, 2001; Baş, Kubiatko&Sünbül, 2016; Demirer, Özdinç, & Şahin, 2009; Koçak-Usluel & Seferoğlu, 2003; Yılmaz, Köseoğlu, Gerçek, & Soran, 2004). The teaching has become a profession that requires more qualifications and competence today. The skills, attitudes and self-efficacy of teachers who will use computer and computer-assisted educational software are very important in the use of this technology (Demirer, Çintaş & Sünbül, 2010; Özçelik & Kurt, 2007).

For CAI in music lesson, course supporting materials can be created with sound recording and musical notation programs apart from basic computer operations such as typing, drawing shapes, making lists or graphs. In addition, these programs may enable creativity oriented works such as small scale compositions and arrangements. The computer can also facilitate the listening and music reading stages, which are very important

in music education. Therefore, determining the attitudes and self-efficacy perceptions of pre-service music teachers towards CAI in music education is important in terms of providing the necessary conditions for the use of new technologies in music education (Lehimler, 2016). Computers in music teaching, in general, focus on specific tasks related to typical musical activities in an attempt to minimise uncertainties from such an open-ended domain. A number of teaching strategies ranging from simple concept presentation to more exploratory strategies have been adopted to achieve the particular educational goals (Brandao, Wiggins & Pain, 1999).

It has been stated that CAI positively affects the learning speed and creative thinking skills of students who receive music education in many ways (Alan & Sünbül, 2010). Thanks to CAI in music education, different information can be blended and audiovisual materials can be used as a whole. Thus, the goals of music education can be easily achieved in a short time (Portowitz, Peppler & Downton; Upitis & Brook, 2016). Utilizing CAI in the education of pre-service music teachers, enabling it to integrate and interact with the existing teaching processes will make important contributions to this field (Barry, 2004).

Although technology-assisted instruction has been adopted in the field of education by many universities in Turkey, it has not yet started literally in music education (Kasap, 2007). However, it is a necessity of the age to spread the technology-oriented teaching environments in the field of music education and to teach the pre-service music teachers how to use the related programs especially in technology-related courses. Technological materials can also help overcome some deficiencies that may be encountered during the education and training process in music education departments. An important problem is that many students play their instruments solo as they cannot find someone to accompany the musical piece on the piano. Thus, students are deprived of the many benefits of playing together with others. In many studies on music education, these gains are expressed as increasing student motivation, creating a pleasant working environment, developing self-confidence, listening to other instruments, making clear intonation, and developing polyphonic hearing (Mustul, 2005; Yüksel & Mustul, 2015).

It is a proven fact that piano education, which is one of the most important dimensions of music education, makes an effective contribution to the individual's other musical elements in addition to playing the piano. The training performance of the individual receiving education is directly proportional to the level of piano playing (Napoles et al., 2017). The piano instructor should also help the learner accurately determine the path to the goal. Research shows that individuals learning piano today only read the notes, memorize as soon as possible, and then forget and have difficulty playing the same piece of music again (Deal, 1985; Dannenberg et al., 1990). Using supportive teaching materials and applying them to the teaching process throughout the piano education makes the learning process more efficient. Thus, the instructor can give an efficient and effective piano education using instructional technologies.

The piano lasts one academic year and two semesters, one credit per semester in music education program. Computer-related courses in the Music Teaching Program are four credits in the first semester of the first year and the fourth semester of the second year (Lehimler, 2016). Interdisciplinary studies are frequently encountered with scientific studies in the education and training applications. These studies are also valid for piano and computer lessons. Trying to solve the problems encountered in piano rhythm and melodies by using music technologies also offers students a new perspective in music analysis.

This research is extremely important in terms of materializing the topics to be taught in the students' mind, ensuring more enjoyable and repeatable lessons, explaining CAI methods in piano lessons and drawing attention to the use of CAI methods in all other courses in the field of music education and training by using computers, which have become an indispensable part of our lives. Regarding teachers, this study is extremely important in terms of the contribution of computer-assisted piano lessons to academic success, permanent learning, determining the educational program and software criteria prepared for CAI in accordance with the curriculum. In this regard, the effects of computer-assisted piano instruction on student achievement, piano playing skills and permanent learning were examined in this research.

