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Technology based ınstruction of precipitation titrations

Canan Koçak [a] , Fatma Alkan [a] *

[a]*Hacettepe Üniversitesi, Faculty of Education, Beytepe, Ankara, 06800, Turkey*

Abstract

The aim of this study is to investigate the effects of technology based chemistry education on preservice teachers' views related to the role of technology on teaching and learning and achievement in chemistry. To determine preservice teachers' views of science teacher candidates about the roles of technology on teaching and learning in education The Roles of Technology on Teaching and Learning Practices Scale developed by Çil (2008) was used.. As a result of the research it has been determined that preservice teachers' developed positive views towards the roles of technology on teaching and learning practices and the achievement of the preservice teachers' has increased.

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Keywords: Chemistry, technology based education, teacher candidates

1. Main text

In the constructivist paradigm, it is believed that each individual's past experiences, beliefs and perceptions are different and that through them knowledge is constructed in diverse forms by that individual (Jonassen, 1990). This is because learning is an active process and in this process knowledge is handled by means of organisation. Individuals use different channels in order to process knowledge visually and aurally (Mayer, 2001). One of these channels is technology. Technological devices change daily, and like the way it is in daily life, technology can also be used in forms that respond to the needs of education and instruction settings (Van Wyk & Louw, 2008). The more the learners use knowledge the more their usage of it improves (Klauer, 2001). With the inclusion of technology in the field of education, the construction and application processes of knowledge have transformed alongside the process of accessing it.

* Corresponding Author Canan Koçak. Tel.: +90-312-297-67 83 fax: +90-312-297-20 83
E-mail address: canan.kck@gmail.com

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Technology is constantly changing and improving. The newest technologies also render the teachers' educational instructions more important and interesting. According to Uşun (2000), educational technology is the kind of technology that increases the quality in the learning-teaching process and makes it more productive and efficient for both the teacher and the student. Teachers and trainee teachers, who can choose the most appropriate tools and materials for the students, stand out in the implementation of technology at schools. This is because teachers and trainee teachers are the people who facilitate the use of technology at schools and classrooms (Heinich, Molenda, Russell & Smaldino, 2002).

Hooper and Rieber (1995) propose a model that consists of five stages for the facilitation of new technologies in education: familiarisation, utilisation, integration, reorientation and evolution. At the familiarisation stage, the teachers themselves learn how to use the technology. At the utilisation stage, they begin to use this newly learned technology in the classroom, but since there will be some problems during application, tolerance is necessary. At the integration stage, technology becomes an inseparable part of the teachers in class from instruction to classroom management. At the reorientation stage, the teachers manage to effectively implement the technology as a tool based on the function and the aim of the class. Finally, at the evolution stage, the teachers, with the help of their gained experiences, can use the technology much more actively and successfully according to the structure of the class and the aims of education and instruction, by reshaping it. However, unfortunately, most teachers may not be able to get as far as the integration stage. Therefore, especially in teacher training, it is of great importance that technology is employed and that the trainee teachers are provided with educational and instructional opportunities for its use. Moreover, when the idea that sciences preoccupied with exploring facts and technology aiming at transforming those facts into application in daily life steer the course of life is considered, the importance of science in life could be better understood. According to Layton (1993), the knowledge acquired with the help of activities used in science education shares similarities with technological knowledge (Hill, 1998). Particularly in fields like chemistry, in which scientific applications are executed, learning is rendered more permanent, productive and effective with the use of technology.

2. Main text

The aim of this study is to examine the effects of technologically supported titration applications in chemistry classes on the opinions of trainee teachers regarding the role of technology in education and instruction activities and their success in chemistry. The study group of the research consists of 31 trainee teachers enrolled at Hacettepe University's Faculty of Education. In the study, participants' opinions on the traditional face-to-face instruction method and the technology-supported instruction that was prepared for their chosen subject of argentometric titration are analysed in detail. The research pattern of pre-test/post-test with experimental/control group is employed in the study. Whilst instruction with chemistry laboratory activities supplemented by technologically supported titration applications is employed in the experimental group, instruction with traditional verification laboratory approach is used in the control group. The opinions of the trainee teachers on the role of technology in education and instruction activities are evaluated by means of the analysis of their replies to the questions in "The Role of Technology in Education and Instruction Activities Assessment." The opinions of the trainee teachers on the role of technology in education and instruction activities are assessed along the lines of how effective technology is in teaching certain skills and how important technological tools are inside the classroom. Furthermore, "The Titration Achievement Test," developed by the researchers, is used in order to determine the success of the trainee teachers.

