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Research Article

The Role of Technology in Science Teaching Activities: Web Based Teaching Applications [1]

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Abstract

In this research the attitudes of pre-service teachers studying at Hacettepe University, Division of Science Education towards the importance of technological equipment in chemistry education activities and how effective they find technology in teaching different skills and applications have been examined. Pre-test/post-test control group design has been used in the research. In the experimental group Titrimetric Analysis has been conducted with simulations supported web based instruction and in the control group with teacher-centered instruction. In general, it has been found out that the attitudes of pre-service teachers in experiment group towards the importance of technological equipment as a teaching tool in chemistry are more positive than those in control group. In other words, statistically significant differences have occurred in attitudes of pre-service teachers in both experiment and control group towards the role of technology in chemistry teaching activities after web based teaching.

Keywords

usage of technology in teacher education, web based chemistry teaching, pre-service teachers

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Introduction

Today using technology has become an obligation, not a privilege. Because we reach more quickly to news, information or progress with technology and it facilitates our daily lives. Technology changes on a daily basis, and just like it is in daily life, it can be used in response to the needs of education and instruction settings (Van Wyk & Louw, 2008). Technological developments have an impact on the structures and functions of educational institutions. Quality of use of technology influences both the quality of life (Li & Perkins, 2007) and education (Ferdig, 2006). Technology brings daily life into the education setting, provides tools to improve learning and increases opportunities for students and teachers for feedback, deliberation and improvement (Bransford, Brown & Cocking, 2000). For the individuals to adapt the technological advancements into their daily lives, they need to be brought up acquainted with technology through formal and informal educational means (Çepni, 2005).

Integrating technology into the education process is not enough to include it within the education and instruction setting. The trainee teachers need to receive practical training on the uses of educational technology before they join the profession (Harwood & McMahon, 1997). Additionally, it is undeniable that chemistry, which aims at reaching facts through exploration and technology that utilizes those facts in daily life have a very important place in the world of education. Therefore, teachers are expected, on the one hand, to use their knowledge and skills, and on the other hand, present attitudes and values that benefit a scientist, in order to achieve compatibility with technology whilst teaching chemistry. The pre-service teachers, who are the pre-services for being the teachers of the future, should be able to both possess advanced skills in the facilitation of technology and use those technologies at an optimum level of productivity in the teaching-learning processes.

The rapid advancements in the world of education renders training of pre-service teachers, who grasp the role of technology in education and instruction and are open to innovations, more important every day. Therefore, it is rigorously for the institutions that train teachers to determine the pre-service teachers' opinions on the active use of technology in education and instruction and to overcome their inadequacies in its use. The aim of the research, conducted with this idea in mind, is to determine the attitudes of the pre-service teachers of web-based chemistry education on the active use of technology in education and instruction and its contributions to overcome their inadequacies in its use.

Method

In the study, pre-test/post-test control group design was used (Fraenkel & Wallen, 2009). The experimental and control groups are determined by using the objective sampling method. While simulation-supported web-based instruction is utilized in the experimental group, the control group used the teacher-centered instruction approach.

Sample of Research

The study group of the research consists of 106 pre-service teachers who are enrolled at Hacettepe University, Faculty of Education and Division of Science Education. In the research, the role of technology in education-instruction activities assessment to determine the attitudes of pre-service teachers and web-based instruction assessment are used as data collection instruments.

Data Collection Tools

The Role of Technology in Education-Instruction Activities

The attitudes of the pre-service teachers on the role of technology in education-instruction activities are determined by the assessment developed by Çil (2008). The assessment consists of 17 items in the format of five-point Likert scale. The Cronbach alpha reliability coefficient of the assessment is 0.705. Cronbach alpha reliability coefficient which was calculated with the sample data in this study was 0.762.

Web-Based Instruction Attitude Assessment

The attitudes of pre-service teachers towards web-based instruction is determined using the assessment developed by Erdoğan, Bayram and Deniz (2007). The Cronbach reliability coefficient of the assessment is 0.917. Cronbach alpha reliability coefficient which was calculated with the sample data in this study was 0.906. The scale consists of 26 items in the format of five-point Likert scale.

Data Analysis

In the study, data acquired from pre-test/post-test scores for the experimental and control groups are examined. As the sample size is within the recommended range in literature and meets the normality hypothesis, the data from research is analyzed using (Kolmogorov Smirnov $p<.05$) parametric tests (Green & Salkind, 2008). Whether there are any differences between the experimental and control groups before implementations is determined using the independent sample t-test during the examination of the role of technology in education and instruction and the data on the attitude towards web-based instruction assessment. The differences between pre-test and post-test scores following web-based and teacher-centered instruction, however, is examined using the dependent sample t-test.

Findings

The descriptive statistics regarding the pre-test/post-test averages of the assessment conducted as a part of the web-based instruction research is summarized in Table 1.

Table 1. Descriptive statistics of Pre- and Posttest scores

Scale	Group	N	Pretest		Posttest	
			M	SD	M	SD
The Role of Technology in	Experiment	51	3.76	0.54	3.99	0.40

Education and Instruction Activities Assessment	Control	55	3.78	0.54	3.87	0.92
Web based instruction attitude scale	Experiment	51	2.27	0.52	1.89	0.53
	Control	55	2.36	0.59	2.24	0.45

The findings on the role of technology in education-instruction activities:

In the research, no statistically significant difference is found between the experimental and control groups regarding the pre-service teachers' attitudes on the role of technology in education-instruction activities pre-test averages before implementation ($t=0.152$; $p>0.05$). This result shows that before the implementations there were no meaningful differences in the attitudes of pre-service teachers in experimental and control groups regarding the role of technology in education-instruction activities.

