Using WebQuest and Wiki Activities in Chemistry Courses: Pre-Service Elementary Teachers' Views and their Motivation to Learn Chemistry

Tansel Tepe[1], Nail Ilhan[1] and Mustafa Murat Inceoglu[2]
[1]Muallim Rifat Faculty of Education, Kilis 7 Aralık University
[2]Faculty of Education, Ege University

Abstract

This study aims to determine pre-service elementary teachers' views with regard to evaluating the effectiveness of WebQuest and Wiki activities prepared for general chemistry courses. It also aims to detect the effects of these activities on pre-service elementary teachers' levels of motivation to learn chemistry. For this aim, we used a mixed method research design. Data were gathered using focus group interviews and the 'Chemistry Motivation Questionnaire'. The sample of the study consisted of 111 pre-service elementary teachers from two different universities. The frequency of the pre-service teachers' logging into WebQuest and Wiki activities of the Moodle Learning Management Systems were monitored. The qualitative result of the study shows that both systems made cognitive contributions to pre-service teachers and attracted their interest at the sensory level. As for the quantitative analysis, the results of our study indicate that pre-service teachers had positive views toward using WebQuest or Wiki activities in courses, whereas their motivation to learn chemistry did not increase. A positive, significant relationship but at a low level was observed between pre-service teachers' motivation to learn chemistry and the frequency of logging into Wiki activities.

Key words: *Chemistry course; Moodle; motivation; WebQuest; Wiki.*

Introduction

The Internet comes first in the list of sources of information. Because learners can be exposed to topics irrelevant to their research on the Internet, this may lead to

concept confusion, causing learners to have difficulty reaching and organizing the right information. The results obtained from the Internet search engines or e-libraries on a topic of interest may not always be suitable for teaching aims. Moreover, the process of finding accurate information about a topic of interest and focusing on a topic can be unnecessarily time-consuming.

With Web 2.0 technologies, social platforms present opportunities for dynamic, interactive sharing and reuse with the help of Web 2.0 tools and the web contents which can be modified by anyone and can be easily devised. Using the WebQuest technique, a Web 2.0 technology used in education, pre-service teachers can accomplish research-based tasks during which they can improve analysis, synthesis and evaluation processes without directly searching for information on the Internet and by focusing their attention on information in accordance with the sources provided. Consisting of introduction, task, process, resources, evaluation and conclusion, WebQuests are an alternative learning technique which enables teachers to let their pre-service teachers surf the Internet to gather information. They may enter unsuitable web sites while surfing on the Internet which constitutes a huge risk. Moreover, pre-service teachers may be exposed to a large amount of junk information while searching for information on the Internet. Due to using the web sites predetermined by teachers for WebQuest search, exposure to unnecessary information can be avoided (Weeks, 2005). WebQuest activities enable teachers to teach online, which is different from face-to-face education. Furthermore, WebQuest activities develop pre-service teachers' skills to put into practice and demonstrate online the knowledge they acquire, to follow instructions, to organize their knowledge. Also, these applications increase pre-service teachers' compatibility with the use of technology, develop their experiences with virtual platforms and support them to carry out group work online (Tepe, 2013). In WebQuest activities, pre-service teachers collect information by doing research and create new information actively using their own experiences and background, through which they base their knowledge on the principles of the constructivist approach (Zlatkovska, 2010). WebQuest activities improve the abilities of pre-service teachers to solve problems and conduct research because the tasks given in WebQuests are designed to support pre-service teachers' levels of thinking, analysis, synthesis, and evaluation. The existing literature on the topic reveals that WebQuest activities provide pre-service teachers with cognitive contributions (Allan & Street, 2007), increase pre-service teachers' learning performances (Chang et al., 2010), and equip pre-service teachers with research abilities (Tabanlı, 2008).

Wikis, another example of Web 2.0 technologies, are readable and writable web sites where all users can create a new page or modify an existing one. Wikis provide opportunities for groups from different regions to work cooperatively on documents of interest via the Internet. Another feature of Wikis is that if a participant makes an incorrect or inappropriate modification or adds content of such nature, other users can easily correct or undo it (Minocha & Roberts, 2008). Wikis play an important role

in providing for constructivist learning environments (Karasavvidis, 2010). Internet-based instruction can be used via Wiki applications which support cooperative learning by allowing pre-service teachers to work in groups to build and design web sites, to store documents, pictures and presentations about a specific subject matter, to manage and monitor modifications in these documents, and to carry out online discussions (Parker & Chao, 2007). In Wiki applications, pre-service teachers formulate knowledge on their own or within groups. Using Wiki applications as a teaching tool, a constructivist learning environment can be created (Heafner & Friedman, 2008). For putting Wiki activities into practice, the teacher acts as a guide who monitors the process in which pre-service teachers create a Wiki instead of operating as a person who transmits knowledge to teach a lesson or a subject matter. Teachers have access to all sections of Wiki applications and can control all sections (Tepe, 2013). Wiki applications play not only the role of tool transferring information to pre-service teachers but also of an educator facilitating information exchange. These claims are supported in literature through evidence that Wiki activities facilitate information exchange and encourage discovery learning (Raman et al., 2005), support learning (Chou & Chen, 2008), provide knowledge and ability (Snelling & Karanicolas, 2008), and also support group activities by creating a cooperative environment (Raman et al., 2005; Mindel & Verma, 2006; Chou & Chen, 2008; Frydenberg, 2008; Elgort et al., 2008; Morgan & Smith, 2008; Snelling & Karanicolas, 2008; Huang & Nakazawa, 2010; Su & Beaumont, 2010; Tsai et al., 2011; Wever et al., 2011).

WebQuest and Wiki applications enable interaction among learners through cooperative learning activities, gather information from different sources and contribute to teaching by using technological tools. Wiki applications are performed to foster collaborative writing activities. Wiki-based collaborative writing is used to evaluate the level of contributions of pre-service teachers by looking at log records and creating statistics (Hadjerrouit, 2014). On the other hand, inquiry-based activities are performed via WebQuest. Dodge (1995) described WebQuests as "an inquiry oriented activity in which some or all of the information that learners interact with comes from resources on the Internet, optionally supplemented with video conferencing" (p. 10). Additionally, when these applications are compared with respect to the way they are built to support education, they may have different effects on pre-service teachers (attitudes, motivation, success, etc.). However, there is a limited number of studies which focus on how the use of these systems may influence pre-service teachers' motivation to learn chemistry.

One of the significant defects of Internet-based teaching is considered to be its inability to present materials that are not synchronized, to share and discuss the presented materials in different ways, to keep records of the system, pre-service teachers, and teachers, and also to fulfill such necessities as reporting. In order to overcome these deficiencies Learning Management Systems (LMS's) come into action. Moodle LMS is a free online open-source lesson management system whose

most significant advantage is that lesson notes, discussions, homework, and tests can be managed on the Internet. In the Moodle LMS environment, courses can be conducted in a synchronized and unsynchronized way and pre-service teachers have the opportunity, if given permission, to follow courses in any place at any time (Inner, 2007). In the Moodle LMS, what pre-service teachers do on the system and their level of activity in tasks can be easily monitored.

In our study, using WebQuest and Wiki applications of the Moodle Learning Management Systems (LMS) for the general chemistry course were prepared. The main purpose of including WebQuest and Wiki activities in Moodle LMS is that pre-service elementary teachers can be monitored in Moodle LMS, observations can be made regarding which pre-service teachers follow activities and for how long, along with other details. The use of Moodle LMS in chemistry courses has been the topic of some studies (Vega & Salas, 2011; Dughila et al., 2013; Jordan, 2013). However, there is little research examining how pre-service teachers use WebQuest and Wikis with Moodle LMS, the problems that can be encountered in activities and suggestions about possible solutions to those problems, as well as how this situation affects pre-service teachers' motivation to learn chemistry.

As topics in chemistry course are theoretical, there are some difficulties in teaching. Also, an increase in pre-service teachers' negative motivation for chemistry has recently been discussed in various studies (Gilbert, 2006; OECD, 2006; Yaman, 2009). This study is important for its contribution to the awareness of how the use of WebQuest and Wikis affects pre-service elementary teachers' motivation to learn chemistry. It is also important to mention that the study covers two significant social platform tools such as WebQuest and Wiki in Moodle LMS and for its presentation of a comparative point of view about these tools.

In our study, some of the contents for general chemistry course were prepared using WebQuest and Wiki applications of the Moodle LMS from Web 2.0 technologies.

Our study aims to determine pre-service elementary teachers' views with regard to evaluating the effectiveness of WebQuest and Wiki applications prepared for general chemistry courses. It also aims to detect the effects of these applications on the levels of pre-service elementary teachers' motivation to learn chemistry. We seek to answer the following research questions:

1) What are the views of pre-service elementary teachers about the application WebQuests and Wikis in the General Chemistry Course?

2) Is there a difference in pre-test and post-test scores of motivation to learn chemistry of pre-service elementary teachers using the WebQuest and Wiki activities in the chemistry course?

3) Is there a significant relationship between the frequency of pre-service elementary teachers' logging into WebQuest and Wiki activities and their level of motivation to learn chemistry?

Research Methodology
Research Design

A mixed method research design was used in our study. In the mixed method, the qualitative and quantitative data for a study is gathered, analyzed, and interpreted (Creswell, 2003; Onwuegbuzie & Leech, 2006). The static-group comparison design was used for the quantitative part of this study. This design is often referred to as the nonequivalent control group design (Fraenkel & Wallen, 2012). For the qualitative part of this study, a descriptive qualitative research design with focus group interviews was used.

In our study, the general chemistry courses of pre-service elementary teachers at the Department of Elementary Education of the Faculty of Education, Ege University and of Kilis 7 Aralık University were performed with WebQuest and Wiki applications within Moodle LMS. Three different data gathering tools were used: Chemistry Motivation Questionnaire (CMQ) for gathering the quantitative data, WebQuest Semi-structured Focus Group Interview (WQSFGI) and Wiki Semi-structured Focus Group Interview (WKSFGI) for gathering qualitative data. Moreover, particular questions were asked in CMQ in order to obtain demographic information. Table 1 presents the details of the research design application levels.

Table 1

Research design application levels

Groups	Pretest	Application	Posttest
GWQ	CMQ	WebQuest	CMQ WQSFGI
GWK	CMQ	Wiki	CMQ WKSFGI

WebQuest Group (GWQ); Wiki Group (GWK); Chemistry Motivation Questionnaire (CMQ); WebQuest Semi-structured Focus Group Interview (WQSFGI); Wiki Semi-structured Focus Group Interview (WKSFGI).

Sample

The research sample consisted of 111 freshmen pre-service elementary teachers from Ege University (Wiki Group – GWK=24; WebQuest Group – GWQ=29) and Kilis 7 Aralik University (GWK=31; GWQ=27). The research was conducted in the spring semester of the 2012/2013 academic year (Table 2). Because the participants were from researchers' universities, the convenience sampling method was used (Fraenkel & Wallen, 2012) in the selection of GWQ and GWK. In the qualitative part of the research, 24 pre-service teachers were divided into two groups, each consisting of 12 pre-service teachers from GWQ and GWK who were interviewed in focus groups. Criterion based sampling method, a purposive sampling method, was used in the qualitative part of the research (Patton, 1990, pp. 169-186). Participants of the focus group interviews were selected among the pre-service teachers who attended the lesson's activities most

frequently. In order to monitor how much time pre-service teachers spent with the applications, the reporting feature of Moodle LMS was utilized. In the quantitative part of the research, 11 pre-service teachers did not participate in the post-test CMQ. The chemistry course is a compulsory course in the curriculum of the department of elementary education in Turkey. After starting the activities in the study, some participants did not want to attend the course and wanted to attend traditional courses. Joining the CMQ and focus group interviews were performed according to voluntary participation. Demographic features of the study group are shown in Table 3.