The research aimed to find answers to the following questions:
1. Is there a significant difference between the academic achievements of the experimental group who received computer-assisted piano instruction and the control group that received the regular curriculum instruction?
2. Is there a significant difference between permanent piano skills of the experimental group who received computer-assisted piano instruction and the control group that received the regular curriculum instruction?

3. Is there a significant difference between piano skills of the experimental group who received computer-assisted piano instruction and the control group that received regular curriculum instruction?
4. Is there a significant difference between the scores of permanent piano skills of the experimental group who received computer-assisted piano instruction and the control group that received regular curriculum instruction?

Method

Pre-test/post-test design with a control group was conducted in the study in order to investigate the effect of CAI on student achievement and permanent learning in the first year piano lessons of Music Education Department. Table 1 presents the experimental model with symbols.

Table 1. Experimental Design of the Research

	T11	Experimental Treatment	T21	Retention Test
RG1 Experimental Group	Pre-test Measurements	-X-Computer-Assisted Instruction	Post-test Measurements	T3
RG2 Control Group	Pre-test Measurements	Regular Curriculum Instruction	Post-test Measurements	T3

RG1- Experimental group
RG2- Control group
T1, 1- Pre-test (Piano achievement test)
X- Computer Assisted Instruction
T2 Post-test (Piano achievement test)
T3 Retention Test (Piano achievement test)

The research was conducted using the pre-test/post-test design with a control group, one of quasi experimental research designs. 3 basic rules must be followed in experimental research designs (Karasar, 2002). Accordingly, in the real experimental designs, there are at least two groups as experiment and control, and pre-test is applied at the beginning of the application and post-test in the end. In addition, subjects are randomly assigned to experimental and control groups. Due to some limitations, individuals could not be randomly assigned when creating groups. Therefore, the experimental model used in the study was accepted as a quasi-experimental research design. In this research, in which the effect of computer-assisted teaching practices on the first year piano lesson was tested, a curriculum covering CAI was implemented in the experimental group and the regular curriculum instruction in the control group for the first year piano lesson.

Participants

This study was carried out with pre-test/post-test design with a control group aiming to find out the effect of CAI on first year students' piano lesson outcomes and permanent learning in the Department of Music Education. Accordingly, experimental and control groups were formed according to the principles of the experimental model. Permissions from the relevant university were obtained in order to carry out this study. The research was conducted at a university in Turkey. There were 13 students in the experimental and control groups of the study, in which random assignment could be made in groups. 7 of the students in the experimental group were female and 6 of them were male. The average age of students in the experimental group was 19.11±0.83. There were 7 female students and 6 male students in the control group. The average age of the control group was 19.26±0.89. Students studying in the classes included in the study had a similar socio-economic level. The same lecturer conducts piano lessons of all groups. Different variables had an impact on the inclusion of experimental and control groups in the research. These variables can be listed as providing the necessary support of the university in experimental applications, and high motivation of managers and students in the department of music education for research.

Experimental Treatment

In this study, which investigated the effect of computer-assisted first year piano instruction in Department of Music Education on students' success and permanent learning, the following experimental processes were carried out:

1. The CAI curriculum was prepared to be used in the experimental group as a contribution to the first year piano lesson outcomes. For this purpose, a plan was made that illustrates the contents of the course curriculum related to the learning outcomes and turns them into activities. These plans included CAI activities created for each outcome. At this stage, a team of 2 academicians who held PhD in music education and 1 instructor in the field of Instructional Technologies was established. The activities were planned and carried out in line with the opinions of the experts in the team. The principles and instructions of the first year piano lesson curriculum and the explanations about the activities were taken into consideration in the experimental group.

2. Piano Achievement Scale and Piano Observation Form to be applied in the research was created and the reliability and validity tests of the scales were performed. Piano Achievement Scale was developed and its reliability and validity were tested before research.

3. Experiment and control groups were formed. At this stage, students studying in music teaching department were assigned to experimental and control groups according to the selected experimental model criteria.

4. Piano Achievement Scale was applied as a pre-test in experiment and control groups. The application was carried out simultaneously within the same week.

