Students' Views about the Problem Based Collaborative Learning Environment Supported By Dynamic Web Technologies

Erhan ÜNAL [1] , Hasan ÇAKIR [2]

[1] Res. Assist., Afyon Kocatepe University, Faculty of Education, Department of Computer Education and Instructional Technology, Afyonkarahisar, Turkey
eunal@aku.edu.tr

[2] Assoc. Prof. Dr., Gazi University, Faculty of Education, Department of Computer Education and Instructional Technology, Ankara, Turkey
hasanc@gazi.edu.tr

ABSTRACT

The purpose of this study was to design a problem based collaborative learning environment supported by dynamic web technologies and to examine students' views about this learning environment. The study was designed as a qualitative research. Some 36 students who took an Object Oriented Programming I-II course at the department of computer programming in a public university participated in the study. The Object Oriented Programming I-II course was designed by incorporating different dynamic web technologies (Edmodo, Google Services, and Mind42) and the collaborative problem solving method by Nelson (1999). For the implementation process, students worked on real problem scenarios and ultimately produced software. During this process students worked in a learning environment supported by dynamic web technologies in order to solve the problems. To determine students' views on this learning environment a semi-structured interview form was prepared; this consisted of questions on the learning environment supported by dynamic web technologies where collaborative problem solving methods were implemented. At the end of the course, focus group interviews were conducted with collaborative learning groups. The interview data were analyzed through content analysis. The results showed that 4 themes emerged, namely: positive aspects of the learning environment, difficulties faced in the learning environment, advantages of the learning environment, and skills gained as a result of the project. The results suggest that problem based collaborative learning methods and dynamic web technologies can be used in the community college learning environment.

Keywords: *Collaborative problem solving, learning environment, community college, dynamic web technologies*

***This study is produced from one part of the first author's doctoral dissertation.**

INTRODUCTION

Nowadays, community colleges have an important role in training individuals with the necessary skills and competencies needed in the business sector. This is because the main goal of these colleges is training individuals to meet business sector needs. Hence, according to the Higher Education Institution's definition in Turkey, community colleges are institutions that concentrate on education directed toward a specific career (The Council of Higher Education, 1982).

In Turkey and around the world, vocational and technical education is regarded as a process to satisfy business sector needs and work in close connection with it to train individuals at both a national and international level, while considering both national and international standards in the curriculum (The Group of Restructuring Vocational Education, 2014). Hence, community colleges are tasked with instilling in individuals the abilities required for a career. In the 21st century, community colleges not only teach individuals the skills for a certain job, but also provide the qualifications and cognitive abilities needed to fulfill the requirements in a fast-changing business sector (Organisation for Economic Co-operation and Development [OECD], 2011).

In this regard, community colleges are maintaining their education according to changing conditions. However, many problems occur in the community college education process. These problems are expressed

by many groups in our country, and the chief concern is the students' lack of a proper foundation. Most community college students are accepted by open admission. Consequently, most students are unsuccessful in both vocational and general areas (Alkan, Suiçmez, Aydınkal, & Şahin, 2014; Çetin, 2010; Kaya, 2014; Kayır & Kılıç, 2008; Külekçi, 2010; Şahin & Fındık, 2008). This situation continues after students have graduated, as they do not show the skills needed to apply theoretical knowledge in the real world. Other issues are the traditional methods used in the learning environment (Şahin & Fındık, 2008), the limited number of practical courses (Adıgüzel, 2014; Göktürk, Aktaş, & Göktürk, 2013), and differences between the community college curriculum and business sector requirements (Alkan, Suiçmez, Aydınkal, & Şahin, 2014; Adıgüzel, 2014; Binici & Arı, 2004; Ekinci, Şahinoğlu, Çalmaşur, & Daştan, 2011; Kaya, 2014; Kayır & Kılıç, 2008; Şahin & Fındık, 2008; Şencan, 2008). These problems may lead to inadequacies in satisfying business sector needs.

Educational technology can be used for solving these problems. The problems educational technology can resolve are those oriented around lack of information and skills. Educational technology is defined by the Association for Educational Communications and Technology (AECT, 2008) as the study and ethical practice of facilitating learning and improving learning and performance by creating, using, and managing appropriate technological processes and resources. Therefore, educational technology can be used in different areas for improving learning and performance. Educational technology aims at solving problems with educational solutions. Using lecture-based teaching methods in developing both theoretical and practical information in community colleges is insufficient. Instead, constructivist learning environments could be designed to help students develop both the abilities needed for the 21st Century business sector and lifelong learning skills.

