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INFLUENCE OF SUPPLEMENTING THE COURSE OF CHEMISTRY LABORATORY WITH THE WEB ENVIRONMENT ON STUDENTS' ATTITUDES TOWARDS THE COURSE

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ABSTRACT

The present study examined the influence of supplementing the course of Chemistry Laboratory with the web environment on students' attitudes towards the course. For this purpose, on the web page of http://www.diclekimyaegitimi.org, the students were presented the contents of the course of Basic Chemistry Laboratory II. In the study, the pretest-posttest experimental design with a control group was used. The study group included a total of 107 junior students from the departments of Physics Teaching, Chemistry Teaching and Biology Teaching at Ziya Gokalp Education Faculty of Dicle University in the academic year of 2009-2010. The study was carried out with three groups: two of them were the experimental groups, and one of them was the control group. The first experimental group (web-based group), prior to the lesson, examined the experiments transferred into the web environment, and the second experimental group (web-based group) followed the lesson both in the laboratory environment and via the web. As for the control group, the lesson was taught via the demonstration method. In order to determine the students' attitudes towards the course of chemistry laboratory, the "Chemistry Laboratory Attitude Scale" developed by the researcher based on the Physics Laboratory Attitude Scale – which was developed by Nuhoğlu and Yalçın (2004) – was used. The research data were analyzed with the package software of SPSS 17.0. The results revealed a statistically significant difference regarding the students' attitudes towards the Chemistry Laboratory in favor of the web-based group. The results revealed a statistically significant difference in the students' post-test scores regarding their attitudes towards the Chemistry Laboratory in favor of the web-based group.

Key Words: Web-based instruction, Web-assisted instruction, Chemistry laboratory.

INTRODUCTION

In the present era, the rapid developments in information technologies influence economic and social systems. This influence is increasingly perceived especially in the field of education. According to Akgündüz (2007:22), each part of a civilization system is in direct and indirect interaction with other parts. As a sub-social tradition, the interaction of education with the other parts has a more complex structure. The reason is that all the functions of social experience are in relationship with the education system that connects subjective and objective components to the same vision as reasons and results Web-based education systems are considered to be a top point in terms of use of the developments in computer and Internet technologies in education. There are different concepts used in literature regarding web-based education/instruction. Among these concepts are online learning, web-based instruction, web-assisted instruction, Internet-based instruction,

Internet-aided instruction, education via the Internet, synchronous education, asynchronous education, virtual education and computer-aided education. All these concepts and other similar ones not only include different applications but also explain the teaching-learning processes conducted via computer networks (Aydın, 2002). Web-based instruction involves the use of Internet services for the distribution of course materials, for the management of education, for the evaluation of students and for the establishment of communication with students (Mutlu and Öztürk, 1999). Web-based instruction can be defined as "an environment which allows synchronous and asynchronous learning in sharing information found in different information environments with the use of the Internet and computer sub-structure rather than traditional instructional methods for the purpose of helping students learn about a subject". Web-based education is the complement of face-to-face instruction carried out in class environment. The development of web-assisted instruction first occurred with the Internet – one of information networks - in 1990s and with the spread of its use. In a number of sources, web-assisted instruction and web-based instruction are used in the same meaning. However, when these two concepts are examined in terms of their applications, it is seen that web-based instruction can be applied alone, while web-assisted instruction is used to increase students' learning regarding a subject and or a course and to supplement the teaching-learning process in cases of failure or inefficiency of other instructional methods and techniques (Uzunboylu, 2002).

Today, the number of web-based and online courses is increasing rapidly, and these courses constitute an important part of the education pedagogy throughout the world. Online learning, or e-learning, is especially influenced by the use of such communication technologies and www tools as electronic mail, bulletin board systems, electronic white boards, chat rooms and desktop video conferences (Suanpang et. al., 2003 cited in Engelbrecht and Harding, 2005). At universities, web-assisted education, which provides important contributions to the development of new sources, is regarded as one of the instructional approaches most commonly used in the world (Zhang, Niu, and Jiang, 2002 cited in Çakır, 2003).

Creating changes in individuals' attitudes and values is considered to be an important process. Studies conducted generally focused on achievement, yet attitudes towards an event, a situation or a phenomenon plays constitutes the basis of achievement and of behavior. Attitudes are, in general, tendencies that lead to behavior (Kağıtçıbaşı, 2006, 106).