5. The piano teaching program based on CAI activities in the experimental group, and the regular first year piano teaching curriculum instruction activities in the control group were applied simultaneously. Instruction in both groups lasted for 10 hours (10 Sessions) within the framework of the curriculum. At this stage, a program was prepared in accordance with the contents of the piano lesson for the first year determined by Higher Education Board.

6. At the end of the experimental period, the piano achievement test developed for the students in both groups was applied as a post-test. Post-test application was carried out simultaneously on the same day. 15 days after the post-test application, piano achievement test and observation forms were applied to both groups as retention test.

In the experimental group, Finale Software, one of the music software, was used for CAI. In the Finale Software, the pieces of music existing in the piano literature were arranged and the supporting contributions of technology were analyzed with certain criteria by using computer technology supported methods. The music pieces to be played were written together with the student with the Finale Program, and MIDI application was used to speed up/slow down the pieces during the piano study. Arrangements such as Rhythm Recognition, Melody Recognition, Tone Terms Recognition, Tempo Terms, Dynamics-Thesis, Syncope, Fermata, Legato, Staccato, Portato applications in the work were performed with the Finale Program. By using Music Animation Machine (MAM) program, the musical notes in written form were converted into visual elements and the tracks were supported with colorful graphics according to the duration and sections of the notes.

Data Collection Tools

Piano Achievement Test and Piano Skills Observation Form were used to collect the data in this study, which investigated the effect of the curriculum based on CAI activities on students' success and learning retention in the first year piano lessons in the Department of Music Education

Piano Achievement Test

It was developed to measure the piano achievements of first year pre-service teachers in the Department of Music Education. While developing the first year Piano Achievement Test Scale, the course curriculum was examined and opinions of the experts and academicians in the field were elicited. Thus, expressions representing the achievements of the first year piano lesson are included in the scale. In this way, the content validity of first year Piano Achievement Test was established.

Then, two test questions were prepared to represent each acquisition. Thus, 30 questions were prepared for the piano lesson. In order to test the agreement of the questions in the pilot test with the gains and scale development principles and to ensure the content validity, expert opinions of three academicians in the field of music education and one in the field of assessment and evaluation area were elicited. At this stage, a rating scale from 1 to 5 (Less appropriate -Very appropriate) was used for the questions in the test. The experts were also asked to write a brief explanation about the items they did not find appropriate and why they did not find it.

According to the opinions of the experts, the 20-question test has 3 dimensions in terms of content validity. These dimensions are 'piano education', 'harmony' and 'forms of music'. The psychoanalytic behaviors, basic harmonic and formal analysis methods in the piano pieces prepared according to the course content of the first class in the scale were asked theoretically. 1 and 0 point system was used for scoring of the scale. In the total of the scale, the lowest score a student can get is 0 and the highest score is 20. Piano Lessons Achievement Test was applied with 40 students who study in the music departments of different universities in Turkey, and reliability and validity analyses were performed. The results of the item analysis of the pilot application are shown in the Table 2 below.

Table 2. Item Analysis

Questions	Pj	Rjx	Questions	Pj	Rjx
m1	.73	.66	m11	.46	.34
m2	.73	.62	m12	.35	.38
m3	.73	.62	m13	.78	.55
m4	.59	.46	m14	.38	.31
m5	.78	.51	m15	.70	.54
m6	.70	.32	m16	.13	.34
m7	.86	.72	m17	.68	.33
m8	.35	.43	m18	.62	.46
m9	.49	.24	m19	.81	.68
m10	.73	.58	m20	.73	.38

As a result of the analyses, it was found that the item difficulty values (pj) were between 0.13-0.78, and item discrimination values (rjx) were between 0.34 and 0.72. Especially in achievement tests, the item discrimination index has an important place. This value is desired to be above 0.30 (Yılmaz and Sünbül, 2003; Tekin, 1982). According to these findings, it can be argued that all the items of the piano achievement test have a high discrimination value. The total KR-20 value for piano education achievement test is .86. This indicates a high reliability value in terms of testing.