Teaching methods based on constructivist learning are the most appropriate approach to instill in students the skills demanded by the business sector (Ertmer & Newby, 1993). Hence, this study was conducted in the department of computer programming at the community college in a public university. This department has a two-year program to meet the needs of qualified technical staff in the department of information technologies of institutions by equipping students with both theoretical and practical knowledge in computer programming. The graduates of this department are known as computer programmers and are employed in the business or government sector (Afyon Kocatepe University Bologna Information System, 2017). As students should gain programming skills to graduate and to meet the needs of qualified technical staff in the institutions after graduation, Object Oriented Programming course can be considered important for the department of computer programming. Therefore at the beginning of the course, ill structured problems can be given to students and at the end of the course they can solve that problem by designing and developing software. On the other hand, students can not only learn by doing the programming and but also develop their skills such as problem solving, critical thinking, individual learning skills and lifelong learning skills during the problem solving process.

The Bologna Process is related to skill development at international level. Some 48 countries including Turkey have collaborated to enhance their higher education system through the Bologna Process. The aim of this process is to implement reforms in higher education and adapt the higher education system to make it more compatible with respect to various quality control mechanisms. To achieve this aim, stakeholders such as policy makers, business sector, students and graduates should participate in the process. Therefore, the higher education system can be more useful besides meeting international needs of the business sector (The Council of Higher Education, 2010). In this regard, students at the department of computer programming in Turkey should gain skills in programming to meet the needs of both national and international institutions. Especially students can learn computer programming and the other skills needed in the 21st century by solving ill structured problems in the Object Oriented Programming Course. Furthermore, dynamic web technologies can be integrated into the problem solving process to make students more active in their learning by allowing them to collaborate, interact and participate actively in learning given the features of dynamic web technologies. Among the educational benefits of dynamic web technologies, the foremost are: success, active learning, motivation, collaborative learning (Gülen & Çakır, 2012), communication and interaction, and improvement of thinking skills (problem solving, critical thinking, etc.) (Karaman, Yıldırım, & Kaban, 2008). Consequently, a study on designing a learning environment with ill structured problems and incorporating dynamic web technologies in an Object Oriented Programming Course is well worth conducting.

LITERATURE REVIEW

Constructivism and Constructivist Learning Environments

According to constructivism, learning is defined as obtaining knowledge through an active process, and teaching as the support of that process through exploration and dialog (Duffy & Cunningham, 1996). Learning is paramount, and student centered approaches are used (Ertmer & Newby, 1993). A constructivist learning environment is defined as a place where learners work together and support each other as they use a variety of tools and information sources in their guided pursuit of learning goals and problem-solving activities (Wilson, 1996). As apparent from the definition, a constructivist learning environment emphasizes the learning instead of the teaching. Also, flexibility is at the forefront in this learning environment. Ill structured problems must be used instead of structured problems. The instructor's role in guiding, counselling, and giving students the necessary support is emphasized (Jonassen, 1999; Wilson, 1996). Researchers have advanced different methods related to the constructivist learning environment. In most of these, students are given a problem to solve; in this way, they improve both their knowledge and cognitive skills.

The problem based learning (PBL) approach based on constructivism has been used in the learning and teaching process. Problem based learning is a process that ends up with solving a problem (Barrows, 1996). The learning process takes place by solving a real life problem. In other words, during the learning process, the students are actively involved with solving the problem given and are therefore responsible for their own process (Hmelo-Silver, 2004). The collaborative learning approach based on constructivism is an in-class method where students work in groups and are rewarded according to their performance (Slavin, 1980). Students generally work with two or more classmates on researching a certain topic, finding a solution to a problem, or preparing a project (Smith & MacGregor, 1992). The collaborative problem solving is also used in designing constructivist learning environments. In the collaborative problem solving approach, students learn collaboratively, and involve in activities such as improving group skills, creating groups, showing effort during the problem solving process, and evaluation at the end of the process (Nelson, 1999).

Studies have been conducted on educational contributions of these constructivist learning environments. It has been found that learning environments designed based on problem based learning and collaborative learning methods increase academic success (Arıcı & Kıdıman, 2007; Gürsul & Keser, 2009; Hou, Yu, Wu, Sung, & Chang, 2016; Hwang & Kim, 2006; Karami, Karami, & Attaran, 2013; Korucu, 2013; McParland, Noble, & Livingston, 2004; Nuutila, Törmä, & Malmi, 2005; Podges, Kommers, Winnips, & Joolingen, 2014; Ribeiro & Mizukami, 2005; Tsai, Lee, & Shen, 2013); improve problem solving, critical thinking, individual learning skills and lifelong learning skills (Gu, Chen, Zhu, & Lin, 2015; Hung, Jonassen, & Liu, 2008; Kadir, Abdullah, Anthony, Salleh, & Kamarulzaman, 2016; Öztürk, Karayağız-Muslu, & Dicle, 2008; Sungur & Tekkaya, 2006; Şendağ & Odabaşı, 2009; Yin, Abdullah, & Alazidiyeen, 2011); and develop students' attitudes toward the course (Batdı, 2014; Demirel & Dağyar, 2016; Toraman & Demir, 2016). Therefore, these methods can be used effectively in community colleges.