This study examined the influence of the course of Basic Chemistry Laboratory taught via web-based and web-assisted instruction methods on students' attitudes towards the course.

METHOD

In the present study conducted to determine the influence of supplementing the course of Chemistry Laboratory with the web environment on students' attitudes towards this course, the pretest-posttest experimental design with the control group was used. This design, which provides the researcher with a high level of statistical strength, allows interpreting the findings within the reason-result context (Büyüköztürk, 2010).

Study Group

The study group was made up of 107 junior students taking the course of "Basic Chemistry Laboratory" who were all attending such departments as Physics Teaching, Chemistry Teaching or Biology Teaching at Ziya Gokalp Education Faculty of Dicle University in the Spring Term of the academic year of 2009-2010. In the study, the students from these three departments were divided in three groups with the help of the probability sampling-random selection method: control group (n=34), experimental group 1 (n=38) and experimental group 2 (n=35). Before the research process, the experimental group students received approximately one hour long training.

Data Collection Tools

In order to determine the students' attitudes towards the chemistry laboratory, the "Chemistry Laboratory Attitude Scale" developed by the researcher based on the Physics Laboratory Attitude Scale – which was developed by Nuhoğlu and Yalçın (2004) – was used. In the scale development process, first, the attitude-related statements found in the Physics Laboratory Attitude Scale were adapted to chemistry laboratory. This Likert-type scale made up of 36 items was adapted to the course of Chemistry Laboratory by excluding one item. In the scale including 22 positive and 13 negative items, the options were "I completely agree", "I agree", "I'm neutral", "I disagree" and "I completely disagree". This scale structured was applied to 65 students who had taken the course of Chemistry Laboratory. The validity and reliability studies of the scale were conducted by the researcher, and the Cronbach Alpha internal consistency coefficient was calculated as 0.825. In this study, the internal consistency coefficient of the scale was found to be 0.932. These results demonstrated the reliability of the scale. At the beginning of the 15-week training, a pretest was applied to the students in the research sample group to determine their attitudes, and the same scale was applied as posttest at the end of the training.

Research Design

Table 1 presents the pretest-posttest research design with the control group.

Table 1: Research Design

Group	Before the experiment	Experimental Process	Following the experiment
Control	Pretest (KLTÖ)	Traditional in-class Learning	Posttest (KLTÖ)
Experiment 1	Pretest (KLTÖ)	Web-based learning	Posttest (KLTÖ)
Experiment 2	Pretest (KLTÖ)	Web-assisted learning	Posttest (KLTÖ)

During the research process, the experiments regarding such subjects as "Substance Properties and Its Identification, Preparation of Solutions, Acid-Base Titrations, *Diffusion of Gases and Law of Conservation of Mass*" were taught to the control group students in the laboratory environment via the demonstration method. The experiments conducted previously by the researcher were transformed into a video course with the help of a professional video-camera. After the theoretical information necessary for the experiment was uploaded as a text on the web-page, the web-page was made ready. The students in experimental group 1 followed the experiments in the web environment independently of time (on online basis out of class hours). The students in experimental group 2 followed the course both in the laboratory environment and on online basis.

With the help of such tools as forum, e-mail group and messaging, the out-of-class communication was established, and information sharing was achieved.

Data Analysis

The data collected in the study was analyzed with the package software of SPSS 17.0. In order to test the significance of the difference between the pretest scores and posttest scores of the students in the control group and those in the experimental groups, one-way ANOVA tests were applied. For these tests, the significance level was determined as $\alpha = 0.05$.

FINDINGS

Table 2 presents the results of the descriptive analysis of the pretest attitude scores of the teachers found in the control and experimental groups regarding web-based instruction before the experimental application.

Table 2. Descriptive Analysis of Pretest Attitude Mean Scores

Group	N	Mean	SD
Control	34	4.0126	0.39722
Experimental 1	38	3.8038	0.58298
Experimental 2	35	4.0327	0.50234

The analysis results demonstrated that there was a difference between the pretest attitude mean scores of the preservice teachers in the control and experimental groups regarding the course of chemistry laboratory. In order to reveal whether there this difference was statistically significant or not, analysis of variance was conducted. The results of the analysis of variance are presented in Table 3.