Piano Lesson Observation Form

The piano lesson observation form developed by Pirgon (2013) was adapted for this study by the researcher to measure the piano lesson skills of the students in the experimental and control groups. The observation form was prepared in line with the criteria of the selected pieces. Within the scope of the research, the observation form consists of 7 criteria. These criteria are: "Play the Piece with Clear Sound", "Play the Piece with Correct Rhythm", "Play the Piece with Correct Finger Positions", "Play the Piece without Coherence Problem", "Apply Legato Technique in the Piece", "Use both Hands in Coordination", "Play the Piece at the Correct Tempo". Likert-type scale was taken into account in scoring the observation form. If the student fulfilled the related criterion completely, he or she would get 5, if the student fulfils the criterion very little, he or she would get 1. Item analysis was performed on the results of the trial application of the observation form to a group of 40 students, and then Cronbach's alpha was calculated. The results are shown in the Table 3 below.

Table 3. Piano Observation Form Item Analysis

Observation Criteria	Mean	Std. Deviation	Item-Total Correlation
C1. Play the Piece with Clear Sound	1.98	1.54	.870
C2. Play the Piece with Correct Rhythm	2.93	1.12	.876
C3. Play the Piece with Correct Finger Positions	2.78	1.12	.854
C4. Play the Piece without Coherence Problem	2.95	0.85	.845
C5. Apply Legato Technique in the Piece	2.83	0.81	.712
C6. Use both Hands in Coordination	3.45	0.60	.498
C7. Play the Piece at the Correct Tempo	3.25	0.67	.513

As can be seen in the table, the results obtained by the trial use of the Piano Lesson Observation Form can be seen. Item means, item standard deviation, and item test correlations (Item-Total) analyses for all items of the first year piano lesson observation form were performed. It shows that the mean values of the items of the piano lesson Observation Form was between 1.98 and 3.25. In addition, it is seen that all items in the scale had an item-test correlation of over 0.40. This indicates that all items of the observation form measured consistently with the course outcomes (Yılmaz & Sünbül, 2004). Cronbach's alpha was found at 0.88. This shows that the first year Piano Observation Form had a high reliability coefficient.

Data Analysis

Data were collected through achievement tests and piano playing skills. the analysis of the data, the normality test was performed first (Shapiro Wilk) and it was found that the data showed normal distribution ($p<.05$). Therefore, independent samples t Test was used to compare the achievement test and piano playing skills scores of the groups. Data were analyzed using SPSS 25.0. Because statistical significance is strongly affected by sample size, it is recommended by the American Psychological Association (2014) to report the exact magnitude of difference or effect.

Findings

Table 4 below shows the test scores of students' pre-test piano achievement scores in both groups.

Table 4. Comparison of Pre-test Piano Achievement Test Scores of Students in the Experimental and Control Groups

Groups	N	Mean Rank	Sum of Ranks	Mann Whitney U/Z	p
Experimental	13	12.38	161.00	-.763	0.446
Control	13	14.62	190.00		

The table shows the results of the analysis carried out on the pre-test academic achievement scores of piano lesson of the students in the experimental and control groups. According to statistical analysis, 0.781 value was found between the pre-test total scores of the two groups. Thus, there was no significant difference between the pre-test total scores of the experimental and control groups before the experimental procedures began. Before the research, it could be argued that the experimental group who received CAI and the control group who received the regular curriculum instruction were equivalent in terms of the academic achievement in the piano lesson. Table 5 below shows the test scores of students' pre-test piano skill scores in both groups.

Table 5. Comparison of Pre-test Piano Skill Scores of Students in the Experimental and Control Groups

Observation Criteria	Groups	N	Mean Rank	Sum of Ranks	Mann Whitney U/Z	p
C1. Play the Piece with Clear Sound	Experimental	13	15.27	198.50	-1.38	.243
	Control	13	11.73	152.50		
C2. Play the Piece with Correct Rhythm	Experimental	13	12.85	167.00	-0.50	.687
	Control	13	14.15	184.00		
C3. Play the Piece with Correct Finger Positions	Experimental	13	12.12	157.50	-1.35	.362
	Control	13	14.88	193.50		
C4. Play the Piece without Coherence Problem	Experimental	13	11.73	152.50	-1.60	.243
	Control	13	15.27	198.50		
C5. Apply Legato Technique in the Piece	Experimental	13	13.81	179.50	-0.22	.840
	Control	13	13.19	171.50		
C6. Use both Hands in Coordination	Experimental	13	14.23	185.00	-0.56	.650
	Control	13	12.77	166.00		
C7. Play the Piece at the Correct Tempo	Experimental	13	11.81	153.50	-1.25	.264
	Control	13	15.19	197.50		
Total	Experimental	13	12.38	161.00	-0.75	.479
	Control	13	14.62	190.00		