Constructivist Learning Environments and Technology

In the constructivist learning environment, technology is an important factor in terms of access to learning sources, communication with other students, and cognitive tools usage. Technology refers to cognitive tools such as computers and other related technologies as indicated by Jonassen and Reeves (1996). According to constructivism, technology is not solely used for preparing and presenting a pre-planned layout. This is because constructivism requires various technologies in tasks such as researching information, presenting, communicating, support, and collaboration during the problem solving process. With this approach, technology is not only for presenting information as in traditional use, but it is also used for assisting students in finding, interpreting, organizing, sharing, and presenting the information (Jonassen & Reeves, 1996). As such, technology should be for the learner, not for the teacher. Dynamic web technologies have the potential to develop students' skills concerning problem solving, collaboration, critical thinking, and self-regulated learning skills.

O'Reilly (2005) states that dynamic web technologies have services that can be controlled by the user.

Dynamic technologies are web based applications that bring a new dimension to interaction. They allow users to create content, share it, and collaborate with other users (Franklin & Van Harmelen, 2007). With dynamic technologies, users are not passively accessing information, but actively using, creating, and sharing it (Yükseltürk & Top, 2013). In literature, these dynamic web technologies are known as "read/write" technologies (Albion, 2008). Because of opportunities dynamic web technologies provide, communication, interaction, collaboration, and active participation between users have further increased. As a result, dynamic technologies have been noticed by researchers who have conducted studies on them. Dynamic web technologies in the learning environment have been found to increase success (AlJeraisy, Mohammad, Fayyoumi, & Alrashideh, 2015; Arslan & Şahin-Kızıl, 2010; Chou & Chen, 2008; El Tantawi, 2008; Hou, Yu, Wu, Sung, & Chang, 2016; Korucu, 2013; Lavonen, Meisalo, & Lattu, 2002; Malhiwsky, 2010). Similarly, Hew and Cheung (2013) compiled studies on how dynamic web technologies affected learning and concluded that the general effect was that dynamic web technologies in K-12 and universities increased students' success. Thus, constructivist learning environments can be supported by dynamic technologies in primary, secondary, and even higher education.

A problem based collaborative learning environment may also benefit by solving educational problems faced by community colleges. This is because in a problem based collaborative learning environment, students exert themselves to find solutions to real problems, use different technological tools to find the necessary sources, collaborate with classmates, receive instructor support and come up with a solution. In the literature, studies conducted on solving problems faced in learning environments in Turkey, community colleges in particular, are very limited. From this point, a study on designing problem based collaborative learning environment supported by dynamic web technologies in community colleges is well worth conducting. In this regard, Object Oriented Programming I-II courses at the department of computer programming are suitable for this design. In the programming courses, students can solve the ill structured problems given to them. Thus, they can learn programming and improve 21st century and lifelong learning skills within the problem solving process as stated in similar studies. Studies conducted on computer programming activities also show us how they reflect on students' cognitive abilities positively (Akpınar & Altun, 2014; İsmail, Ngah, & Umar, 2010; Liao & Bright, 1991). A problem based collaborative learning environment supported with dynamic web technologies may be useful to equip students with those skills. Within these parameters, the main problem of this study is: what are the views of students regarding the learning environment supported by dynamic technologies where collaborative problem solving method is used.

Purpose of the Study

The purpose of this study is to design a learning environment supported by dynamic technologies where collaborative problem solving method is implemented and determine students' views on this environment. For this purpose, the study seeks an answer to the question: "What are the students' thoughts on a learning environment supported by dynamic technologies where collaborative problem solving method is implemented?"

METHOD

Research Method

This study was set up as a qualitative research in order to determine students' views on a learning environment supported by dynamic technologies where collaborative problem solving method was applied. In this regard, students had focus group interviews as the groups they formed during in-class activities. Focus group interviews enable researchers to get a better sense of the participants' views, experiences and feelings on a certain matter (Yıldırım & Şimşek, 2013). Hence, the students' full ideas on the environment created were obtained.

Study Group

One of the researchers worked in a public university in Turkey, and the study group was selected from the students in the department of computer programming at the community college through convenience sampling method. This study took place during the autumn-spring semester of the 2015-2016 school year. Some 36 students at the department of computer programming from a public university in Turkey who took the Object Oriented Programming I-II course participated in the study.