Table 2

Study groups

Groups	Faculty	Department	Class	Qualitative(f)	Quantitative(f)
GWQ	Education	Elementary Education	1	12	56
GWK	Education	Elementary Education	1	12	55
Total				24	111

Table 3

Demographic features of the study group

Variable	Property	GWQ (f)	GWK (f)
Gender	Female	43	42
	Male	13	13
Do you have a PC?	Yes	27	36
	No	29	19
Do you have Internet access?	Yes	31	34
	No	25	21
How much time do you spend on the Internet per week?	Never	6	4
	1-4 hours	19	23
	5-9 hours	22	16
	10 and more hours	9	12
Have you ever taken online courses?	Yes	27	25
	No	29	30

Data Collection Instruments

Chemistry Motivation Questionnaire (CMQ)

The CMQ was developed by Glynn et al. (2007; 2009), and was adapted into Turkish by Ilhan, Yildirim, and Yilmaz (2012). During the adaptation work done by Ilhan et al. (2012), the final form of the questionnaire was set to 22 items. The CMQ is a Likert-type questionnaire with rating grades ranging from Never (1) to Always (5). Questionnaire reliability coefficient (Cronbach Alpha) was measured to be 0.82. This result shows that the questionnaire is reliable enough and usable. In the adaptation study done by Ilhan et al. (2012), exploratory factor analysis was performed. The CMQ consists of 22 items and six dimensions. These dimensions are "intrinsically motivated science learning", "extrinsically motivated science learning", "relevance of learning science to personal goals", "responsibility for learning science", "confidence in learning

science", and "anxiety about science assessment". In this study, pre-service elementary teachers' motivation to learn chemistry was calculated with 22 items.

WebQuest Semi-structured Focus Group Interview (WSFGI) and Wiki Semi-structured Focus Group Interview (WKSFGI)

For the purpose of this study, the WSFGI and WKSFGI were developed. WSFGI and WKSFGI consist of open-ended questions which include probes. While creating WQSFGI and WKSFGI, a question pool was formed in accordance with the research questions of the study. The lecturers who teach in the field of qualitative research methods were consulted in order to evaluate the validity of these questions and their opinions were used as expert opinions. After receiving expert opinions, the draft focus group interview forms were prepared. Afterwards, pilot interviews were conducted with second persons among the pre-service teachers in GWQ and GWK who spent more time with WebQuest and Wiki activities. The focus group interview questions were reviewed based on the answers from pre-service teachers, necessary modifications were made on probes, and finally WSFGI and WKSFGI were prepared. The focus group interviews were recorded on video in order to prevent data loss. In our study, we paid a special attention to ensuring that the questions were impartial and speech-like. Semi-structured focus group interviews lasted around 50 minutes on average.

Data Analysis

The qualitative data in WQSFGI and WKSFGI of the study were analyzed with the inductive content analysis method (Elo & Kyngäs, 2008). SPSS statistical analysis software was used to analyze the quantitative data. In order to discover the effect of WebQuest and Wiki activities on pre-service teacher motivation to learn chemistry, paired samples t-test and independent samples t-test were conducted.

Implementation Process

Before WebQuest and Wiki activities were implemented, Moodle LMS user accounts were created for each pre-service teacher. During the research, pre-service teachers were monitored via Moodle LMS which recorded the attendance statistics. In this way, we could determine whether individual pre-service teachers performed the activities or not and how many times they logged into these applications (Table 4).

Table 4

Frequency of logging into applications

Application Groups		Basic Concepts			Atom Structures and Theories			Periodic Table			Chemical Bonds			Total
		Look	Add	Update	Look	Add	Update	Look	Add	Update	Look	Add	Update	
	GWQ	2204	28	16	2133	48	4	1726	24	1	723	8	4	6919
	GWK	3865	30	54	2825	47	16	2050	9	7	490	4	11	9408
	Total	6069	58	70	4958	95	20	3776	33	8	1213	12	15	16327

WebQuest Group (GWQ); Wiki Group (GWK)

The pre-service teachers in GWK with 9408 actions in total performed the most actions in the applications, followed by GWQ with 6919. During the study, WebQuest and Wiki activities were prepared in Moodle LMS. The activity contents were designed according to the contents of the subjects of the general chemistry course (Atom structures and theories, periodic table, and chemical bonds). Before the study, pre-service teachers had a week-long orientation on the basic chemistry concepts. The orientation program aimed to familiarize pre-service teachers with the system. During the orientation, we prepared a WebQuest activity related to the unit called "basic concepts". In the implementations, pre-service teachers in GWQ were asked to explain each distinctive feature of matters in relation to daily life and to prepare a report showing three physical states (solid, liquid and gas). In the Wiki application which prepared "the basic concepts", the pre-service teachers were expected to create a book section by filling the given subject headings. The pre-service teachers were involved in a seven-week performance process consisting of one week orientation and six weeks for the implementation process. Pre-service teachers in the GWQ were assigned specific tasks and they were expected to complete their homework related to the tasks assigned to them. While preparing the course contents for GWK, mostly course books were used. After determining the concept lists and subject headings of units, GWK were expected to create a book section related to each of the units by filling the related subject headings. While preparing the course contents, expert opinions were consulted all the time and the necessary changes were made accordingly.

Results

Pre-service teachers' views in GWK and GWQ in our study were analyzed. Themes and codes were created with content analysis. Frequencies of codes are presented in Table 5. According to pre-service teachers' views about WebQuest and Wiki activities, there were four themes established: cognitive contribution, sensory effect, usability, and suggestion about applications.

Table 5

Frequencies of pre-service teachers' expressions in the themes and codes created with the content analysis

Themes	Codes	WebQuest		Wiki	
		Positive (f)	Negative (f)	Positive (f)	Negative (f)
Cognitive Contribution	Provides learning	3	0	10	0
	Easy to remember	13	2	10	3
	Effective learning	5	1	4	0
	New learnings	4	0	8	0
	Facilitates understanding	4	0	3	1
	Maintains subject coherence	0	6	0	0
	More information	6	0	9	0
	Provides research	4	0	5	0
	Helpfulness	7	6	11	1
	Contribution to success	7	0	9	0

Themes	Codes	WebQuest		Wiki	
		Positive (f)	Negative (f)	Positive (f)	Negative (f)
Sensory Effect	Liking	17	1	16	1
	Responsibility	9	2	5	2
	Attitude	15	3	13	8
	Motivation	10	1	15	0
	Boringness	0	1	0	9
Usability	Assistance to exams	2	0	2	0
	Systematic studying	4	0	0	2
	Associate with daily life	7	0	7	1
	Opportunity to review	3	0	3	2
	Interaction	15	4	7	4
	Facilitates learning	13	0	9	0
	Quick access to information	4	0	9	0
Suggestion About Applications	Feedback	0	11	0	10
	Application to other courses	7	1	14	4
	Visual design	0	4	0	13
	Serves the purpose	1	5	1	16
	Example applications	0	0	0	3
	Seeing past subjects	0	0	1	3
	Communication between groups	0	6	0	0
	TOTAL	160	54	170	81

Pre-service Teachers' Views of WebQuest and Wiki Activities

When pre-service teachers' views under the theme *cognitive contribution* were examined, a series of codes emerged: provides learning, easy to remember, effective learning, new learnings, facilitates understanding, maintains subject coherence, more information, provides research, helpfulness, and contribution to success. When the pre-service teachers' views under the theme of sensory effect were evaluated, codes such as liking, responsibility, attitude, motivation, and boredom emerged. Some of the pre-service teachers' views about cognitive contribution and sensory effect are given below:

"Thanks to Moodle, there was no need to take more notes. It already had notes. I mean there is a certain build up in that. Doing only listening in the class was very helpful" [GWK5].

"We all log on to the system at the same time and have to wait for each other" [GWK7].

"As elementary pre-service teachers, we don't have much interest in science classes but thanks to this, we now do. I am learning chemistry, I have started liking it, it's like I now have some knowledge about science subjects. That is, this way influences our participation" [GWK12].

"Seeing something visually makes it better understood" [GWQ11].

According to the pre-service teachers' views, it can be said that WebQuest and Wiki activities have had cognitive contribution for pre-service teachers. The pre-service teachers in GWK shared many views stating their cognitive contributions. They made rather positive statements, especially about easy remembering, helpfulness and contribution to success. According to these statements, the pre-service teachers

found the applications cognitively positive. They shared their views about liking, responsibility, attitude, motivation and boredom in a sensory point of view. Although some interviewees in the focus groups shared a couple of negative views about the activities from a sensory point of view, the majority of the views were positive. The pre-service teachers stated that they liked the applications, that the activities gave them a sense of responsibility, and that they increased their attitude and motivation. Some of the pre-service teachers stated that although they found the applications interesting in the beginning, their interest dropped in time and the activities became boring.

Judging by the answers from the pre-service teachers about the usability of WebQuest and Wiki in courses, such codes as assistance to exams, systematical studying, associations with daily life, opportunity to review, interaction, facilitating learning and quick access to information were formed. Some pre-service teachers' views about usability codes are given below:

"Basically while you go through the Moodle to see which one is better, you read the content. It's like rereading something you already know" [GWK1].

"It was helpful in that we had quick access to information… Quicker, that is, because it is supported by the Internet, it is quick to reach the information" [GWK5].

"It helps a lot while studying for exams, too. It is better for studying for exams" [GWQ11].

"Because most of our friends didn't delay their homework, they worked systematically. They didn't skip through every subject. As elementary education pre-service teachers, it guided us. It made it easy that it was on the Internet. We don't have any problems while doing homework. Also, because of its multi-level structure it helps us in that matter. It is not very difficult for us. It helps us to learn this lesson" [GWQ12].

When the pre-service teachers' views on the usability of WebQuest and Wiki activities are evaluated, it is evident that the pre-service teachers in GWQ found the applications more usable compared to the pre-service teachers in GWK (Table 5). Pre-service teachers found the activities more usable because of its facilitating learning and interaction. Moreover, they made positive statements about the usability of the applications in daily life. The pre-service teachers stated that they could have quick access to information because the activities are on the Internet.

Pre-service teachers expressed their opinions about what modifications could increase the usability of the activities under the theme of *suggestions about activities*. The codes created under this theme were categorized as feedback, application to other courses, visual design, serving to purpose, example applications, seeing past subjects, and communication between groups. Some pre-service teachers' views are given as follows:

"If the lecturer corrected our mistakes after we had an activity, it would certainly be more effective for permanent knowledge" [GWK2].

"If we have had the opportunity to see the homework our group friends do, I mean, for example, log on to WebQuest, I would still just do my homework. But, I couldn't

see the ones my group friends do. It had a negative effect. Or if we had been able to see Wiki homework, we could have been able to read all of them. In my opinion, it is very logical to see others' homework" [GWQ9].

"It could be much better when it is used in science courses, especially in physics and math. For example, we wouldn't be stuck with just one person's solution and could see several other solutions. We could be in interaction with our friends, solve our problems" [GWQ12].

Although pre-service teachers found the applications effective, they expressed their concerns about their deficiencies and stated their opinions about how the applications should be improved. The pre-service teachers in GWK expressed more need for modifications compared to the ones in GWQ (Table 5). This shows that pre-service teachers in GWK have more problems with doing the applications than pre-service teachers in GWQ. The pre-service teachers especially had complaints about the feedback deficiency of the lecturers who were teaching the general chemistry course and they also complained that the activities were not serving the purpose. The pre-service teachers stated that the applications did not serve their purpose in the context, there were deficiencies in the infrastructure, the subject headings were not in the form of links and they were insufficient, they did not have enough time for Wiki applications, they had to wait online to add contents to Wiki activities, and that the copy and paste feature was disabled. Moreover, pre-service teachers in GWK expressed more positive opinions about the usability of the activities in other courses.

In conclusion, according to pre-service teachers' views, WebQuest applications contributed cognitively more than Wiki applications did and pre-service teachers in GWQ found the applications more useful. While WebQuest and Wiki activities both contributed to pre-service teachers in similar ways within the context of sensory effect, pre-service teachers in GWK expressed more opinions about the necessity of modifications in the activities.