Table shows the results of the Mann Whitney U test performed on the pre-test first-year piano skill scores of the students in the experimental and control groups. According to the analysis, the Z values in all dimensions of the piano skills scale of the two groups were not significant at the significance level of 0.05. The results showed that

there was no significant difference between the pre-test piano skills scores of the experimental group who received CAI practice and the control group who received the regular curriculum instruction before the experimental procedures began.

Sub Problem 1: *Is there a significant difference between the post-test academic achievement scores of the students in the experimental group where CAI practice is used and the students in the control group where the regular instruction is used?*

Table 6 shows the mean and standard deviation values of the pre-test/post-test scores of the students in the experimental and control groups obtained from the piano lesson academic achievement test.

Table 6. Descriptive Analysis of Pre-test/Post-test Academic Achievement Scores of the Students in the Experimental and Control Groups

	Groups	N	Mean	Std. Deviation
Pre-Test	Experimental	13	9.77	1.92
	Control	13	10.31	1.32
Post-Test	Experimental	13	17.46	0.97
	Control	13	13.77	2.01

Table 7 shows the results of the analysis performed on the post-test piano achievement scores of the students in the experimental group receiving CAI and the students in the control group receiving the regular instruction. According to the analyses performed with the Mann Whitney U test, z-value was found between the two groups. This finding shows that there was a significant difference in favor of the experimental group regarding piano instruction post-test scores. The students in the experimental group, where CAI was used, obtained significantly higher mean scores compared to the control group.

Table 7. Comparison of Post-test Piano Lesson Academic Achievement Scores of Students in the Experimental and Control Groups

Group	N	Mean Rank	Sum of Ranks	Mann Whitney U/Z	p
Experimental	13	19.50	253.50	-4.047	0.000
Control	13	7.50	97.50		

   *p<0.05

Sub Problem 2: *Is there a significant difference between the academic achievement retention test scores of the students in the experimental group where CAI is used and the students in the control group where the regular instruction is used?*

As shown in Table 8, a significant difference was found between the retention test total achievement scores of the students in the experimental group where the CAI activities were performed and the students in the control group where the regular curriculum instruction was applied. (Z=2.25; p<0.05). There was a significant difference in favor of the experimental group in terms of retention test total scores. The applied experimental treatment created a significant level of retention in the academic success of students in the experimental group, where CAI is practiced when compared to the students in the control group.

Table 8. Comparison of Academic Achievement Retention Test Scores of Students in Experimental and Control Groups

Group	N	Mean Rank	Sum of Ranks	Mann Whitney U/Z	p
Experimental Group	13	16.81	218.50	2.25*	0.024
Control Group	13	10.19	132.50		

   *p<0.05

Sub Problem 3: *Is there a significant difference between the students in the experimental group who receive CAI and the students in the control group who receive the regular curriculum instruction?*

Table 9 shows the mean and standard deviation values of the pre-test/post-test scores of the students in the experimental and control groups from the piano observation form.

Table 9. Descriptive Analysis of Pre-test/Post-test Piano Playing Skill Scores of Students in the Experimental and Control Groups

| | Pre-Test | | | | Post-Test | | | |
| | Experimental Group | | Control Group | | Experimental Group | | Control Group | |
Observation Criteria	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
C1. Play the Piece with Clear Sound	2.46	0.52	2.15	0.55	2.92	0.64	3.00	0.41
C2. Play the Piece with Correct Rhythm	2.31	0.48	2.38	0.65	3.54	0.52	3.15	0.38
C3. Play the Piece with Correct Finger Positions	2.00	0.41	2.23	0.44	3.62	0.65	3.08	0.49
C4. Play the Piece without Coherence Problem	1.77	0.44	2.08	0.49	3.85	0.55	3.69	0.85
C5. Apply Legato Technique in the Piece	2.62	0.87	2.62	0.96	3.62	0.77	3.46	0.78
C6. Use both Hands in Coordination	2.77	0.73	2.69	0.63	3.54	0.66	3.46	0.66
C7. Play the Piece at the Correct Tempo	2.00	0.58	2.31	0.75	3.46	0.52	3.31	0.48
Total	15.92	2.29	16.46	2.37	24.54	1.45	23.15	2.15