Data Collection Tools

A semi-structured interview form was prepared to determine students' views on a learning environment supported by dynamic web technologies for collaborative problem solving. At the end of the course, focus group interviews were conducted with collaborative learning groups. The interview involved questions about students' thoughts on a learning environment supported by dynamic web technologies where collaborative problem solving methods is implemented, such as the pros and cons, any difficulties they had faced, the effect of environment on student learning, and any skills they had gained. The focus group interview sessions lasted around 30 minutes and were recorded on a tape recorder.

Development of the Learning Environment

The learning environment supported by dynamic technologies and collaborative problem solving method was used. Students worked in groups to solve the problems presented and ultimately developed a software. While the learning environment, incorporating dynamic web technologies and based on collaboration, was being set up, the collaborative problem solving method introduced by Nelson (1999) was utilized. This process was as follows:

1. Build Readiness: Ill-structured problems were prepared by the researcher. Later the collaborative problem solving method, dynamic web technologies, and how to use them were explained to the students. During a 3 week period students were oriented regarding how to sign up for dynamic web technologies, how to use the relevant technology (menus, buttons etc.), how to share files, and so forth. In this way, the students were accommodated to the environment.

2. Form and Norm Groups: At the beginning of the implementation, groups of 3 to 5 people were formed. Later, these students were assigned to Edmodo and formed groups based around virtual collaboration.

3. Determine a Preliminary Problem Definition: The collaborative learning groups had online meetings using Google Services to solve the real problem scenarios given. They identified the problem and prepared a draft plan aimed at finding a solution. Later, they researched the necessary resources, tools and other support needed for the plan.

4. Define and Assign Roles: Each student in the collaborative learning groups fulfilled the tasks assigned to their own role.

5. Engage in an Iterative Collaborative Problem-Solving Process: In order to solve the real problem scenarios given, the groups conducted a series of activities such as online meetings via Google Hangouts, documenting group decisions with Google Documents, sharing progress on Edmodo weekly, sharing comments with other groups on Edmodo, and completing the steps necessary for creating the software.

6. Finalize the Solution or Project: The groups shared the final draft of the software they had prepared with the instructor and the other groups, and received feedback.

7. Synthesize and Reflect: Students prepared a report detailing their experiences during the collaborative learning process, what they had learned, and the skills they had gained.

8. Assess Products and Processes: The researcher evaluated the prepared software and the process.

9. Provide Closure: The prepared software was shared with the instructor through Google Drive and the process was concluded.

During the problem solving process, the groups used dynamic technologies to solve the problem scenarios. These dynamic web technologies were Edmodo, Google Hangouts, Google Documents, Google Drive, and the Mind42. The next section gives a detailed explanation of how these technologies were used.

Edmodo can be identified as an educational social media. Students signed up for Edmodo and all announcements, sharing the lesson programs, creating groups, sharing the group agreements, presenting real problem scenarios to the groups, and planning activities were made through Edmodo.

Using Google Hangouts, the group members had planned online meetings among themselves and with the instructor. During these meetings they used other dynamic technologies such as Google Drive, Google Documents, and Mind42.

They used Google Docs for activities such as creating group rules, role distribution in the group, forming the steps in the project, and writing up the project report. By using Google Docs, students were able to access the prepared documents at any time and make online adjustments.

With Google Drive, students stored any documents they prepared online (such as projects, reports, etc.) to be accessed by those permitted to view them. By using Google Drive they were able to save their projects and other important documents online, access these at any time and make online adjustments.

Mind42 was used as a mind mapping tool. Students used mind maps for the layout of the project they created to solve the given problems.

During the implementation process of this study, students used the aforementioned dynamic technologies. These dynamic web technologies could be useful during the research process as they provided a space for students to produce content, share content with the instructor and other groups, and work in collaboration. This is because dynamic web technologies are in widespread use and easily accessible. These technologies are publicly available, free, and easy to use. Edmodo was selected for this study for similarities with Facebook as social media, authentication, Turkish language support, and minimum distracting elements. Google services can be used with only authentication and provide students to use Google services synchronously. Mind42 can be used with authentication and enable students to work on the same mind map and export the mind map in different file formats.

Implementation Process

This study lasted 8 weeks during the autumn-spring semester of the 2015-2016 academic years, with computer programming students from a public university who took the Object Oriented Programming I-II courses. During the implementation process, students worked on the real problem scenarios given to them and ultimately produced a software. During this process they worked in a learning environment supported by dynamic web technologies in order to solve these problems. The course aimed at designing and building a software using object oriented programming language. The content of the courses are defining variable, data types, using operators, control structures, arrays, classes, methods and properties, delegates and events, functions and database connection (Afyon Kocatepe University Bologna Information System, 2017). In this regard, at the beginning of the autumn semester, the instructor explained the course design and started with algorithm, basics of the programming for 6 weeks. Then, the implementation started and continued till half of the spring semester. During the implementation, students learnt the course content and produced a software for solving the ill structured problem given.