2.1. Data collection tools

2.1.1. The role of technology in education and instruction activities assessment

The assessment that is used to determine how technology shapes education and that has been conducted with over one thousand participants all over the United States (Crystal, 2006) has been adapted to Turkish by Çil (2008). The questionnaire titled "The Role of Technology in Education and Instruction Activities" is expanded by Çil (2008) with additional items in consideration with the education and instruction activities in Turkey. It consists of two main sections and seventeen questions in total. Cronbach's alpha coefficient for the reliability of the questionnaire came out 0.705.

2.1.2. The titration achievement test

A test is developed as a part of the research in order to measure the trainee teachers' success on titration. Validity and reliability inspections are done on the 15-item multiple choice achievement test with the participation of 250 trainee teachers. As a result of the work done with ITEMAN Windows Version 3.50 statistics software, the Titration Achievement Test with an average difficulty level of 0.5 and Point Biserial Correlation of 0.621 is developed.

2.2. Data analysis

In the first part of "the role of technology in education and instruction activities assessment," how effective the trainee teachers find technology in teaching various skills and applications is explicated. In the second part of the assessment, the trainee teachers' opinions on the importance of technological tools in the classroom are examined. Furthermore, the data from the Titration Achievement Test, developed by the researchers in order to determine the success of the trainee teachers, is used.

3. Results

In the research, the pre-test and post-test scores of the participants in experimental and control groups at the "The Role of Technology in Education and Instruction Activities Assessment" and "Titration Achievement Test" are checked to determine whether there were meaningful differences between the groups. As the number of participants in the sample is low, it is decided that using parametric tests might lead to errors in evaluation, and thus, the non-parametric U Test (Mann-Whitney test) is used.

3.1. Findings of the role of technology in education and instruction activities assessment

The Examination of the Pre-Test Results of the Experimental and Control Groups at The Role of Technology in Education and Instruction Activities Assessment The data acquired through "The Role of Technology in Education and Instruction Activities Assessment" used as a pre-test with the trainee teachers is shown in Table 1.

Table 1. The Mann-Whitney U test results on the experimental and control groups' pre-test scores.

	Group	N	Mean Rank	Sum of Ranks	U*	p
How effective is technology in teaching various skills?	Experimental group	15	15.94	255.00	119.00	.984
	Control group	16	16.07	241.00		
How important are technological tools in the classroom?	Experimental group	15	15.84	253.50	117.50	.922
	Control group	16	16.17	242.50		
The Role of Technology in Education and Instruction Activities Assessment	Experimental group	15	15.75	252.00	116.00	.892
	Control group	16	16.27	244.00		

*p> .05

As can be seen in Table 1, it is found that statistically, there is not much meaningful difference between the sub-dimension scores of the trainee teachers in the experimental and control groups at The Role of Technology in Education and Instruction Activities Assessment before the implementation (U=119; 117; 116 p>0.05). In other words, it is established that there is not much meaningful difference between the opinions of trainee teachers in the experimental and control groups on the role of technology in education and instruction activities before the implementation.

3.2. The comparison of the experimental group's pre-test and post-test scores at the role of technology in education and instruction activities assessment

In order to determine whether there is any contribution of technologically supported teaching practices on the opinions of trainee teachers participating in the research on the role of technology in education and instruction

activities, the non-parametric alternative to the t-test, Wilcoxon Signed-Rank test is applied to the pre/post-test scores. The results reflecting their effects are seen in Table 2.

Table 2. The Wilcoxon signed-rank test results on the experimental group's pre/post-test scores at the role of technology in education and instruction activities assessment.