Pre-test and Post-test Scores of Pre-service Elementary Teachers' Motivation to Learn Chemistry

CMQ was used in order to examine the effects of the activities on the levels of pre-service elementary teachers' motivation to learn chemistry. Firstly, the average of pretest and posttest points of GWQ, and secondly the averages of the pretest and posttest points of GWK were compared by conducting a paired samples t-test.

Normality test was applied to assess whether or not the parametric tests would be used in our study. When the results of the Shapiro-Wilks test were examined, the significance values were greater than .05 (p>.05). Data show a normal distribution (Büyüköztürk, 2007, p. 42). The paired samples t-test was used to determine the difference between the pretest-CMQ and posttest-CMQ points of pre-service elementary teachers' motivation to learn chemistry as part of GWQ and GWK (Table 6).

Table 6

Paired samples t-test for GWQ and GWK

Groups	N	Mean(M)		Standard Deviation (SD)	df	t	p	Eta Squared ($\eta2$)
		Pretest	Posttest					
GWQ	55	72.65	71.87	10.98	54	.52	.60	.081
GWK	45	78.84	76.86	11.37	44	1.16	.25	.044

According to the quantitative data results, there was no statistically significant difference between the pretest-CMQ and posttest-CMQ average of GWQ (t(54)=.52;p>.01; $\eta2$=.081) and GWK (t(44)=1.16;p>.01; $\eta2$=.044). Based on these findings, it can be concluded that there was no significant change in the pre-service teachers' motivation to learn chemistry at the beginning and at the end of the WebQuest and Wiki applications use. That is, WebQuest and Wiki activities did not cause a significant effect on pre-service teachers' motivation to learn chemistry.

The independent samples t-test was conducted in order to determine whether WebQuest and Wiki activities have an effect on the pre-service teachers' motivation to learn chemistry (Table 7). First, the pretest points of the GWQ and GWK and then the motivation posttest points were compared.

Table 7

Results of the independent samples t-test for pretest and posttest

		N	M	SD	df	t	p	Eta Squared ($\eta2$)
Pretest-CMQ	GWQ	55	72.65	10.45	98	2.97	0.00	0.083
	GWK	45	78.84	10. 25				
Posttest-CMQ	GWQ	55	71.87	12.62	98	2.15	0.03	0.045
	GWK	45	76.87	10.07				

According to the results of the independent samples t-test, a significant difference on the importance level of 0.01 (t(98)=2.97;p<.01;$\eta2$=.083) emerged between the pretest-CMQ points of GWQ and GWK. This significant difference is in favor of the pre-service teachers in GWK and it shows that the levels of the pre-service teachers' motivation to learn chemistry in GWK were higher at the beginning. Moreover, considering the importance level of 0.01 (t(98)=2.15;p>0.01;$\eta2$=0.045), no significant difference was found according to the posttest points between GWK and GWQ. The fact that there were no significant differences between the motivation posttest points of GWQ and those of GWK at the end of the study in contrast to the levels of Wiki pre-service teachers' motivation to learn chemistry, which were higher at the beginning of the study, is an indicator that WebQuest activities motivated pre-service teachers more than Wiki activities did.

The Relationship between the Frequency of Logging into Applications and Pre-service Elementary Teacher Motivation to Learn Chemistry

In examining the relationship between the posttest-CMQ points of WebQuest and the frequency of logging into activities, we found that this relationship was at a positive level, weak, but not significant (r=0.164, p<.05). This shows that the frequency of logging into Web Quest activities did not cause any significant effect on the pre-service teachers' motivation to learn chemistry. When the relationship between the frequency of logging into Wiki activities and the posttest-CMQ points were examined, there was a positive significant relationship but it was at a low level (r=0.299, p<.05). It can be concluded that as frequency of the pre-service teachers' logging into Wiki activities increases, the CMQ points also increase. Moreover, when the coefficient of determination (r^2=0.09) is taken into consideration, 9% of the total variance in the CMQ results from the frequency of logging into Wiki activities. The results are presented in Table 8.

Table 8

The relationship between the points of posttest-CMQ and the frequency of logging into applications

		Frequency of logging into applications
Posttest-CMQ of WebQuest	Pearson Correlation (r)	.164
	Sig. (p)	.230
	N	55
Posttest-CMQ of Wiki	Pearson Correlation (r)	.299[*]
	Sig. (p)	.046
	N	45

Discussion and Conclusions

As a result of the interviews conducted with the pre-service teachers about the effectiveness of WebQuest and Wiki activities, four themes were established: cognitive contribution, sensory effect, usability, and suggestions about the class. At the end of the implementation, the majority of the pre-service teachers stated that the activities cognitively contributed to them. A number of research studies reveal that WebQuest activities are helpful as a cognitive contribution (Allan & Street, 2007; Halat, 2007; Chang et al., 2010; Zacharia et al., 2010). Raman et al. (2006) state that Wiki activities facilitated information sharing, were effective tools in education, and encouraged discovering learning; the pre-service teachers scored better grades with Wiki activities (De Pedro et al., 2006); Wiki activities supported learning (Chou & Chen, 2008); contributed to learning (Frydenberg, 2008); provided knowledge and abilities (Snelling & Karanicolas, 2008); encouraged research and new learnings (Tsai et al., 2011).

In our study, considering the sensory effect of WebQuest and Wiki activities, the majority of pre-service teachers stated that they liked the activities, the applications

increased their interest, attitude, and motivation, and they acquired a sense of responsibility thanks to the activities. On the other hand, some of the pre-service teachers stated that the activities decreased their interest and became boring after a while. In the literature related to WebQuest activities, there are similar results for sensory effect confirming that these applications are interesting, motivating, encouraging and entertaining (Allan & Street, 2007; Kılıç, 2007; Lim & Hernandez, 2007; Tabanlı, 2008). In studies conducted by Börekçi (2010) and Gökalp (2011), WebQuest activities did not increase the pre-service teachers' attitude towards the lesson. In some studies, pre-service teachers did not like to participate in Wiki activities (Ma & Yuen, 2008) and participated in activities reluctantly (Carr, Morrison, & Deacon, 2007). Moreover, Karasavvidis (2010) concludes that using Wiki in higher education led to gaining information by copy-and-paste causing reluctance about sharing information.

When we examined the usability of WebQuest and Wiki activities in our study, pre-service teachers reported that these activities were helpful for their exams and systematic studying, were associated with daily life, provided opportunity for review, interaction and quick information access, and facilitated learning. Since the majority of these opinions are positive, it can be said that both WebQuest and Wiki applications are usable. The usability of the activities is supported by similar studies in the literature which conclude that relating tasks to daily life during WebQuest activities increased their usability (Kundu & Bain, 2006; Köse, 2007; Chang et al., 2010). It revealed that both WebQuest activities (Chan, 2007; Tabanlı, 2008) and Wiki activities (Raman et al., 2005; Mindel & Verma, 2006; Halat, 2007; Chou & Chen, 2008; Frydenberg, 2008; Elgort et al., 2008; Morgan & Smith, 2008; Snelling & Karanicolas, 2008; Huang & Nakazawa, 2010; Su & Beaumont, 2010; Tsai et al., 2011; Wever et al., 2011) created an environment for cooperation and encouraged group work. Contrary to these opinions, Karasavvidis (2010), states that Wiki activities created a lack of cooperation and communication. Altun (2008) states that Wiki activities were difficult although the activities encouraged interaction in the lesson.

No matter how usable the activities were found to be, based on the positive feedback of pre-service teachers about WebQuest and Wiki activities in our study, some pre-service teachers provided suggestions for improving the effectiveness of the activities. These suggestions were as follows: providing feedback from lecturers or the system, using applications in other courses, visual design, serving its purpose, example applications, seeing past subjects, and communication between groups.

When the literature on using WebQuest activities in other courses is examined, we can see that its use in Geography, History, Turkish Language and Literature, Health, and Nutrition was easier than its use in Mathematics, Chemistry, and Physics (Joseph, 2000; Summerville, 2000; Açıkalın & Duru, 2005). In our study, as well, pre-service teachers expressed their opinions about the need to use these applications in courses such as Geography and History. Examining the opinions of pre-service teachers about

using WebQuest in other courses, Halat (2007) finds that WebQuest activities can be made more fun with games, and that some visual modifications are necessary for the activities. In our study, we found similar results. Some pre-service teachers stated that some applications caused them health problems (dizziness, red eyes, etc.) while doing WebQuest applications. On the evaluation of WebQuest as computer-based learning, Hassanien (2006) also states that the pre-service teachers experienced physical problems during the activities. In our study, some of the pre-service teachers expressed their opinions about the lack of activity during WebQuest activities. This situation is also mentioned in the study conducted by Perkins and McKnight (2005). These studies present findings that pre-service teachers could not complete the applications during the time assigned. In Wiki applications, pre-service teachers complained that the lecturer did not provide feedback by joining the system and there were no warning messages sent by the system. In addition, they expressed their opinions about the necessity of the related modifications in the system. Similar opinions can be found in the literature (Raman et al., 2005; Su & Beaumont, 2010; Tsai et al., 2011).

When we examined the influence of WebQuest and Wiki applications on pre-service teachers' motivation to learn chemistry in our study, no significant differences were found between the pre-service teachers' pretest-CMQ and posttest-CMQ points in WebQuest group. The study conducted by Gökalp (2011), which investigated the influence of WebQuest activities on the pre-service teachers and their attitude towards courses, reveals that there is no significant influence on the pre-service teachers' attitudes towards courses.

However, the studies conducted by Akçay (2009) for Turkish courses, and Kılıç (2007) for Mathematics courses, confirmed an increase in the pre-service teachers' attitudes towards the courses, and in the studies conducted by Lim and Hernandez (2007) for Family Therapy Education, and Chan (2007) for Simulation and Statistical Analysis courses an increase was determined for the pre-service teachers' motivation to learn chemistry.

In our study, no statistically significant differences were observed between the pretest-CMQ and posttest-CMQ points of the pre-service teachers in Wiki group's motivation to learn chemistry. Studies which show the influence of Wiki applications on the pre-service teachers' attitude toward a course and on their motivation were examined and the results showed that the pre-service teachers' motivation for some courses was increased (Chou & Chan, 2008; Su & Beaumont, 2010; Tsai et al., 2011). While the levels of pre-service teachers' motivation to learn chemistry in the Wiki group were significantly higher than the WebQuest group at the beginning of the implementation, no significant differences emerged between the posttest points of WebQuest and Wiki activities at the end of the implementation. This shows that WebQuest applications motivate pre-service teachers to learn chemistry more than Wiki applications. We could not find any studies which comparatively examined the effect of WebQuest and Wiki activities on the pre-service teachers' motivation to learn chemistry.

In our study, the frequency of the pre-service teachers' logging into activities was monitored on Moodle LMS. While a low and positive significant relationship between the frequency of logging into Wiki activities and the motivation to learn chemistry was discovered, there were no significant relationships between the frequency of logging into WebQuest applications and the motivation to learn chemistry. After the pre-service teachers completed their research assignments on WebQuest activities, they uploaded these studies on Moodle LMS as well. Pre-service teachers in WebQuest groups did not have a need to log into Moodle LMS continuously during their research, whereas the pre-service teachers in Wiki group had to complete their Wiki activities on the Moodle LMS. During Wiki activities, their adding data to Wiki activities, seeing each other's mistakes and correcting them, monitoring each other forced them to log into Moodle LMS more frequently. Due to these reasons, Wiki activities might have increased the pre-service teachers' motivation to learn chemistry more.

The results of our study indicate that pre-service teachers have positive views toward using WebQuest or Wiki activities in courses, whereas their motivation to learn chemistry did not increase. It can be suggest that studies about the effects of Wiki and WebQuest activities on the attitudes of students, pre-service teachers and teachers and motivation towards learning in courses can be made.

References

Açıkalın, M., & Duru, E. (2005). The use of computer technologies in the social studies classroom. *The Turkish Online Journal of Educational Technology, 4*(2), 18-26.