At the beginning of the implementation, groups of 3-5 people were created. Before the implementation began, students first learned about problem based education, collaborative learning, dynamic web technologies, and how to use them. During a 3 week period students were oriented regarding how to sign up for dynamic web technologies, how to use the corresponding technology (menus, buttons etc.), how to share files, and so forth. In this way, the students were accommodated with the environment.

The implementation process began with the students being assigned to their collaborative learning groups. Later, these students were assigned to Edmodo and created groups based around virtual collaboration. After this step, the groups continued their communications and interactions through Edmodo. Any course related documents such as the syllabus, assignments, and real problem scenarios, were shared through Edmodo by the instructor. Afterward, students were asked to come up with a group agreement that covered the role distribution, plans, responsibilities and so forth, during the implementation process. Students used Edmodo, Google Drive, Google Hangout, and Google Documents to compose and publish their group agreements.

In order to solve the real problem scenarios given to them, students did the following weekly activities with their groups:

- Had weekly meetings with their group members
    - Used Google Hangouts for these meetings
    - Prepared the decisions made during these meetings with Google Docs
    - Shared these decisions through Edmodo
- Shared news related to the project through Edmodo weekly
- Shared comments related to the project with other groups on Edmodo
- Shared the projects with the instructor through folders in Google Drive every week
- Had at least one online meeting with the instructor during the implementation process.

At the end of the implementation process the students had come up with a software as a solution to the real problem scenario. The groups concluded the process by preparing a report on their project and sharing it with the instructor through Google Drive.

Data Analysis

Content analysis was used for the qualitative data. To do this, first of all interviews were transcribed. Students' answers were reviewed and the codes explaining the data were accessed. The codes relevant to each other were collected and sorted into categories and themes. After this, the code, category, and theme were made into a report with citations from students' views (Yıldırım & Şimşek, 2008).

In this qualitative research, some issues were taken into consideration for reliability and validity. To ensure internal validity, prolonged engagement, peer examinations, expert reviews were taken into consideration. Prolonged engagement is the presence of researcher and students together for a certain period during the study. The researcher conducted this study for 8 weeks. Therefore the researcher and the students knew each other well. As a result, during the focus group interviews, an intimate and warm climate was built between the researcher and the students. This led to valid answers to interview questions. Another approach was peer examination. The researcher inquired about interpreting the findings to an expert in qualitative data analysis. To ensure content validity and accuracy of qualitative questions 3 experts evaluated the interview form. In order to ensure external validity, how the study was conducted was explained in detail and quotations from students' answers were presented in the findings of the study.

In order to ensure reliability, inter-coder reliability analysis was conducted. To do this the data were analyzed by a separate coder with experience in qualitative data analysis. Afterwards, the consistency of the codes were determined by the following formula:

$$\text{inter} - \text{coder reliability} = \frac{number\ of\ agreements}{number\ of\ agreements + number\ of\ disagreements}$$

(Miles & Huberman, 1994)

As a result, the reliability coefficient was calculated as 88%. According to Miles and Huberman (1994), this shows that the qualitative data are reliable.

FINDINGS

Students' Views on a Learning Environment Supported by Dynamic Technologies Where Collaborative Problem Solving Method Is Applied

The research question is "What are students' views on a learning environment supported by dynamic technologies where collaborative problem solving method is applied?" At the end of the implementation, students had focus group interviews. The data collected at the end of the implementation were analyzed using content analysis method. First, the data were reviewed and the codes explaining the data were accessed. After this, the codes relevant to each other were collected and sorted into categories and themes. The students' answers were submitted with their group and student number (e.g., G11, G23, G64) under the theme, category, and codes obtained. Lastly, the results were interpreted. The themes, categories, codes, and their frequencies are shown in Figure 1.