The difference between the pre-test/post-test averages of the pre-service teachers' attitudes on the role technology in education-instruction activities following the web-based and teacher-centered instruction applications are examined using the dependent sample t-test. The findings are summarized in Table 2.

Table 2. T-test results of the role of technology in education and instruction activities

The Role of Technology in Education and Instruction Activities	N	M	SD	t	p
Experiment group pretest	51	3.76	0.54	-2.624	.011
Experiment group posttest	51	3.99	0.40		
Control group pretest	55	3.78	0.54	-0.626	.534
Control group posttest	55	3.87	0.92		

When the Table 2 is examined, it can be seen that the attitudes on the role of technology in education-instruction activities of pre-service teachers in experimental and control groups have improved following implementations and that the increase in the experimental group is statistically meaningful ($t:-2.624$; $p<0.05$). This result shows that web-based instruction has been influential in the improvement of the opinions of the pre-service teachers on the role of technology in education-instruction activities.

According to the analysis results of the pre-service teachers' attitudes on the role of technology in education-instruction activities post-test score averages, there is no statistically significant difference between the experimental and control groups ($t=0.858$; $p>0.05$).

Findings regarding the attitude towards web-based instruction;

The results of the analysis regarding the pre-test/post-test score averages of the pre-service teachers following the web-based and teacher-centered instruction applications are summarized in Table 3.

Table 3. T-test results of the role of technology in education and instruction activities

Web based instruction attitude scale	N	M	SD	t	p
Experiment group pretest	51	3.13	0.57	-2.818	.007
Experiment group posttest	51	3.31	0.74		
Control group pretest	55	3.33	0.54	-0.813	.420
Control group posttest	55	3.42	0.80		

When the Table 3 is examined, it is seen that the experimental and control group pre-service teachers' web-based attitude scores following implementation have increased and that the increase is statistically significant (t:-2.818; $p<0.05$). This result shows that the utilization of web-based instruction is influential on the improvement of the pre-service teachers' attitudes towards web-based instruction. When the post-test averages of the pre-service teachers' are studied, it is determined that there are no statistically significant differences between the experimental and control groups ($t=0.894$; $p>0.05$).

Discussion and Conclusion

In this research the attitudes of pre-service teachers towards the importance of technological equipment in chemistry education activities and how effective they find technology in teaching different skills and applications have been examined. The results of the research establish that web-based chemistry instruction is more effective on the attitudes of pre-service teachers on the use of technology in education-instruction activities and the improvement of their attitude towards web-based instruction than the teacher-centered instruction. Web-based learning expands the learning framework of the learners by providing them an unlimited learning environment and adds a new dimension to the traditional classroom setting with the inclusion of real-life applications and assessments (Alkan & Koçak 2015).

Web-based education is one of the important learning settings with new and rich learning experiences for the students. The web environment provides a global and democratic learning opportunity to students from various cultures and regions, speaking different languages, and does so without gender discrimination (Kurubacak, 2000). The interests, expectations and needs of the students differ greatly from the traditional education approach (Frith & Kee, 2003; Glenn, 2001). The success targeted in education is possible by getting to know students with different interests and expectations. Web-based education

takes individual differences into account and presents opportunities that appeal to each and every student. In web-based instruction setting, the active involvement of the student is essential and instruction is more individualistic. There is a consensus that learning in such an environment would reach higher standards with the active involvement of the student (Collins, 1998; Horton, 2000). Moreover, that technology in other words web-based education changes and develops rather speedily under today's circumstances points to the necessity of such research to be up to date (Çetin, Çalışkan & Menzi, 2012).

Chemistry is one of the scientific disciplines that deal with abstract incidents. Therefore, visual representations in the descriptions of abstract incidents have a great importance in the learning and teaching of chemistry (Crawford & Cullin, 2004). Kozma and Russell (1997) focused on the necessity to use symbols and other shapes in order to create a clear meaning in chemistry. Some researchers have maintained that the use of three dimensional visual representations in chemistry makes the understanding of chemical structures and related qualities easier (Urhahne, Nick, & Schanze, 2009). The contribution of the use of technology in chemistry classes to instruction is undeniable in regards to its assistance in the visualization of abstract expressions (Waight, Liu, Gregorius, Smith & Park, 2014). The abstract knowledge of the pre-service teachers on chemistry has been transformed into concrete representations with the use of web-supported instruction. These concrete representations lessen the cognitive burdens of the pre-service teachers and improve their opinions on technology-supported education.

As a result of the research it has been determined that web based chemistry teaching activities is effective. When the literature analyzed it has been point out the existence of studies supporting the research results. Chemistry is one of the science that deals with the abstract event. Students should be able to visualize the events in their minds created for lasting learning. Web based instruction help students visualize the abstract events. The features of web-based chemistry instruction such as making comprehension and remembering easier, giving a chance to reinforce and being interesting and enjoyable have contributed to the research results. As the interests and expectations of the learners are different, a learning environment that will appeal to the level of each one of them should be provided. With this aim, web-based instruction is one of the rare methods that would provide learners with different learning environments. This research has a great importance in assisting the teachers of the future to be able to keep up with the rapidly developing and changing age and guide them in raising qualified individuals.

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