Akçay, A. (2009). *The effect of WebQuest teaching method on the attitudes on the academic achievement towards Turkish lesson.* (Master's thesis), Institute of Social Sciences, Atatürk University, Erzurum /online/. Retrieved on April 22, 2014 from https://tez.yok.gov.tr/UlusalTezMerkezi

Allan, J., & Street, M. (2007). The quest for deeper learning: an investigation into the impact of a knowledge-pooling WebQuest in primary initial teacher training. *British Journal of Educational Technology*, *38*(6), 1102-1112. http://dx.doi.org/10.1111/j.1467-8535.2007.00697.x

Altun, A. (2008). *The use of Wiki in the constructivist teaching process*. Paper presented at the 8th International Educational Technology Conference, Anadolu University, Eskişehir

Börekçi, C. (2010). *Effects of a WebQuest activity for the information technology course on students' achievement.* (Master's thesis), Institute of Science, Balıkesir University, Balıkesir /online/. Retrieved on November 13, 2015 from https://tez.yok.gov.tr/UlusalTezMerkezi

Büyüköztürk, Ş. (2007). *Sosyal bilimler için veri analizi el kitabı [Data analysis for social sciences handbook],* (8th edition). Ankara: Pegem A Pub.

Carr, T., Morrison, A., Co, G., & Deacon, A. (2007). Weathering Wikis: Net-based learning meets political science in a South African university. *Computers and Composition, 24*(3), 266–284. http://dx.doi.org/10.1016/j.compcom.2007.06.001

Chan, Y.-Y. (2007). *Teaching queuing theory with an inquiry-based learning approach: A case for applying WebQuest in a course in simulation and statistical analysis*. Paper presented at the 37th ASEE/IEEE Frontiers in Education Conference, Milwaukee, WI.

Chang, C., Chen, T., & Hsu, W. (2010). The study on integrating WebQuest with mobile learning for environmental education. *Computers & Education, 57*(1), 1228-1239. http://dx.doi.org/10.1016/j.compedu.2010.12.005

Chou, P.-N., & Chen, H.-H. (2008). Engagement in online collaborative learning: A case study using a web 2.0 tool. *MERLOT Journal of Online Learning and Teaching, 4*(4), 574-582.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches (2ⁿᵈEd.)*. California: Sage Publications.

Dodge, B. (1995). WebQuests: A technique for Internet-based learning. *Distance Educator, 1*(2), 10-13.

Dughila, P., Adascalitei, A., & Grigoriu, A. (2013). *Blended learning textile chemistry using Moodle virtual learning environment.* Paper presented at the 9th International Scientific Conference E-Learning and Software for Education. Bucharest.

Elgort, I., Smith, A., & Toland, J. (2008). Is Wiki an effective platform for group course work?. *Australasian Journal of Educational Technology, 24*(2), 195-210. http://dx.doi.org/10.14742/ajet.1222

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(1), 107–115. http://dx.doi.org/10.1111/j.1365-2648.2007.04569.x

Fraenkel, J., Wallen, N., & Hyun, H. (2012). *How to design and evaluate research in education*. 8th edition. New York: McGraw-Hill.

Frydenberg, M. (2008). Wikis as a tool for collaborative course management. *MERLOT Journal of Online Learning and Teaching, 4*(2), 169-181.

Gilbert, J. K. (2006). On the nature of "context" in chemical education. *International Journal of Science Education, 28*(9), 957-976. http://dx.doi.org/10.1080/09500690600702470

Glynn, M. S., Taasoobshirazi, G., & Brickman, P. (2007). Nonscience majors learning science: a theoretical model of motivation. *Journal of Research In Science Teaching, 44*(8), 1088-1107. http://dx.doi.org/10.1002/tea.20181

Glynn, M. S., & Koballa, T. R. Jr. (2009). Motivation to learn college science. In J. J. Mintzes & W.H. Leonard (Eds.), *Handbook of college science teaching* (pp. 25-35). Arlington, VA: National Science Teachers Association Press.

Gökalp, M. S. (2011). *The effect of WebQuest based instruction on ninth grade students' achievement in and attitude towards force and motivation*. (Master's thesis), Institute of Science, Middle East Technical University, Ankara /online/. Retrieved on November 13, 2014 from https://tez.yok.gov.tr/UlusalTezMerkezi

Hadjerrouit, S. (2014). Wiki as a collaborative writing tool in teacher education: Evaluation and suggestions for effective use. *Computers in Human Behavior, 32*, 301-312. http://dx.doi.org/10.1016/j.chb.2013.07.004

Halat, E. (2007). Views of pre-service elementary teachers on the use of WebQuest in mathematics teaching. *Elementary Education Online, 6*(2), 264-283.

Hassanien, A. (2006). An evaluation of the WebQuest as a computer-based learning tool. *Research in Post-Compulsory Education, 11*(2), 235-250. http://dx.doi.org/10.1080/13596740600769230

Heafner, T. L., & Friedman, A. M. (2008). Wikis and constructivism in secondary social studies: Fostering a deeper understanding, computers in the schools. *Interdisciplinary Journal of Practice, Theory, and Applied Research, 25*(3-4), 288-302. http://dx.doi.org/10.1080/07380560802371003

Huang, W., & Nakazawa, K. (2010). An empirical analysis on how learners interact in Wiki in a graduate level online course. *Interactive Learning Environments, 18*(3), 233-244. http://dx.doi.org/10.1080/10494820.2010.500520

İlhan, N., Yıldırım, A., & Yılmaz, S. (2012). Chemistry motivation questionnaire: the study of validity and reliability. *Journal of Mustafa Kemal University Institute of Social Sciences, 9*(18), 297-310.

İnner, B. (2007). *Öğrenme yönetim sisteminin (Moodle) örgün öğretim laboratuvar uygulamalarında kullanılması.* Ulusal Teknik Eğitim, Mühendislikve Eğitim Bilimleri Genç Araştırmacılar Sempozyumu /online/. Retrieved on November 13, 2014 from http://akademikpersonel.kocaeli.edu.tr/binner/bildiri/binner13.02.2013_18.33.25bildiri.pdf

Jordan, C. (2013). Comparison of international baccalaureate (IB) chemistry students' preferred vs actual experience with a constructivist style of learning in a moodle e-learning environment. *International Journal for Lesson and Learning Studies, 2*(2), 155-167. http://dx.doi.org/10.1108/20468251311323397

Joseph, L. C. (2000). FoodQuest for health. *Multimedia Schools, 7*(1), 34-37.

Karasavvidis, I. (2010). Wiki uses in higher education: exploring barriers to successful implementation. *Interactive Learning Environments, 18*(3), 219–231. http://dx.doi.org/10.1080/10494820.2010.500514

Kılıç, R. (2007). *The effects of WebQuest assisted cooperative learning method on the attitudes and achievement towards mathematics lesson.* (Master's thesis), Institute of Science, Niğde University, Niğde /online/. Retrieved on November 13, 2014 from https://tez.yok.gov.tr/UlusalTezMerkezi

Köse, F. (2007). *Moving the WebQuest process from static to dynamic: Preservice teachers' experience with the dynamic WebQuest environment.* (Master's thesis), Institute of Science, Middle East Technical University, Ankara /online/. Retrieved on February 13, 2013 from https://tez.yok.gov.tr/UlusalTezMerkezi

Kundu, R., & Bain, C. (2006). WebQuests: Utilizing technology in a constructivist manner to facilitate meaningful. *Art Education, 59*(2), 6-11.

Lim, S-L., & Hernández, P. (2007). The WebQuest: An illustration of instructional technology implementation in MFT training. *Contemporary Family Therapy, 29*(3), 163-175. http://dx.doi.org/10.1007/s10591-007-9038-y

Ma, W. W. K., & Yuen, A. H. K. (2008). A qualitative analysis on collaborative learning experience of student journalists using Wiki. In J. Fong, R. Kwan, & F. L. Wang (Eds.), *Hybrid Learning and Education: Proceedings of the First International Conference, ICHL 2008*, LNCS 5169 (pp. 103-114). Berlin Heidelberg: Springer-Verlag. http://dx.doi.org/10.1007/978-3-540-85170-7_9

Mindel, J., & Verma, S. (2006). Wikis for teaching and learning. *Communications of the Association for Information Systems, 18*(1), 1-23.

Minocha, S., & Roberts, D. (2008). Social, usability, and pedagogical factors influencing students' learning experiences with Wikis and blogs. *Pragmatics & Cognition, 16*(2), 272–306. http://dx.doi.org/10.1075/pc.16.2.05min

Morgan, B., & Smith, R. D. (2008). A Wiki for classroom writing. *Reading Teacher, 62*(1), 80-82. http://dx.doi.org/10.1598/RT.62.1.10

Onwuegbuzie, A. J., & Leech, N. L. (2006). Linking research questions to mixed methods data analysis procedures. *The Qualitative Report, 11*(3), 474-498.

OECD. (2006). *Assessing scientific, reading and mathematical literacy*. Paris: OECD Publishing. http://dx.doi.org/10.1787/9789264026407-en

Parker, K., & Chao, J. (2007). Wiki as a teaching tool. *Interdisciplinary Journal of E-Learning and Learning Objects, 3*(1), 57-72.

Patton, M. (1990). *Qualitative evaluation and research methods*. Beverly Hills, CA: Sage.

De Pedro, X., Rieradevall, M., López, P., Sant, D., Piñol, J., Núñez, L., et al. (2006). *Writing documents collaboratively in Higher education using Traditional vs. Wiki methodology (I): Qualitative results from a 2-year project study.* Paper presented at the 4th International Congress of University Teaching and Innovation, Montreal Quebec, Canada. Retrieved on December 10, 2014 from http://uniwiki.ourproject.org/tiki-download_wiki_attachment.php

Perkins, R., & McKnight, M. L. (2005). Teachers' attitudes toward WebQuests as a method of teaching. *Computers in the Schools, 22*(1-2), 123-133. http://dx.doi.org/10.1300/J025v22n01_11

Raman, M., Ryan, T., & Olfman, L. (2005). Designing knowledge management systems for teaching and learning with Wiki technology. *Journal of Information Systems Education 16*(3), 311-321.

Snelling, C., & Karanicolas, S. (2008). *Why Wikis work: assessing group work in an on-line environment.* ATN Assessment Conference 08: Engaging Student with Assessment. Retrieved on November 13, 2014 from http://ojs.ml.unisa.edu.au/index.php/atna/article/viewFile/298/276.

Su, F., & Beaumont, C. (2010). Evaluating the use of a Wiki for collaborative learning. *Innovations in Education and Teaching International, 47(*4), 417-431. http://dx.doi.org/10.1080/14703297.2010.518428

Summerville, J. (2000). WebQuests. *TechTrends, 44*(2), 31-55. http://dx.doi.org/10.1007/BF02822950

Tabanlı, S. (2008). *Constructivist teaching in the foundations of information technologies lesson: Student opinions about WebQuest technique.* (Master's thesis), Institute of Science, Ege Üniversitesi, İzmir /online/. Retrieved on April 22, 2014 from https://tez.yok.gov.tr/UlusalTezMerkezi

Tepe, T. (2013). *Students' opinions related to general chemistry lesson aided by WebQuest and Wiki applications.* (Master's thesis), Institute of Science, Ege Üniversitesi, İzmir /online/. Retrieved on November 13, 2014 from https://tez.yok.gov.tr/UlusalTezMerkezi

Tsai, W., Li, W., Elston, J., & Chen, Y. (2011). Collaborative learning using Wiki web sites for computer science undergraduate education: A Case Study. *IEEE Transactions on Education*, 54(1), 114-124. http://dx.doi.org/10.1109/TE.2010.2046491

Vega, C., & Salas, L. (2011). Finding support in Moodle: A face-to-face chemistry course for engineers. *US-China Education Review, A1*, 10-21.