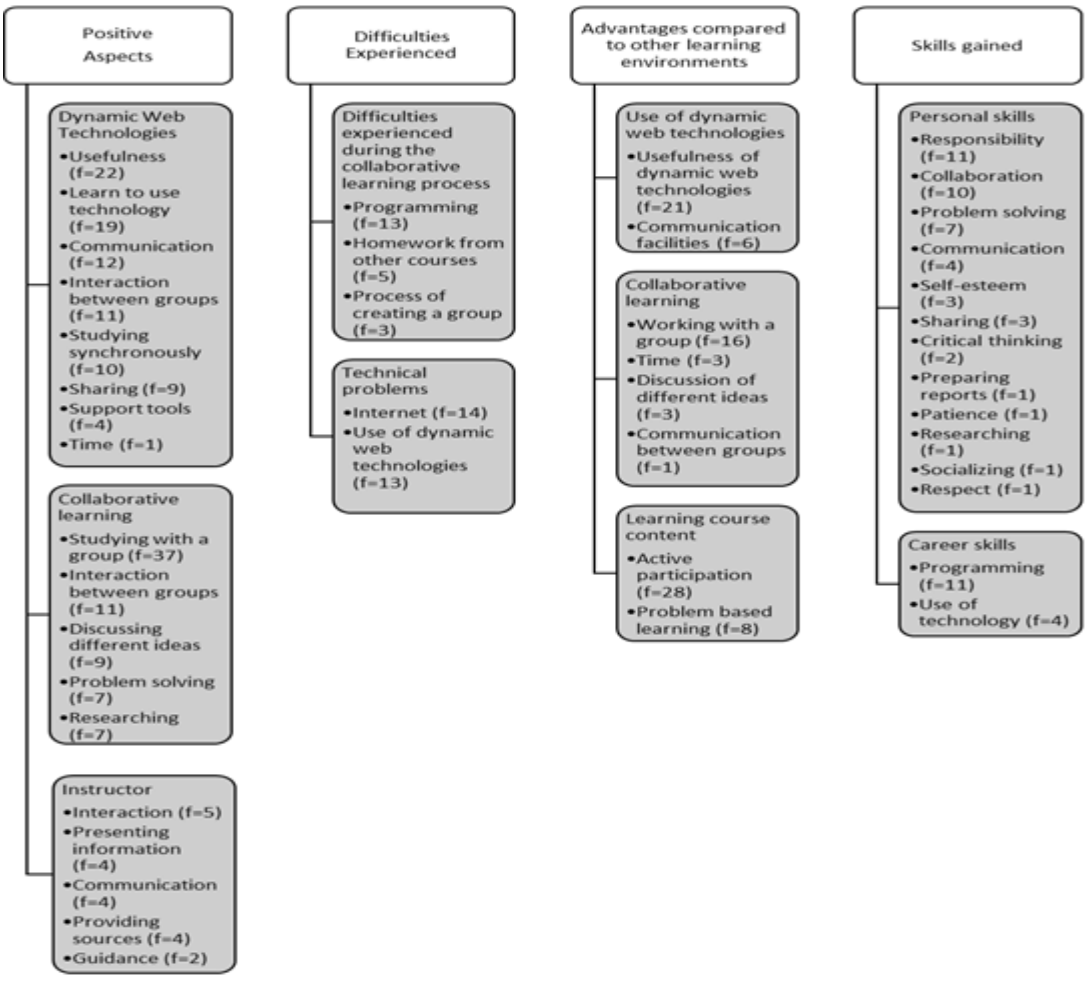

Figure 1. Analysis Results Regarding Qualitative Data.

Four themes were obtained from the data analysis, including positive aspects of the learning environment, difficulties faced in the learning environment, advantages of the learning environment, and skills gained as a result of the project. The categories, codes, and answers related to these themes will now be explained in detail.

The students were asked about the positive aspects of the learning environment and their answers were sorted under three categories, "Dynamic web technologies", "Collaborative learning", and "Instructor". In general, students expressed their satisfaction with the dynamic web technologies. The most common statement was that dynamic web technologies had simplified learning (f = 22). Regarding the positive aspects of dynamic web technologies, students expressed that the learning environment had given them opportunities to use many different dynamic web technologies, that they had not been able to benefit from these technologies before the course, that they had realized the potential of these technologies (f = 19), that communication with group members and the instructor was easier thanks to dynamic web technologies (f = 12), that they were able to constantly exchange ideas with other groups using these technologies (f = 11), that they were able to work simultaneously (f = 10), that dynamic web technologies provided them with the means to share the project with their group members and the instructor (f = 9), that dynamic web technologies made the group work more convenient (f = 4), and that it gave them more time flexibility (f = 1). These were the most prominent student views regarding dynamic web technologies:

"We didn't know a lot of the dynamic web tools before the course- Edmodo, for instance. We made the mind maps on Paint before. Along with Mind42, this made our work a lot easier." (G11).