Table 10 shows the results of the Mann Whitney U test performed on the lesson skills pre-test scores of first year students in the experimental and control groups. The analysis revealed that only in the third criterion of the scale, two groups' mean scores of piano skills showed a significant difference ($Z=-2.48$; $p=045$). However, no significant difference was found in other criteria of the scale and the post-test total scores. According to this result, there was no significant difference between the post-test piano lesson skills scores of the experimental group receiving CAI and the control group receiving the regular instruction after the implementation processes.

Table 10. Comparison of Post-test Piano Skills Scores of Students in Experimental and Control Groups

	Groups	N	Mean Rank	Sum of Ranks	Z	p
C1. Play the Piece with Clear Sound	Experimental Group	13	13.04	169.50	-0.40	.76
	Control Group	13	13.96	181.50		
C2. Play the Piece with Correct Rhythm	Experimental Group	13	16.00	208.00	-2.40*	.048
	Control Group	13	11.00	143.00		
C3. Play the Piece with Correct Finger Positions	Experimental Group	13	16.31	212.00	-2.48*	.045
	Control Group	13	10.69	139.00		
C4. Play the Piece without Coherence Problem	Experimental Group	13	14.58	189.50	-0.78	.47
	Control Group	13	12.42	161.50		
C5. Apply Legato Technique in the Piece	Experimental Group	13	14.35	186.50	-0.65	.57
	Control Group	13	12.65	164.50		
C6. Use both Hands in Coordination	Experimental Group	13	13.96	181.50	-0.35	.76
	Control Group	13	13.04	169.50		
C7. Play the Piece at the Correct Tempo	Experimental Group	13	14.50	188.50	-0.79	.51
	Control Group	13	12.50	162.50		
Total	Experimental Group	13	15.85	206.00	-1.60	.12
	Control Group	13	11.15	145.00		

*$p<0.05$

Sub Problem 4: *Is there a significant difference between the students in the experimental group who underwent CAI and those in the control group where the regular curriculum instruction was applied regarding retention of piano playing skills?*

Table 11 shows first year students in the experimental and control groups' retention test scores of piano skills performed by Mann Whitney U. The analysis revealed that significant differences were only between the two groups' mean piano skills regarding total retention test scores (Z=-2.10; p=.039). However, no significant difference was found between the mean scores in the sub-dimensions (criteria) of the scale. Thus, there was a significant difference in favor of the experimental group receiving CAI in terms of permanent learning in piano skills.

Table 11. Comparison of Piano Skills Retention Test Scores of Students in Experimental and Control Groups

Observation Criteria	Groups	N	Mean Rank	Sum of Ranks	Z	p
C1. Play the Piece with Clear Sound	Experimental Group	13	14.92	194.00	-1.08	.36
	Control Group	13	12.08	157.00		
C2. Play the Piece with Correct Rhythm	Experimental Group	13	14.46	188.00	-0.72	.54
	Control Group	13	12.54	163.00		
C3. Play the Piece with Correct Finger Positions	Experimental Group	13	14.42	187.50	-0.83	.54
	Control Group	13	12.58	163.50		
C4. Play the Piece without Coherence Problem	Experimental Group	13	14.85	193.00	-1.16	.39
	Control Group	13	12.15	158.00		
C5. Apply Legato Technique in the Piece	Experimental Group	13	15.19	197.50	-1.28	.26
	Control Group	13	11.81	153.50		
C6. Use both Hands in Coordination	Experimental Group	13	15.69	204.00	-1.66	.15
	Control Group	13	11.31	147.00		
C7. Play the Piece at the Correct Tempo	Experimental Group	13	14.96	194.50	-1.05	.33
	Control Group	13	12.04	156.50		
Total Retention	Experimental Group	13	16.62	216.00	-2.10*	.039
	Control Group	13	10.38	135.00		