	Group	N	Mean Rank	Sum of Ranks	Z	p
How effective is technology in teaching various skills?	Negative Ranks	9	7.67	69.00	-2.36	.018
	Positive Ranks	3	3.00	9.00		
	Ties	3				
How important are technological tools in the classroom?	Negative Ranks	9	7.33	66,00	-1.44	.149
	Positive Ranks	4	6.25	25,00		
	Ties	2				
The Role of Technology in Education and Instruction Activities Assessment	Negative Ranks	11	8.41	92.50	-2.51	.012
	Positive Ranks	3	4.17	12.50		
	Ties	11				

In Table 2, it can be seen that there are meaningful differences between the pre-test and post-test scores of the experimental group at the Role of Technology in Education and Instruction Activities Assessment along the lines of both the assessment in general after the implementation of technology-supported instruction and "how effective technology is in teaching various skills" [z=- 2.36; -1.44; -2.51, p<.05]. That the differentiation is in favour of the post-test results stand out, when their ranking averages and totals are examined. In other words, the technology-supported teaching of the subject of argentometric titration has affected the opinions of trainee teachers, particularly on the effectiveness of technology in teaching various skills, at a statistically meaningful level.

3.3. The comparison of the control group's pre-test and post-test scores at the role of technology in education and instruction activities assessment

In order to determine whether the scores of the trainee teachers in the control group at the Role of Technology in Education and Instruction Activities Assessment change significantly between the repeated measurement before and after the traditional laboratory instruction, the non-parametric Wilcoxon test is used. The results of the analysis are shown in Table 3.

Table 3. The wilcoxon signed-rank test results on the control group's the role of technology in education and instruction activities assessment pre/post-test scores.

	Gorup	N	Mean Rank	Sum of Ranks	Z	p
How effective is technology in teaching various skills?	Negative Ranks	12	8.46	101.50	-1.73	.083
	Positive Ranks	4	8.63	34.50		
	Ties	0				
How important are technological tools in the classroom?	Negative Ranks	10	8.95	89.50	-1.67	.093
	Positive Ranks	5	6.10	30.50		
	Ties	1				
The Role of Technology in Education and Instruction Activities Assessment	Negative Ranks	11	9.27	102,00	-1.75	.079
	Positive Ranks	5	6.80	34.00		
	Ties	0				

When the z values in Table 3 are examined, it can be seen that there was not much meaningful differentiation between the pre/post-test scores of the trainee teachers in the control group [z= -1.73; -1.67; -1.75, p>.05]. In other words, the traditional instruction of the subject of argentometric titration without the support of technology did not

have meaningful effects on the opinions of the trainee teachers on the role of technology in education and instruction activities.

3.4. The examination of the experimental and control groups' pre-test scores in the titration achievement test

As a part of the research, in order to measure the trainee teachers' success on the subject of argentometric titration, a valid and reliable achievement test is developed. The test, which is prepared to determine the trainee teachers' levels of knowledge on the subject of argentometric titration, is given to the participants before the technology-supported instruction. The trainee teachers' answers to the 15 multiple choice questions in the achievement test are examined and evaluated.

In the research, the pre-implementation titration achievement test averages of the trainee teachers in the experimental group, with whom technology-supported instruction is employed and in the control group, with whom traditional verification laboratory approach is utilised are analysed using Mann Whitney U Test. The results are summarised in Table 4.

Table 4. The results of the mann-whitney u test on the achievement pre-test scores of the experimental and control groups.

Group	N	Mean Rank	Sum of Ranks	U*	p
Experimental group	15	14.34	229.50	93.5	.448
Control group	16	16.82	235.50		

*p> .05

According to the analysis results in Table 4, a statistically meaningful difference between the achievement pre-test averages of the experimental and control group trainee teachers is not seen (U=93.5; p>0.05). This result shows that there are no meaningful differences in the trainee teachers' levels of knowledge on the argentometric titration subject between the experimental and control groups before the implementations.

3.5. The comparison of the pre-test and post-test scores of the experimental group in the titration achievement test

The difference between the trainee teachers' pre-test and post-test scores after the implementation of technology-supported instruction and traditional verification laboratory approach are examined using the Wilcoxon Signed-Rank Test. The findings are summarised in Table 5.

Table 5. The wilcoxon signed-rank test results on the experimental group's achievement pre-test and post-test scores.