Table 3: Analysis of Variance regarding the Pretest Attitude Mean Scores

Source of Variance	Sum of squares	Degree of freedom	Means of Squares	F	p
Inter-groups	1.182	2	0.591	2.332	0,102
Intra-group	26.362	104	0,253		
Total	27.544	106			

When Table 3 is examined, it is seen that there was no statistically significant difference between the posttest attitude scores of the preservice teachers in the experimental groups and of those in the control group regarding the course of chemistry laboratory; $p=0.102$, $p<0.05$.

Following the experimental study, the descriptive statistics regarding the posttest attitude scores of preservice teachers found in all the three groups regarding the course of chemistry laboratory are presented in Table 4.

Table 4: Descriptive Analysis of the Posttest Attitude Mean Scores

Group	N	Mean	SD
Control	34	3.9580	0.4722
Experimental 1	38	3.8850	0.4940
Experimental 2	35	4.3396	0.3665

The results of the analysis demonstrated that there was a difference between the posttest attitude mean scores of the preservice teachers found in the control and experimental groups regarding the course of chemistry laboratory. In order to find out whether this difference was statistically significant or not, analysis of variance was conducted. Table 5 presents the results of analysis of variance.

Table 5: Analysis of Variance regarding the Posttest Attitude Mean Scores

Source of Variance	Sum of squares	Degree of freedom	Means of Squares	F	p
Inter-groups	4.253	2	2.127	10.552	0,000
Intra-group	20.959	104	0,202		
Total	25.212	106			

As a result of the analysis conducted, a statistically significant difference was found between the posttest attitude mean scores at the significance level of $p<0.05$. In order to find out between which groups this difference occurred, post hoc tests were run. For this purpose, Scheffé test was applied, and the results obtained are presented in Table 6.

Table 6: Scheffé Test Results of Control and Experimental Groups

Groups	X	Standard Error	p
Control Group-Experimental Group 1 (WTÖ)	0.07302	0.10598	0.789
Control Group-Experimental Group 2 (WDÖ)	-0,38161*	0.10810	0.003
Experimental Group 1 (WTÖ)- Experimental Group 2 (WDÖ)	-0,45463*	0,10517	0,000

According to the results of Scheffé Test presented in Table 6, there was a significant difference between experimental group 2 and the control group – the former receiving Web-Assisted Instruction and the latter receiving traditional instruction – and between experimental group 2 and experimental group 1 – the former receiving Web-Assisted Instruction and the latter receiving Web-Based Instruction. Depending on these results, it could be stated that web-assisted laboratory instruction applied to experimental group 2 had positive influence on students' attitudes towards the course of Chemistry Laboratory than the other instructional methods applied.

DISCUSSION AND CONCLUSION

The quantitative results of the study revealed that the web-assisted method used in teaching the course of Basic Chemistry Laboratory had positive influence on the students' attitudes towards this course. The web-based and web-assisted methods used as the experimental process in the present study constituted the independent variable, and the students' attitudes towards the course of Basic Chemistry Laboratory constituted the dependent variable. In the study, the students participating in the instructional applications of the Web-assisted course of Basic Chemistry Laboratory had significantly higher levels of attitudes towards the course than those who did not participate in such applications did. However, there was no significant difference between the attitudes of the students who took part in the course applications conducted via the demonstration method (control group) and the attitudes of those who followed the course only by watching the videos of the teacher and by accessing the theoretical information about the course via the web-site (web-

based group). The affective contributions of the video lessons to the course which were watched by the students who were exposed to the experimental process were as follows: the students in both groups found the video lessons interesting and entertaining and focused only on the subject while watching the video lessons. In addition, the students were more motivated because they were able to access the video lessons in the web environment whenever they wanted and because they reviewed the videos as many times as they wanted based on their own paces of learning. The opportunity to re-access the video lessons via the web-site at different times and to watch repeatedly the parts they failed to understand influenced their attitudes positively.

According to the results obtained via the research findings and to the results of other studies reported in related literature;
Studies on the influence of multimedia use in educational settings on students' attitudes towards the course could be conducted.

In addition, further research could be designed to examine how use of interactive instructional web-sites involving different instructional methods and instructional design models especially in chemistry courses will influence students' attitudes towards web-based instruction.

Also, studies could be carried out to examined how use of videos to teach chemistry in educational institutions where there is no opportunity to conduct experiments could influence students' attitudes towards web-assisted courses.

Finally, research could be conducted to investigate how students' attitudes towards computers and the Internet influence their attitudes towards web-based and web-assisted instruction.

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