p*<0.05

Discussion

In this study, the effect of CAI practices on students' course success, piano playing skills and permanent learning in the first year piano lessons in the Department of Music Education was investigated with an experimental research pattern. According to the findings of the research, students in the experimental group who received CAI practice in piano lessons achieved higher success levels than the students in the control group where the regular curriculum instruction was implemented. This finding is similar to the results of the research conducted by Barg (2009), Carter (2004), Güven and Sülün (2012), Traynor (2003) and Yeşiltaş and Öztürk (2015). In these studies, it was concluded that CAI practices in general affect the students' academic success and permanent learning positively. In a multivariate study conducted by Jaschke, Eggermont and Honing (2013), significant relationships were found between CAI in music education and academic achievement. It was found that especially CAI music practices significantly increase students' cognitive learning products.

Another finding was that no significant difference was found between the students in the experimental group, where CAI was applied in piano lessons, and those in the control group where the regular curriculum instruction was applied, in terms of total scores. Significant increases were found in the post-test scores of both groups compared to the pre-test scores. Experimental procedures in experimental and control groups provided increases in post-test scores, but did not cause a significant difference between the groups. These findings are similar to the results of the studies conducted by Percival, Wang, and Tzanetakis (2007). According to Percival et al. (2007), daily practice and exercises are especially important in terms of instrument playing skills. One of the most important factors to consider when developing computer-assisted music education programs is to include applications that increase daily practice. Many studies have pointed out the importance of one-to-one teaching activities performed under the guidance of teachers during daily practice (Akbulut, 2013; Pirgon, 2013). In addition, regular and daily work is one of the most important factors in the positive and stable progress of the piano playing process, which is a mental and physical activity. Thus, the exercises and repetitions carried out both in CAI and in the regular curriculum instruction have led to a significant increase in the piano playing skills of students in both groups.

The last finding obtained in the study is that the students' permanent learning in the CAI practice group is higher than the students in the control group in piano lessons. Students in the experimental group achieved higher permanent learning in both academic success and piano playing skills. These findings corroborate the findings of Barg (2009), Dori and Sasson (2008), Kraus et al. (2004), Robb et al. (2015) and Walker (2001).

Throughout the study, it was observed that students who were bored with the monotony of the traditional piano instruction environment had a pleasant lesson and interest in the lesson in CAI environments. This supported permanent learning. According to Robb et al (2015), CAI provides high level of permanent learning because of creating a multi-media learning process, providing opportunities for individual differences and the possibility of customization at every point of the software.

Conclusion

When the effect of CAI and the current curriculum applied in piano lessons in the department of music education on students' success, piano playing skills and the permanence of what is learned was compared, this research revealed significant results. There were significant differences between the success of students in groups where CAI (experiment) and current teaching programs were used in piano lessons. In the experimental group, where CAI was implemented, students' success and the permanence of learning was better and more effective than the students' success in the control group which received the current curriculum. However, no significant difference was found between the post-test levels of the experimental and control groups in terms of piano skills. Using CAI methods and applying them to the teaching process throughout the piano education makes the learning process more efficient. Thus, the instructor can give an efficient and effective piano education using CAI technologies.

Recommendations

The findings of this research show that computer-assisted piano instruction, in particular, and music education, in general, is more effective than the current traditional education. Based on these findings, the use of computer-assisted music education in schools should be expanded. Therefore, music technology institutions that train all the music teachers in Turkey are required to follow the rapid developments. Laboratory environments where music technologies could be used should be created in institutions where music teachers are educated. It should be aimed to train teachers with these qualities by teaching computer and instructional technology lessons in music to pre-service teachers in the programs. In addition, it is recommended to provide the use of music programs and software in computer lessons in institutions that educate music teachers, in addition to instrument training, such as musical hearing-reading-writing, harmony, accompaniment playing, electronic organ training, orchestra/chamber music.

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