Weeks, T. S. (2005). *A critical analysis of the representation of race in secondary social studies WebQuests.* (Unpublished Doctoral Dissertation, North Carolina State University). Retrieved on November 13, 2014 from http://repository.lib.ncsu.edu/ir/bitstream/1840.16/3534/1/etd.pdf

Wever, B., Keer, H., Schellens, T., & Valcke, M. (2011). Assessing collaboration in a Wiki: The reliability of university students' peer assessment. *Internet and Higher Education, 14*(4), 201–206. http://dx.doi.org/10.1016/j.iheduc.2011.07.003

Yaman, M. (2009). Context and methods on respiration and energy acquisition interesting for students. *Journal of Hacettepe University Education Faculty, 37*, 215-228.

Zacharia, C., Xenofontos, A., & Manoli, C. (2010). The effect of two different cooperative approaches on students' learning and practices within the context of a WebQuest science investigation. *Education Tech Research Dev, 59*(3), 399–424. http://dx.doi.org/10.1007/s11423-010-9181-2

Zlatkovska, E. (2010). WebQuests as a constructivist tool in the EFL teaching methodology class in a university in Macedonia. *Computer Resources for Language Learning, 3*, 14-24.

Tansel Tepe
Muallim Rifat Faculty of Education, Kilis 7 Aralık University
Mehmet Sanlı Mah. Doğan Güreş Paşa Bul. No:134 Kilis, Turkey
tanseltepe@kilis.edu.tr

Nail Ilhan
Muallim Rifat Faculty of Education, Kilis 7 Aralık University
Mehmet Sanlı Mah. Doğan Güreş Paşa Bul. No:134 Kilis, Turkey
naililhan@gmail.com

Mustafa Murat Inceoglu
Faculty of Education, Ege University
Bornova 35100 Izmir, Turkey
mustafa.inceoglu@ege.edu.tr

Appendix

A.1 WebQuest Semi-structured Focus Group Interview

1. How do you think teaching courses with the Moodle-assisted WebQuest method affects your success in learning chemistry concepts?

Probe: In terms of associating concepts with daily life, in terms of permanence of learning, in terms of learning speed.

2. What are the features that you think should be modified in order to increase your success in the applications (tasks, homework) prepared with the Moodle-assisted WebQuest method?

Probe: Pre-service teacher - pre-service teacher interaction, teacher - pre-service teacher interaction, applications, visual design of Moodle-assisted WebQuest.

3. How did your roles and responsibilities in using the Moodle-assisted WebQuest method for chemistry courses affect your learning chemistry concepts?

Probe: While reaching information, during tasks, in peer evaluations, during the tasks in research applications.

4. Do you think that your working in groups while performing applications with the Moodle-assisted WebQuest method had an effect on your success? How?

Probe: In terms of using forum pages, in terms of cooperative work (preparing shared homework).

5. Do you prefer preparing homework by researching the Moodle-assisted WebQuest applications or preparing homework by researching without WebQuest applications? Why?

Probe: In using the Internet effectively, in reaching information fast.

6. How did learning with Moodle-assisted WebQuest applications change your motivation for and attitude to learning chemistry concepts?

Probe: In terms of increase/decrease in motivation for learning chemistry concepts, in terms of liking chemistry course more or less now.

7. What are your views on the usability of the applications prepared with Moodle-assisted WebQuest method in other subjects and courses?

Probe: In terms of planning, in terms of applications, in terms of learning.

8. What are the problems you encountered during Moodle-assisted WebQuest applications?

Probe: In terms of the Internet access, in terms of contacting group members and finishing shared homework, in terms of understanding the tasks given, in terms of computer literacy level.

A.2 Wiki Semi-structured Focus Group Interview

1. How do you think teaching courses with Moodle assisted Wiki method affects your success in learning chemistry concepts?

Probe: In terms of associating concepts with daily life, in terms of permanence of learning, in terms of learning speed.

2. What are the features that you think should be modified in order to increase your success in the applications (tasks, homework) prepared with Moodle-assisted Wiki method?

Probe: Pre-service teacher - pre-service teacher interaction, teacher - pre-service teacher interaction, applications, visual design of Moodle-assisted WebQuest.

3. How did your roles and responsibilities in using Moodle-assisted Wiki method for chemistry courses affect your learning chemistry concepts?

Probe: While reaching information, during tasks, in peer evaluations, during the tasks in research applications.

4. Do you think that your working in groups while performing applications with Moodle-assisted Wiki method had an effect on your success? How?

Probe: In terms of using forum pages, in terms of cooperative work (preparing shared homework).

5. Do you think assisting the cooperative learning method in Moodle-assisted Wiki applications with web has an effect on your success? How?

Probe: In using the Internet effectively, in reaching information fast.

6. How did learning with Moodle-assisted Wiki applications change your motivation for and attitude to learning chemistry concepts?

Probe: In terms of increase/decrease in motivation for learning chemistry concepts, in terms of liking chemistry course more or less now.

7. What are your views on the usability of the applications prepared with Moodle-assisted Wiki method in other subjects and courses?

Probe: In terms of planning, in terms of applications, in terms of learning.

8. What are the problems you encountered during Moodle-assisted Wiki applications?

Probe: In terms of the Internet access, in terms of contacting group members and finishing shared homework, in terms of understanding the tasks given, in terms of computer literacy level.

Primjena WebQuest i Wiki sustava u nastavi kemije: stavovi budućih učitelja i njihova motivacija za učenje kemije

Sažetak

Ovim istraživanjem pokušat će se odrediti stavovi budućih učitelja vezani uz procjenu učinkovitosti primjene WebQuesta i Wikija pripremljenih za nastavu opće kemije. Također se nastoje otkriti učinci njihove primjene na razinu motivacije budućih učitelja za učenje kemije. S tom svrhom koristili smo se mješovitom metodologijom istraživanja. Podaci su dobiveni koristeći se intervjuima u fokus grupama i upitnikom 'Chemistry Motivation Questionnaire'. Uzorak ispitanika sastojao se od 11 budućih učitelja s dva sveučilišta. Promatrala se učestalost prijavljivanja na WebQust i Wiki sustave putem Moodle sustava za upravljanje učenjem/poučavanjem. Rezultati kvalitativne analize pokazali su da je primjena oba sustava imala kognitivni doprinos za buduće učitelje te je potaknula njihov interes na osjećajnoj razini. Što se kvantitativnih rezultata tiče, oni su u ovome istraživanju ukazali na to da budući učitelji imaju pozitivne stavove prema korištenju WebQuest ili Wiki sustava u nastavi, a da njihova motivacija za učenje kemije nije porasla. Pozitivan, značajan odnos, iako na niskoj razini, uočen je kod usporedbe motivacije budućih učitelja za učenje kemije i njihove učestalosti prijavljivanja u Wiki sustav.

Ključne riječi: *nastava kemije; Moodle; motivacija; WebQuest; Wiki.*

Uvod

Prvi na popisu izvora informacija je internet. S obzirom na to da učenici na internetu mogu biti izloženi nebitnim temama za istraživanje, može doći do zbunjenost u vezi s pojmovima, a to može dovesti do poteškoća u traženju i organizaciji točne informacije. Rezultati dobiveni korištenjem mrežnih pretraživača ili e-knjižnice vezane uz neku temu ne moraju nužno odgovarati ciljevima poučavanja. Štoviše, proces traženja točne informacije o nekoj temi i fokusiranje na temu često može biti nepotrebno dugotrajan.

Koristeći se Web 2.0 tehnologijom, društvene platforme predstavljaju priliku za dinamično, interaktivno dijeljenje i ponovno korištenje informacija putem Web 2.0

alata, a sadržaj na mreži može mijenjati bilo tko, odnosno može se lako osmisliti. Koristeći se sustavom WebQuest, Web 2.0 tehnologijom u obrazovanju, budući učitelji mogu realizirati istraživačke zadatke za vrijeme kojih mogu poboljšati procese analize, sinteze i evaluacije bez izravnog traženja informacija na internetu i fokusirajući svoju pažnju na informacije u skladu s osiguranim izvorima. S obzirom na to da se sastoje od uvoda, zadatka, procesa, izvora, evaluacije i zaključka, WebQuest je alternativna tehnika učenja koja omogućuje nastavnicima da usmjere buduće učitelje u pretraživanje interneta kako bi prikupili određene informacije. Za vrijeme pretraživanja budući učitelji mogu otvoriti neprikladne mrežne stranice, što predstavlja određeni rizik. Štoviše, budući učitelji mogu se izložiti velikom broju neželjenih i nepotrebnih informacija dok pretražuju internet. Zbog posjećivanja mrežnih stranica koje su prethodno odredili nastavnici za WebQuest pretraživanja, može se izbjeći izloženost nepotrebnim informacijama (Weeks, 2005). WebQuest aplikacije omogućuju nastavnicima da poučavaju putem interneta, što se razlikuje od neposredne nastave. Primjena WebQuesta razvija kod budućih učitelja vještine stavljanja u praksu i pokazivanja *online* znanja koje usvoje, praćenje uputa i organiziranja znanja. Također, taj sustav povećava kompatibilnost budućih učitelja s korištenjem tehnologije, oni razvijaju svoja iskustva s virtualnim platformama i imaju podršku da izvode skupni rad *online* (Tepe, 2013). U WebQuest aktivnostima budući nastavnici prikupljaju informacije putem istraživanja, a nove informacije aktivno stvaraju koristeći se vlastitim iskustvima i prijašnjim radom na kojem zasnivaju svoje znanje po principima konstruktivističkog pristupa (Zlatkovska, 2010). WebQuest aktivnosti poboljšavaju sposobnosti budućih učitelja za rješavanje problema i u provođenju istraživanja jer su zadaci u WebQuestu osmišljeni tako da postanu potpora budućim učiteljima na razini razmišljanja, analize, sinteze i evaluacije. Postojeća literatura o toj temi otkriva da aktivnosti na WebQuestu kognitivno doprinose budućim učiteljima (Allan i Street, 2007), povećavaju njihovo postignuće učenja (Chang i sur., 2010) i opremaju buduće učitelje sposobnošću provođenja istraživanja (Tabanlı, 2008).

Wiki, drugi primjer Web 2.0 tehnologije, su mrežne stranice koje se mogu čitati i na kojima se može pisati te omogućuju svim korisnicima kreiranje novih stranica ili modificiranje postojećih. Putem interneta, Wiki omogućuje skupinama iz različitih regija zajednički rad na dokumentima. Druga karakteristika Wikija je da ako sudionik napravi netočnu ili neprikladnu promjenu ili doda sadržaj takve prirode, drugi korisnici to lako mogu ispraviti ili izostaviti (Minocha i Roberts, 2008). Wiki ima važnu ulogu u stvaranju okruženja za konstruktivističko učenje (Karasavvidis, 2010). Poučavanje putem interneta može se ostvariti i putem Wiki aktivnosti. Wikiaktivnosti podržavaju suradničko učenje omogućujući budućim učiteljima rad u skupinama kako bi izgradili i stvorili mrežne stranice, pohranili dokumentaciju, slike, prezentacije o određenom sadržaju, rukovođenje i praćenje promjena u nastalim dokumentima, te izvodili *online* rasprave (Parker i Chao, 2007). Kod primjene Wikija, budući učitelji sami ili unutar skupina razvijaju znanje. Primjenom Wikija kao sredstva poučavanja,

stvara se konstruktivističko okruženje za učenje (Heafner i Friedman, 2008). Da bi Wiki aktivnosti zaživjele u praksi, nastavnik ima ulogu vodiča koji prati proces u kojemu budući učitelji stvaraju Wiki umjesto funkcioniranja kao osoba koja prenosi znanje za poučavanje sata ili sadržaja. Učitelji imaju pristup svim dijelovima Wiki aktivnosti i mogu ih kontrolirati (Tepe, 2013). Wiki sustav nema isključivo ulogu alata putem kojega se informacija prenosi budućim učiteljima nego ima i ulogu učitelja koji omogućuje razmjenu informacija. Te tvrdnje našle su uporište i u literaturi putem dokaza da aktivnosti na Wikiju omogućuju razmjenu informacija te potiču učenje otkrivanjem (Raman i sur., 2005), podržavaju učenje (Chou i Chen, 2008), aktiviraju znanje i sposobnosti (Snelling i Karanicolas, 2008), podržavaju skupne aktivnosti kreirajući suradničko okruženje (Raman i sur., 2005; Mindel i Verma, 2006; Chou i Chen, 2008; Frydenberg, 2008; Morgan i Smith, 2008; Elgort i sur., 2008; Snelling i Karanicolas, 2008; Huang i Nakazawa, 2010; Su i Beaumont, 2010; Wever i sur., 2011; Tsai i sur., 2011).