Group	N	Mean Rank	Sum of Ranks	Z	p
Negative Ranks	15	8.50	136.00	-3.53	.000
Positive Ranks	0	.00	.00		
Ties	0				

When Table 5 is examined, a statistically meaningful differentiation is seen between the pre-test and post-test scores in the achievement test of the trainee teachers in the experimental group after the technology-supported laboratory implementations [z=-3.53, p<.05]. The mentioned differentiation is determined to be in favour of the post-test scores, when the ranking average and the total are studied. Therefore, it could be said that technology-supported instruction of the subject of argentometric titration has improved the success of the trainee teachers in a manner that would statistically make a meaningful difference.

3.6. The comparison of the achievement pre-test and post-test scores of the control group

The results of the analysis to determine whether there has been a significant change in the success of the control group's trainee teachers in the repeated measurements before and after the traditional laboratory instruction are presented in Table 6.

Table 6. The wilcoxon signed-rank test results on the control group's pre/post achievement test scores.

Group	N	Mean Rank	Sum of Ranks	Z	p
Negative Ranks	2	3.50	7.00	-2.701	.007
Positive Ranks	12	7.64	84.00		
Ties	2				

When Table 6 is examined it is seen that the achievement pre-test and post-test scores of the trainee teachers in the control group does not show meaningful differentiation [z=-2.701, p>.05]. In other words, the traditional instruction of the subject of argentometric titration, without technology-supported instruction did not lead to a statistically meaningful increase in success.

4. Conclusion and discussion

Educators are continuously working on new research regarding how technology can be implemented effectively in order to increase the quality of instructional activities. This research is conducted with the participation of trainee teachers in order to add a new study to the field. The aim of this study is to examine the effects of technology-supported titration applications in chemistry classes on the trainee teachers' opinions on the role of technology in education and instruction activities and their success in chemistry. The opinions of the participants on the traditional, face-to-face instruction approach and the technology-supported instruction method prepared to supplement the subject of argentometric titration are examined.

Whilst instruction with chemistry laboratory activities supplemented by technology-supported titration applications is employed in the experimental group, instruction with traditional verification laboratory approach is facilitated in the control group. When the average values belonging to the pre-test and post-test scores of the experimental and control groups are examined in the research, the increase in the experimental group's achievement scores after the implementation of technology-supported instruction practices stands out. Essentially, that the members of the experimental and control groups, who have pre-knowledge on the subject of titration, to gain more information during instruction activities is a natural process. However, when the post-test achievement results of the groups are compared, it can be seen that there is a statistically meaningful differentiation between the students of the experimental and control groups in favour of the experimental group and that there is a greater increase in the achievement scores of the experimental group's students in comparison to those of the control group. This increase in the post-test scores of the experimental group's students could be taken as a sign that the laboratory applications based on technology-supported instruction has positive effects on the achievement of the trainee teachers. As the implementation of technology in education and instruction provides students with opportunities to work individually, it is known to improve the success of student learning (Zhao, Wang, Wu & He, 2011; Hsiao, 2012).

In the study conducted by Özmen and Kolomuç (2004), the effect of technology-supported instruction on student success in chemistry classes is examined in an experimental way. At the end of the research, the success was measured to be higher in comparison to the traditional method. In the study, when the average values of the pre-test and post-test scores of the experimental and control groups are examined, it becomes noticeable that the experimental group's success scores and the positive opinions on the role of technology in education and instruction activities show an increase following the implementations of technology-supported instruction. Another important finding of the study is that the post-test scores that reflect the opinions of the trainee teachers in the experimental group on the role of technology in education and instruction activities reveal a statistically meaningful increase. This finding means that the trainee teachers' opinions on the role of technology in education and instruction activities have changed in the positive. There were similar findings in the study conducted by Çil (2006), whereby the trainee

teachers were found to deem technology effective in the classroom. This finding of the study was also emphasised in the works done by Atam (2006), Aykanat, Dogru and Kalender (2005). Integrating technology in the education process is not enough on its own to introduce technology to the education and instruction settings, trainee teachers need to receive applied training on using educational technologies before they join the profession (Çoklar et.al, 2007). Therefore, it is recommended that the trainee teachers are made a part of such implementations often before they join the profession and that they should be studied with larger samples on other subjects.

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