Primjene WebQuesta i Wikija omogućuju interakciju među učenicima putem suradničkih aktivnosti učenja, prikupljanja informacija iz različitih izvora te doprinose poučavanju tako što se koriste tehnologijom kao alatom. Wiki aktivnosti izvode se za poticanje suradničkih aktivnosti pisanja. Suradničkim pisanjem u Wikiju procjenjuje se razina doprinosa budućih učitelja promatranjem broja prijava i stvaranjem statistika (Hadjerrouit, 2014). S druge strane, istraživačke aktivnosti izvode se putem WebQuesta. Dodge (1995) opisuje WebQuest kao „aktivnost usmjerenu na istraživanje u kojoj neke ili sve informacije s kojima su učenici u interakciji dolaze iz mrežnih izvora, a po želji su nadopunjene videokonferencijama" (str. 10). Nadalje, kada se te aktivnosti usporede s obzirom na način na koji podržavaju učenje, mogu se uočiti različiti učinci na buduće učitelje (stavovi, motivacija, uspjeh i dr.). Međutim, postoji ograničen broj istraživanja koja se bave načinom na koji se korištenje tih aktivnosti može odraziti na motivaciju budućih učitelja za učenjem kemije.

Jedan od značajnih nedostataka mrežno-potpomognutog učenja jest nemogućnost prezentiranja materijala koji nisu sinkronizirani, nemogućnost dijeljenja i razgovaranja o prezentiranim materijalima na različite načine, vođenje evidencije samoga sustava, budućih učitelja, ispunjavanje obaveza kao što je izvještavanje. Da bi se ti nedostaci premostili, aktiviraju se sustavi za upravljanje učenjem (LMS). Moodle LMS je besplatan otvoreni sustav za upravljanje nastavom. Najznačajnija prednost Moodle LMS sustava je da se bilješkama sa sata, raspravama, zadaćama i testovima može upravljati na internetu. U Moodle LMS okruženju nastava se može održavati sinkrono i asinkrono, a budući učitelji, ako im se dopusti, imaju mogućnost pratiti nastavu na bilo kojem mjestu i u bilo koje vrijeme (Inner, 2007). Što budući učitelji rade u sustavu Moodle LMS, i njihova razina aktivnosti u zadacima lako se može pratiti.

U našem istraživanju pripremljene su WebQuest i Wiki aktivnosti na sustavu Moodle LMS za nastavu opće kemije. Cilj uključivanja WebQuest i Wiki aktivnosti u Moodle LMS je što se budući učitelji mogu pratiti putem Moodle LMS, može se pratiti

njihova aktivnost u smislu vremena, kao i neki drugi detalji. Korištenje sustavom Moodle LMS u nastavi kemije bio je predmet nekih istraživanja (Vega i Salas, 2011; Dughila i sur., 2013; Jordan, 2013). Međutim, malo je istraživanja koja proučavaju kako se budući učitelji koriste WebQuestom i Wikijem putem sustava Moodle LMS, problemima na koje nailaze u aktivnostima i preporukama o mogućim rješenjima, te kako takve situacije utječu na motivaciju budućih učitelja za učenjem kemije.

S obzirom na to da su teme u nastavi kemije uglavnom teorijske, postoje poteškoće u poučavanju, odnosno praksi. Također, nailazimo na povećanje negativne motivacije budućih učitelja za učenjem kemije, što je zabilježeno u različitim istraživanjima (Gilbert, 2006; OECD, 2006; Yaman, 2009). Ovo istraživanje važno je zbog njegova doprinosa osviještenosti o tome kako korištenje WebQuestom i Wikijem utječe na motivaciju budućih učitelja za učenje kemije. Važno je napomenuti da istraživanje pokriva dva značajna društvena platformska alata, odnosno WebQuest i Wiki u sustavu Moodle LMS, a važno je i za njihovu komparativnu prezentaciju.

U našem istraživanju neki od sadržaja iz područja opće kemije pripremljeni su koristeći se WebQuest i Wiki aktivnostima u sustavu Moodle LMS za Web 2.0 tehnologije.

Naše istraživanje nastoji odrediti poglede budućih učitelja s obzirom na procjenu učinkovitosti primjene WebQuesta i Wikija pripremljenih za nastavu opće kemije. Također, nastoji otkriti učinke tih aplikacija na razine motivacije budućih učitelja za učenjem kemije. Pokušat ćemo naći odgovore na sljedeća istraživačka pitanja:

1) Kakve stavove imaju budući učitelji o primjeni WebQuesta i Wikija u nastavi opće kemije?
2) Postoji li razlika u rezultatima predtestova i posttestova motivacije za učenjem kemije kod budućih učitelja koji se koriste WebQuest i Wiki aktivnostima u nastavi kemije?
3) Postoji li značajan odnos između učestalosti prijavljivanja budućih učitelja u WebQuest ili Wiki aktivnosti i njihove razine motivacije za učenje kemije?

Metodologija istraživanja
Nacrt istraživanja

Za potrebe ovoga istraživanja koristila se mješovita metoda. Mješovita metoda podrazumijeva kvalitativne i kvantitativne podatke koji su prikupljeni, analizirani i interpretirani (Creswell, 2003; Onwuegbuzie i Leech, 2006). Metoda statičke usporedbe skupine koristila se za kvantitativni dio istraživanja. Takav pristup često se naziva istraživanje u obliku neekvivalentnih grupa (eng. *nonequivalent control group design*) (Fraenkel i Wallen, 2012). Što se tiče kvalitativnog dijela istraživanja on je bio deskriptivne prirode, s intervjuima u fokus grupama.

U našem istraživanju nastava opće kemije za buduće učitelje Odsjeka za obrazovanje učitelja Učiteljskog fakulteta Sveučilišta Ege i Sveučilišta Kilis 7 Aralık izvođena je uz pomoć WebQuest i Wiki aktivnosti unutar sustava Moodle LMS. Za dobivanje različitih

podataka koristila su se tri različita alata: Upitnik *Chemistry Motivation Questionnaire* (CMQ) za dobivanje kvantitativnih podataka, WebQuest polustrukturirani intervju u fokus grupi (WQSFGI) i Wiki polustrukturirani intervju u fokus grupi. Upitnik CMQ koristio se također da bi se dobili i neki demografski podaci. Tablica 1 prikazuje detalje istraživanja s obzirom na razine primjene.

Tablica 1

Uzorak

Uzorak u istraživanju sastojao se od 111 studenata prve godine studija za obrazovanje učitelja Sveučilišta Ege (GWK=24; GWQ=29) i Sveučilišta Kilis 7 Aralik (GWK=31; GWQ=27). Istraživanje je provedeno u ljetnom semestru 2012./2013. godine (Tablica 2). S obzirom na to da su ispitanici sa sveučilišta s kojih dolaze i istraživači, koristila se metoda prigodnog uzorka (Fraenkel i Wallen, 2012) za odabir GWQ i GWK. U kvalitativnom dijelu istraživanja 24 buduća učitelja podijeljena su u dvije skupine od 12 budućih učitelja iz GWQ i GWK koji su intervjuirani u fokus grupama. Kriterijska metoda uzorkovanja utemeljena na kriterijima, namjerni uzorak primijenjeni su u kvalitativnom dijelu istraživanja (Patton, 1990, str. 169-186). Sudionici u intervjuima u fokus grupi birani su iz skupine budućih učitelja koji su se najčešće prijavljivali u sustav. Za praćenje količine vremena koju budući učitelji provedu u sustavima koristilo se svojstvo izvještavanja samoga sustava Moodle LMS. U kvantitativnom dijelu istraživanja 11 budućih učitelja nije sudjelovalo u CMQ posttestu. Kolegij kemija obavezan je kolegij u kurikulu obrazovanja učitelja u Turskoj. Nakon prijavljivanja u sustav, neki sudionici nisu htjeli dalje sudjelovati u kolegiju, nego su odlučili prisustvovati tradicionalnoj nastavi. Sudjelovanje u CMQ i intervjuima fokus grupe bili su dobrovoljni. Demografske karakteristike skupine prikazane su u Tablici 3.

Tablica 2 i 3

Instrumenti za prikupljanje podataka
Upitnik *Chemistry Motivation Questionnaire* **(CMQ***)*

Upitnik CMQ razvili su Glynn i sur. (2007; 2009), a na turski su ga prilagodilk Ilhan, Yildirim i Sadi Yilmaz (2012). Tijekom procesa prilagodbe koji su proveli Ilhan i sur. (2012) konačni oblik upitnika postavljen je na 22 čestice. CMQ je upitnik Likertova tipa s razinama od „Nikada“ (1) do „Uvijek“ (5). Koeficijent pouzdanosti upitnika (Cronbachov alfa) je 0,82. Taj rezultat pokazuje da je upitnik dovoljno pouzdan i upotrebljiv. U procesu prilagodbe koju su proveli Ilhan i sur. (2012) provedena je i eksplorativna faktorska analiza. CMQ se sastoji od 22 čestice i šest dimenzija. Te dimenzije su „intrinzična motivacija za učenje prirodoslovlja“, „ekstrinzična motivacija za učenje prirodoslovlja“, „važnost učenja prirodoslovlja za osobne ciljeve“, „odgovornost prema učenju prirodoslovlja“, „samopouzdanje kod učenja prirodoslovlja“ i „tjeskoba kod vrednovanja prirodoslovlja“. U ovome istraživanju motivacija budućih učitelja za učenje kemije mogla se izračunati preko 22 čestice.

WebQuest polustrukturirani intervju u fokus grupi (WSFGI) i Wiki polustrukturirani intervju u fokus grupi (WKSFGI*)*

Za potrebe ovoga istraživanja razvijeni su WSFGI i WKSFGI. Oni se sastoje od pitanja otvorenoga tipa koja uključuju primjere. Kod izrade WSFGI i WKSFGI upitnika stvorena je banka pitanja u skladu s glavnim istraživačkim pitanjima u ovome istraživanju. Predavači iz područja kvalitativnih istraživačkih metoda zamoljeni su da procijene valjanost pitanja te smo njihova mišljenja uzeli u obzir kao ekspertna. Nakon dobivanja ekspertnih mišljenja pripremljen je probni intervju za fokus grupe. Nakon toga su pilotirani intervjui provedeni nad drugim osobama među budućim učiteljima u GWQ i GWK koji su proveli više vremena koristeći se WebQuest i Wiki aktivnostima. Pitanja u intervjuu za fokus grupu prilagođena su s obzirom na odgovore budućih učitelja, određene promjene napravljene su na primjerima te su pripremljene konačne verzije pitanja za WSFGI i WKSFGI. Intervjui u fokus grupama snimljeni su videorekorderom kako bi se osigurala nepristranost i kontinuiran govor. Polustrukturirani intervjui u fokus grupi trajali su, u prosjeku, 50 minuta.

Analiza podataka

Kvalitativni podaci iz pitanja WQSFGI i WKSFGI analizirani su metodom induktivne analize sadržaja (Elo i Kyngäs, 2008). Za analizu kvantitativnih podataka koristio se SPSS statistički program. Za otkrivanje učinka primjene WebQuesta i Wikija na motivaciju budućih učitelja za učenje kemije primijenjen je t-test za zavisne uzorke i t-test za nezavisne uzorke.

Proces implementacije

Prije prijelaza na WebQuest i Wiki aktivnosti kreirani su Moodle LMS korisnički računi za svakog budućeg učitelja. Za vrijeme istraživanja budući učitelji su promatrani putem Moodle LMS sustava koji je bilježio statistiku prijavljivanja. Na taj smo način mogli utvrditi jesu li budući učitelji radili na aplikacijama ili nisu, te koliko su se često prijavljivali na aplikacije (Tablica 4).

Tablica 4

Budući učitelji su u GWK ukupno napravili 9408 radnji u aktivnostima, što je i najviše u odnosu na 6919 u GWQ. Za potrebe ovoga istraživanja WebQuest i Wiki aktivnosti pripremljene su u sustavu Moodle LMS. Sadržaj aktivnosti pripremljen je prema sadržaju predmeta opća kemija (struktura atoma i teorije, periodični sustav elemenata i kemijske veze). Prije istraživanja budući učitelji prošli su jednotjedni program ponavljanja osnovnih pojmova iz kemije. Taj je program za cilj imao upoznati buduće učitelje sa sustavom. Za vrijeme trajanja programa pripremljena je WebQuest aktivnost vezana uz jedinicu koja je nazvana „osnovni pojmovi". U aktivnostima budućih učitelja u GWQ zatraženo je da objasne svaku karakteristiku materija u odnosu na svakodnevni život i da pripreme izvještaj u kojem će pokazati tri fizička

stanja (kruto, tekuće i plinovito). U Wiki aktivnostima koje su pripremile „temeljne pojmove", budući nastavnici morali su napraviti odlomak knjige upisujući ponuđene nazive predmeta. Budući učitelji bili su uključeni u sedmotjedni projekt, odnosno jednotjedno upoznavanje i šestotjedni proces provedbe. Budući učitelji u GWQ imali su specifične zadatke i očekivalo se da će napraviti zadaću vezanu uz iste zadatke. Za pripremu sadržaja za GWK uglavnom su korišteni udžbenici. Nakon određivanja popisa pojmova i naziva jedinica, očekivalo se da GWK kreiraju odlomak knjige vezan uz svaku jedinicu dodajući povezane nazive jedinica. Prilikom pripreme sadržaja konzultirani su stručnjaci te su shodno tome napravljene i odgovarajuće promjene.

Rezultati

Analizirani su stavovi budućih učitelja u GWK i GWQ iz ovoga istraživanja. U analizi sadržaja napravljene su teme i odlike. Frekvencije odlika prikazane su u Tablici 5. Promotrimo li stavove budućih učitelja o primjeni WebQuest i Wiki sustava, mogu se definirati četiri teme: kognitivan doprinos, osjećajni učinak, uporabljivost i prijedlozi o primjenama.

Tablica 5

Stavovi budućih učitelja o primjeni WebQuesta i Wikija

Proučavanjem stavova budućih učitelja vezanih uz temu kognitivni doprinos, pojavljuje se serija odlika: omogućuje učenje, lako pamćenje, učinkovito učenje, novo učenje, pomoć u razumijevanju, zadržavanje povezanosti predmeta, više informacija, omogućuje istraživanje, pomoć, doprinos uspjehu. Kod procjene stavova budućih učitelja vezanih uz temu osjećajni učinak, pojavljuju se oznake poput naklonosti, odgovornosti, stava, motivacije i dosade. Navodimo neke od stavova budućih učitelja o kognitivnom doprinosu i osjećajnom učinku:

„Zahvaljujući Moodle-u, nije postojala potreba za vođenjem bilješki. Bilješke su već postojale. Zapravo, tu postoji određena težina. Samo slušanje na satu bilo je vrlo korisno" [GWK5].

„Svi se prijavimo na sustav u isto vrijeme i moramo čekati jedni druge"[GWK7].

„Kao budući učitelji, nemamo baš velik interes za kolegije iz prirodoslovlja, ali zahvaljujući ovome, sada imamo. Učim kemiju i počela mi se sviđati. Sada imam neka znanja o prirodoslovlju. Odnosno, ovaj je način utjecao na naše sudjelovanje"[GWK12].

„Mogućnost vizualiziranja omogućuje bolje razumijevanje"[GWQ11].

S obzirom na stavove budućih učitelja, može se reći da su im WebQuest i Wiki aktivnosti doprinijeli na kognitivnoj razini. Budući učitelji u GWK podijelili su mnoge stavove u kojima izlažu njihove kognitivne doprinose. Tvrdnje budućih učitelja, posebno vezane uz pamćenje, pomoć i doprinos uspjehu bile su prilično pozitivne. Prema tim tvrdnjama, budući učitelji smatraju da su spomenuti sustavi kognitivno pozitivni. Budući učitelji podijelili su svoje stavove o naklonosti, odgovornosti, motivaciji i dosadi s obzirom na osjećajni učinak. Iako su neki ispitanici u fokus

grupama izrazili neke negativne stavove o aktivnostima s obzirom na osjećajni učinak, većina stavova bila je pozitivna. Budući učitelji izjavili su da im se aktivnosti sviđaju, da im daju osjećaj odgovornosti, i da poboljšavaju njihove stavove i motivaciju. Neki od budućih učitelja izjavili su da se, iako su im aplikacije prvobitno bile interesantne, njihov interes s vremenom smanjio, te su aktivnosti postale dosadne.

Sudeći prema odgovorima budućih učitelja o uporabljivosti WebQuest i Wiki aktivnosti u nastavi, formirale su se sljedeće odlike: pomoć kod ispita, sistematično učenje, povezanost sa svakodnevnim životom, prilika za ponavljanjem, interakcija, pomoć u učenju i brzi pristup informacijama. Niže u tekstu navedeni su neki od stavova budućih učitelja o uporabljivosti odlika:

„U osnovi, dok prolazite kroz Moodle, zapravo čitate sadržaj kako biste vidjeli koji je bolji. To je poput ponovnog čitanja onoga što već znate"[GWK1].

„Bilo je korisno jer smo imali brz pristup informacijama…To jest brži pristup, jer ga podržava internet pa je pristup informacijama brz"[GWK5].

„Puno pomaže u učenju za ispit. Bolji je za učenje za ispit" [GWQ11].

„S obzirom na to da većina naših prijatelja nije odgodila zadaću, rad je bio sustavan. Nisu preskakali teme. Usmjeravao nas je. Bilo je lako jer je bio na internetu. Nismo imali nikakvih problema dok smo radili zadaću. Također, pomaže nam i zbog svoje višerazinske strukture. Pomaže nam učiti sadržaj ovoga kolegija" [GWQ12].

Kada procijenimo stavove budućih učitelja o uporabljivosti WebQuest i Wiki aktivnosti, vidljivo je da budući učitelji GWQ smatraju da su te aktivnosti više uporabljive od budućih učitelja u GWK (Tablica 5). Budući učitelji smatraju da su te aktivnosti korisne jer pomažu u učenju i interakciji. Štoviše, njihove tvrdnje o uporabljivosti aktivnosti u svakodnevnom životu su pozitivne. Budući učitelji tvrde da im je omogućen brzi pristup informacijama jer su aktivnosti bile na internetu.

Budući učitelji izrazili su svoje stavove o promjenama koje bi mogle povećati uporabljivost tih aktivnosti pod nazivom *prijedlozi za primjenu.* Odlike koje su nastale pod tom temom identificirane su kao povratna informacija, primjena na druge kolegije, vizualni dizajn, služenje cilju, primjeri aktivnosti, mogućnost čitanja prijašnjih predmeta, komunikacija među grupama. Neki su od stavova budućih učitelja:

„Kada bi predavač ispravio naše pogreške nakon aktivnosti, bilo bi to puno učinkovitije za trajno znanje" [GWK2].

„Da smo imali priliku vidjeti zadaće koje su odradili naše kolege u grupi. Primjerice prijavim se na WebQuest i samo odradim zadaću, ali nisam mogao vidjeti zadaću svojih prijatelja u skupinu. To ima negativan učinak. Ili, da smo mogli pročitati zadaće u Wiki, mogli smo pročitati sve. Moje je mišljenje da je logično vidjeti zadaće drugih" [GWQ9].

„Bilo bi puno bolje kada bi se koristio u prirodoslovnim predmetima, posebice u fizici i matematici. Na primjer, ne bismo bili ograničeni na odgovor samo jedne osobe, te bismo mogli vidjeti i ostala rješenja. Mogli bismo ostvariti interakciju s ostalim prijateljima i riješiti probleme" [GWQ12].

Iako su budući učitelji navedene aktivnosti doživjeli kao učinkovite, također su izrazili i zabrinutosti zbog njihovih nedostataka, te su izrazili svoja mišljenja o poboljšanju aktivnosti. Budući učitelji u GWK izrazili su potrebu za više modifikacija u usporedbi s onima iz GWQ (Tablica 5). To ukazuje na činjenicu da budući učitelji u GWK imaju više problema s aktivnostima od budućih učitelja u GWQ. Budući učitelji posebno su negodovali zbog nedostatka povratne informacije od predavača koji su držali nastavu iz kolegija Opća kemija te su također izrazili mišljenje da aktivnosti nisu bile svrsishodne. Budući učitelji izjavili su da aktivnosti nisu služile svrsi kod sadržaja, da postoje manjkavosti u infrastrukturi, naslovi predmeta nisu bili postavljeni kao poveznice te su bili nedostatni, nisu imali dovoljno vremena za Wiki aktivnosti, morali su čekati kako bi dodali sadržaj na Wiki, te da je onemogućena funkcija *copy & paste*. Nadalje, budući učitelji u GWK izrazili su više pozitivnih stavova o korisnosti aktivnosti u drugim kolegijima.

Zaključujemo da, s obzirom na stavove budućih učitelja, WebQuest aktivnosti doprinose kognitivno više nego Wiki aktivnosti i da budući učitelji u GWQ smatraju da su te aktivnosti korisne. Dok su WebQuest i Wiki aktivnosti doprinijele budućim učiteljima na slične načine u kontekstu osjećajnog učinka, budući učitelji u GWK izrazili su više stavova o potrebi modificiranja aktivnosti.

Rezultati predtesta i posttesta motiviranosti budućih učitelja za učenjem kemije

Za istraživanje učinaka primjena navedenih aktivnosti na razine motivacije budućih učitelja za učenjem kemije koristili smo se upitnikom CMQ. Najprije su uspoređene srednje vrijednosti rezultata predtesta i posttesta GWQ, a zatim su rezultati uspoređeni sa srednjim vrijednostima predtesta i posttesta GWK koristeći se t-testom za zavisne uzorke.

Test normalnosti primijenjen je kako bi se procijenilo hoće li se parametarski testovi koristiti u našem istraživanju. Nakon provedbe Shapiro-Wilks testa, vrijednosti značajnosti bile su veće od 0,05 ($p > 0,05$). Podaci ukazuju na normalnu distribuciju (Büyüköztürk, 2007, str. 42). Zavisni t-test koristio se kako bi se odredile razlike u rezultatima iz predtesta – CMQ i posttesta – CMQ motivacije budućih učitelja za učenje kemije uz GWQ i GWK (Tablica 6).

Tablica 6

Rezultati kvantitativne analize nisu ukazali na postojanje statistički značajne razlike između predtesta – CMQ i posttesta – CMQ prosjeka GWQ ($t(54)=0,52; p > .01$; $\eta 2 = 0,081$) i GWK ($t(44)=1,16; p > 0,01$; $\eta 2 = 0,044$). Na osnovi tih rezultata može se zaključiti da ne postoji značajna promjena u motivaciji budućih učitelja za učenje kemije na početku i na kraju WebQuest i Wiki aktivnosti. Zapravo, WebQuest i Wiki aktivnosti nisu imale značajan učinak na motivaciju budućih učitelja za učenjem kemije.

Nezavisni t-test primijenjen je kako bi se utvrdilo ima li primjena WebQuest i Wiki aktivnosti učinak na motivaciju budućih učitelja za učenje kemije (Tablica 7). Prvo su uspoređeni rezultati GWQ i GWK, a zatim rezultati posttesta.

Tablica 7

Prema rezultatima nezavisnog t-testa značajna razlika u razinama važnosti 0,01 (t(98)=2,97;p<0,01;η2=0,083) pojavila se između bodova predtesta – CMQ za GWQ i GWK. Ta značajna razlika ide u prilog budućim učiteljima u GWK i pokazuje da su razine motivacije budućih učitelja za učenje kemije u GWK bile više na početku. Štoviše, vezano uz razinu važnosti 0,01 (t(98)=2,15;p>0,01;η2=0,045), nije utvrđena značajna razlika s obzirom na rezultate posttesta između GWK i GWQ. Činjenica da se nisu pojavile značajne razlike između motivacije na rezultatima posttesta GWQ i onih GWK na kraju istraživanja za razliku od razina Wiki pri čemu je motivacija budućih učitelja za učenje kemije veća na početku istraživanja, pokazatelj je da je primjena WebQuesta motivirala više nego primjena Wikija.

Odnos između učestalosti prijavljivanja u sustave i motivacije budućih učitelja za učenje kemije

U proučavanju odnosa između rezultata posttesta – CMQ u WebQuestu i učestalosti prijavljivanja u sustave ustanovili smo da je taj odnos na pozitivnoj razini, slab, ali ne i značajan (r=0,164, p<0,05). To pokazuje da učestalost prijavljivanja u WebQuest sustave nije prouzročila značajne učinke na motivaciju budućih učitelja za učenje kemije. Kada se usporedi odnos između učestalosti prijavljivanja na Wiki sustave i rezultate posttesta – CMQ, uvidjeli smo da postoji značajan, pozitivan odnos, ali na nižoj razini (r=0,299, p<0,05). Možemo zaključiti da kada se učestalost prijavljivanja budućih učitelja u Wiki sustave poveća, rezultati CMQ također se povećaju. Štoviše, kada se koeficijent determinacije (r^2=0,09) uzme u obzir, 9 % ukupne varijance u rezultatima CMQ dolazi od rezultata učestalosti prijave u Wiki sustave. Rezultati su prikazani u Tablici 8.

Tablica 8

Rasprava i zaključak

Intervjui provedeni s budućim učiteljima o učinkovitosti primjene WebQuesta i Wikija iznjedrili su četiri teme: kognitivni doprinos, osjećajni učinak, uporabljivost, i prijedlozi za nastavu. Na kraju istraživanja, većina budućih učitelja izjavila je da je primjena sustava doprinijela kognitivno. Nekoliko istraživanja otkrilo je da su WebQuest aktivnosti korisne kao kognitivni doprinos (Allan i Street, 2007; Chang i sur., 2010; Halat, 2007; Zacharia i sur., 2010). Raman i sur. (2006) ističu da Wiki aktivnosti potiču dijeljenje informacija, da su oni učinkoviti alati u obrazovanju i da potiču učenje otkrivanjem; budući učitelji imali su bolje ocjene s Wiki aktivnostima (Pedro i sur., 2006); Wiki aktivnosti potpomažu učenje (Chou i Chen, 2008); doprinose

učenju (Frydenberg, 2008); aktiviraju znanje i sposobnosti (Snelling i Karanicolas, 2008); potiču istraživanje i novo učenje (Tsai i sur., 2011).

U našem istraživanju, s obzirom na osjećajni učinak WebQuest i Wiki aktivnosti, većina budućih učitelja izjavila je da su im se aktivnosti sviđale, da su im povećale interes, stavove i motivaciju, kao i da su stekli osjećaj odgovornosti kroz sustave. S druge strane, neki od budućih učitelja izjavili su da je njihov interes opao te da im je nakon nekog vremena postalo dosadno. U literaturi koja je povezana s WebQuest aktivnostima navode se slični rezultati za osjećajni učinak primjena tih aktivnosti jer su interesantne, motivirajuće, poticajne i zabavne (Allan i Street, 2007; Kılıç, 2007; Lim i Hernandez, 2007; Tabanlı, 2008). U istraživanjima koje su proveli Börekçi (2010) i Gökalp (2011), WebQuest aktivnosti nisu utjecale na stavove budućih učitelja prema nastavi. U nekim istraživanjima budući učitelji nisu htjeli sudjelovati u Wiki aktivnostima (Ma i Yuen, 2008) ili su nevoljko sudjelovali u njima (Carr, Morrison, i Deacon, 2007). Štoviše, Karasavvidis (2010) zaključuje da je korištenje Wikija u visokom obrazovanju dovelo do dobivanja informacije putem *copy-paste* opcije, što je razlog nenaklonosti davanju informacije.

Kada smo proučili uporabljivosti WebQuest i Wiki sustava u našem istraživanju, budući učitelji izjavili su da su te aktivnosti korisne za ispite, sustavno učenje, da su povezane sa svakodnevnim životom, imaju priliku pregledati i ponoviti, potiču interakciju, pomažu u učenju i brzom pristupu informacijama. S obzirom na to da je većina tih stavova pozitivna, možemo reći da su WebQuest i Wiki sustavi uporabljivi. Uporabljivost tih aktivnosti podržana je i u sličnim istraživanjima u literaturi koja zaključuje da povezivanje zadataka sa stvarnim životom za vrijeme trajanja WebQuest aktivnosti povećava njihovu uporabljivost (Kundu i Bain, 2006; Köse, 2007; Chang i sur., 2010). Otkriveno je da WebQuest aktivnosti (Chan, 2007; Tabanlı, 2008) i Wiki aktivnosti (Raman i sur., 2005; Mindel i Verma, 2006; Halat, 2007; Chou i Chen, 2008; Frydenberg, 2008; Elgort i sur., 2008; Morgan i Smith, 2008; Snelling i Karanicolas, 2008; Huang i Nakazawa, 2010; Su i Beaumont, 2010; Tsai i sur., 2011; Wever i sur., 2011) stvaraju okruženje za suradnju te potiču grupni radi. Suprotno tim mišljenjima Karasavvidis (2010) tvrdi da Wiki aktivnosti smanjuju suradnju i komunikaciju. Altun (2008) tvrdi da su Wiki aktivnosti teške iako aktivnosti potiču interakciju u samoj nastavi.

Bez obzira na uporabljivost primjene WebQuest i Wiki aktivnosti, što smo saznali iz pozitivnih povratnih informacija od budućih učitelja, neki od njih dali su prijedloge za poboljšanjem učinkovitosti tih primjena. Prijedlozi su sljedeći: davanje povratne informacije od predavača ili sustava, primjena sustava u drugim kolegijima, vizualni dizajn, svrsishodnost, primjeri, mogućnost pregleda prijašnjih tema, komunikacija među grupama.

Pregledom literature o korištenju WebQuest aktivnosti u drugim kolegijima, vidimo da je njihovo korištenje u predmetima Geografija, Povijest, Turski jezik i književnost, Zdravstveni odgoj, Nutricionizam puno lakše nego njihovo korištenje u predmetima

Matematika, Kemija, Fizika (Joseph, 2000; Summerville, 2000; Açıkalın i Duru, 2005). U našem istraživanju budući učitelji su također izrazili potrebu korištenja tih sustava u kolegijima poput Geografije i Povijesti. Istražujući stavove budućih učitelja o korištenju WebQUesta u drugim kolegijima, Halat (2007) otkriva da WebQuest aktivnosti mogu biti zanimljivije s igrama, te da su potrebne neke vizualne modifikacije u aktivnostima. U našem istraživanju došli smo do sličnih rezultata. Neki budući učitelji izjavili su da su za vrijeme rada na nekim WebQuest aktivnostima osjetili neke zdravstvene probleme (vrtoglavica, crvenilo očiju itd.). U evaluaciji WebQuesta kao računalno utemeljenog učenja, Hassanien (2006) tvrdi da su budući učitelji doživjeli fizičke poteškoće za vrijeme aktivnosti. U našem istraživanju neki budući učitelji izrazili su svoje stavove o nedostatku fizičke aktivnosti za vrijeme rada u WebQuest aktivnostima. Ta situacija također se spominje u sličnom istraživanju koje su proveli Perkins i McKnight (2005). Istraživanja su otkrila da budući učitelji nisu stigli završiti zadatke u zadanome roku. Kod primjene Wikija budući učitelji žalili su se da predavač nije davao povratnu informaciju uključujući se u sustav i da sustav nije slao nikakve poruke za oprez, te da su izrazili svoja mišljenja o potrebi modificiranja sustava. Slična mišljenja mogu se naći u literaturi (Raman i sur., 2005; Su i Beaumont, 2010; Tsai i sur., 2011).

Kada proučimo utjecaj WebQuest i Wiki aktivnosti na motivaciju budućih učitelja za učenje kemije, iz ovoga istraživanja ne nailazimo na značajne razlike u rezultatima predtesta budućih učitelja CMQ i posttesta CMQ u WebQuest skupini. Istraživanje koje je proveo Gökalp (2011), koje proučava utjecaj WebQuest aktivnosti na buduće učitelje i njihove stavove prema kolegijima, otkriva da ne postoji značajan utjecaj na stavove budućih učitelja prema kolegijima.

Međutim u istraživanjima koje je proveo Akçay (2009) za nastavu turskog, Kılıç (2007) za nastavu matematike, zabilježeno je poboljšanje stavova prema kolegijima, a u istraživanjima koje su proveli Lim i Hernandez (2007) za predmete Obrazovanje za obiteljsku terapiju (eng. *Family Therapy Education*), Chan (2007) za Simulaciju i statističku analizu, motivacija budućih učitelja za učenjem kemije se povećala.

U našem istraživanju nisu uočene statistički značajne razlike u bodovima predtesta – CMQ i posttesta – CMQ budućih učitelja u Wiki skupini i njihove motivacije za učenje kemije. Istraživanja pokazuju utjecaj primjene Wikija na stavove budućih učitelja prema kolegijima i na njihovu motivaciju, pri črmu se motivacija budućih učitelja prema tim kolegijima povećala (Chou i Chan, 2008; Su i Beaumont, 2010; Tsai i sur., 2011). Dok su razine motivacije budućih učitelja za učenjem kemije u Wiki skupini bili značajnije viši od skupine WebQuest na početku istraživanja, nije uočena nikakva značajna razlika između rezultata na posttestu WebQuest i Wiki aktivnosti na kraju istraživanja. To govori da primjena WebQuesta motivira buduće učitelje za učenje kemije više od primjene Wikija. Nismo naišli na istraživanje koje je usporedno istražilo učinak WebQuesta i Wikija na motivaciju budućih učitelja za učenje kemije.

U našem istraživanju učestalost prijava u sustave praćena je putem sustava Moodle LMS. Dok je otkrivena niska, ali pozitivna, značajna povezanost između učestalosti

prijava u Wiki aktivnosti i motivacije za učenje kemije, istraživanje nije ukazalo na značajnu povezanost između učestalosti prijave na WebQuest aktivnosti i motivacije za učenje kemije. Nakon što su budući učitelji završili svoje istraživačke zadatke na WebQuest sustavu, svoje su istraživanje prenijeli na Moodle LMS. Budući učitelji u WebQuest grupama nisu se morali prijaviti na Moodle LMS tijekom trajanja svog istraživanja, a budući su učitelji u Wiki grupi morali završiti svoj rad u Wiki sustavu putem Moodle LMS. Za vrijeme Wiki aktivnosti njihovo dodavanje podataka u Wiki sustav, opažanje tuđih pogrešaka i ispravljanje, praćenje jedni drugih natjeralo ih je na češće prijavljivanje u Moodle LMS. Zbog toga je primjena Wikija možda povećala motivaciju budućih učitelja za učenje kemije.

Rezultati ovoga istraživanja ukazuju na to da budući učitelji imaju pozitivan stav prema uporabi WebQuesta ili Wiki sustava u nastavi, a da njihova motivacija za učenje kemije nije porasla. Može se reći da se istraživanja o učincima Wikija i WebQuesta na stavove i motivaciju za učenje studenata, budućih učitelja, mogu ostvariti.