"We didn't really know how to use these Web tools before. Mind42 for instance. We learned about them thanks to the course and it was beneficial for us." (G53)

"Thanks to the technologies it was much easier to get our work done. We could communicate with each other anytime and talk about what we were going to do." (G22)

"It was really helpful to see what our other friends were sharing on Edmodo." (G61)

"Google Drive is already a system designed for group work. We can all upload files there at the same time, and make changes to the same document. In this regard, it was successful." (G11)

"It was quick and easy to share things with each other. We didn't have to be occupied with paper and documents. So we were lucky that it was all online." (G21)

"Because we could have meetings on Hangouts so our problems and group work weren't left incomplete." (G61)

"It was useful for us in regard to time." (G72)

According to the students, another positive aspect of the learning environment was collaborative learning. Under the collaborative learning category, students expressed that working with a group facilitated learning (f = 37), that exchanging ideas with other groups had benefits (f = 11), that during the process group members expressed their own ideas and each idea was taken into consideration (f = 9), that they learned the problem solving process (f = 7), and that they researched different sources and ideas to solve the problems given (f = 7). These were the most prominent student views regarding collaborative learning:

"This project would have been difficult to do on our own, but as a group we completed each other's shortcomings. As a result, we presented a better project in less time." (G82)

"We would comment on the other groups' work and they would give us ideas as well." (G12)

"During the group work everyone put forth their own ideas on how to do things. We began by considering different ideas." (G22)

"We learned to be a group, to identify problems and solve them together." (G24)

"We had a few problems during the programming process. There was some confusion and mix-ups, so we had help from the instructor, each other, and the Internet." (G61).

According to the students, another positive learning environment aspect was the instructor's support. Under the instructor category, students expressed that they discussed their projects with the instructor and received feedback throughout the problem solving process (f = 5), that it was helpful when the instructor provided them with basic information about programming (f = 4), that communication with the instructor was easy (f = 4), that the instructor provided them with necessary sources throughout the problem solving process (f = 4), and that the instructor guided them throughout the problem solving process (f = 2). These were the most prominent student views regarding the instructor:

"The instructor gave us guidance and advice at times. For example, he told us to add certain things that we hadn't thought of, and he was a lot of help." (G82)

"The codes the instructor gave during the lessons were helpful for us." (G73)

"When we had difficulty finding something or didn't understand the material, the instructor would share files with us and that was beneficial." (G13)

"With a single teacher, there isn't enough time for one-on-one. But we had two instructors and the fact that they were online was a lot of help." (G82)

"Before the project began the instructor gave us all of the information and step-by-step instructions. This was really helpful." (G52)

Students were asked about any difficulties they faced in the learning environment and their answers were sorted under two categories, "Difficulties experienced during the collaborative learning process", and "Technical difficulties". Regarding difficulties experienced during the collaborative learning process, students expressed that they experienced different problems with coding (f = 13), that they had responsibilities from other classes (f = 5), and that some of the collaborative learning groups did not fulfill their duties properly (f = 3).

These were the most prominent student views regarding collaborative learning:

"We had some problems when we divided up the classes-- for instance, we gave the customer class to "A" and the personnel to "E" and I was in charge of payment. So we did that but we had some problems with integration. (G11)

"The thing was, we had other work and to do as well. It all piled up. Dissertations, homework, exams. It was hard when everything was at the same time." (G74)

"We didn't really have any problems in our group. The only thing for us was that one of our group members left the group." (G12)

Under the technical difficulties category, students expressed that they had problems with Internet access (f = 14), that they had not known how to use dynamic web technologies prior to the class and that they had faced difficulty using them during the early stages of the process (f = 13). These were the most prominent student views regarding technical difficulties:

"They weren't exactly difficulties, but we did have a few technical malfunctions. Sometimes we couldn't do the meetings because of one of our group member's Internet wasn't working" (G81)

"We didn't know to use these tools such as Google services, Mind42 especially, Edmodo. We asked our friends about these tools." (G13)

Students were asked about the advantages of the learning environment and their answers were sorted under three categories, "Using dynamic web technologies", "Collaborative learning", and "Learning course

content". With regard to dynamic web technologies, students expressed that integrating dynamic web technologies into the course facilitated learning (f = 21), and that dynamic web technologies enhanced communication with group members and the instructor (f = 6). These were the most prominent student views regarding dynamic web technologies:

"In our other classes, we don't use these tools and we can't exchange ideas with our friends. But we can do that in this course through Edmodo, and that has a lot of advantages." (G71)

"A simple example is that we could reach the instructor anytime we were faced with a difficulty, and he would help us right away." (G63)

As for the collaborative learning environment, students expressed that working in groups had a positive effect on their learning (f = 16), that they learned the content quickly while working with a group (f = 3), that the problem solving process gave them opportunities to discuss different ideas with group members (f = 3), and that they shared ideas, information, sources, and so forth, with other groups (f = 1). These were the most prominent views regarding the collaborative learning environment:

"We help each other out, for example, if one of my friends is stuck he'll ask me for help, and vice versa. If I know the material I'll explain it to him." (G11)

"It's really a time saver." (G12)

"We think this process is more beneficial because we're able to swap ideas with each other in a group environment." (G93)

Under the learning course content category, students expressed that the information they learned was more permanent compared to other learning environments (f = 28), and that they learned more efficiently (f = 8). These were the most prominent student views regarding course content:

"I think the project is more beneficial. After all, we're doing the research ourselves and as we research we're improving ourselves. When the teacher is showing us something fixed, we confine ourselves to it and don't add on to that. I think the project was rewarding." (G102)

"After all, we're only human. We want to choose whatever is easiest for us, and since we're only working on the subjects we already know, it doesn't provide us with any extra information. But when the instructor talked about ticket sales, I didn't know anything about the ticket selling automation so I worked on that and gained new knowledge, which was a plus for me." (G81)

The students were asked which skills they gained in the learning environment, and their answers were collected under the "personal skills" and "career skills" categories. Under personal skills, students stated that they gained the following attributes, fulfilling their responsibilities (f = 11), working in a collaborative format (f = 10), solving the problems faced (f = 7), establishing communication (f = 4), believing in themselves (f = 3), sharing information (f = 3), critical thinking (f = 2), preparing reports on the subject (f = 1), being patient while programming (f = 1), researching on the subject (f = 1), being social (f = 1), and being respectful toward others (f = 1). Some key student views in the personal skills category are as follows:

"Because a group is the responsibility of all of its members, you feel that you need to be doing this, or doing that, and you become more responsible as a result of this. Being in a group is like this nonstop..." (G12)

"I learned how to be less selfish and to do a program with my friends rather than on my own." (G62)

"For example, I could use the step by step technique we used for this project in my other classes as well."(G63)

"This project taught me how to share my views and opinions with my friends, I was strongly affected by seeing how much easier it was to communicate our thoughts had between our group members. In this way, and in a positive light, I was more in communication with my friends and group members." (G103)

"For example, as I was writing and attempting to finish the program I gained more confidence in myself the closer I got to the end." (G61)

"Our ability to share was improved." (G33)

"It improves our ability to think." (G51)

"The project also helped us to learn how to write reports."(G24)

"We were even checking over and over for the smallest punctuation mistakes. This angered us at time but it also taught us to be more patient." (G54)

"We learned how to research." (G53)

"The project improved our social abilities." (G74)

"Since we learn to treat each other with respect and with friendliness during group work, we also learn how to be more empathic." (G11)

Under the career skills category, students stated that they gained the following experience: improving their programming knowledge and skills (f = 11), and how to use a variety of technologies in their professional lives (f = 4). Some student views that stand out in the category of career skills are as follows:

"We learned to solve a problem from scratch and to make programs." (G62)

"This project helped us on a professional level. We learned, for example, let's say that we will be computer specialists and programmers in the future, and we will need to write a accounting software, I use Mind42 in my own professional life and let's say the accountant told me that they [want] certain specifics in the software. Now I don't know much about accounting but we can develop a concept map right then and there, we don't even have to be face to face with the accountant I can just send him a copy of the program that I have written through Google Drive and he can check it to see if it fulfills his needs." (G82)

DISCUSSION AND CONCLUSION

Students evaluated the learning environment supported by dynamic web technologies where collaborative problem solving method is applied as positive aspects of the learning environment such as use of dynamic web technologies and the collaborative problem solving method, and the instructor support. They considered this learning environment was favorable in providing group work, supporting learning with dynamic web technologies, active participation, gaining lifelong learning, career and personal skills compared to their other courses. Hence, it can be concluded that students were satisfied with the use of a learning environment supported by dynamic web technologies and collaborative learning methods.

In particular, students appreciated the ease of communication between both their group members and the instructor using dynamic web technologies, the active engagement, the accessibility of information, the opportunity for interaction with their group members, sources, and the instructor during the construction of knowledge, the opportunity to work on the same things simultaneously, and the access to information anywhere and anytime using the Internet. Magnuson (2012) found that implementing dynamic technologies in the learning environment was beneficial as such tools facilitated sharing and collaboration, organizing information, and discussion. Malhiwsky (2010) found that students were pleased with the learning environment because of easy communication, easy accessibility, entertainment, and the user-friendly dynamic technologies. Uzunboylu, Bicen, and Çavuş (2011) found that students had positive views on these technologies after dynamic web technologies were integrated into their learning environment. Korucu (2013) noted that pre-service teachers considered dynamic web technologies beneficial in terms of communication, interaction, and simplification. Considering the results of this study and those in the literature, using dynamic web technologies in learning environments is seen as beneficial.

Other aspects of the environment the students liked were the real world problem solving process, collaborative work, discussing ideas with group members, and the instructor's guidance. Therefore, students viewed this learning environment as advantageous compared to their other courses. This is because dynamic web technologies are not commonly used in other courses, and face-to-face communication is used as the only communication source. Also, as they did not commonly use processes such as real world problem solving, group work, and active participation, they expressed their willingness to participate in similar courses.

It was shown that the learning environment was effective in developing students' personal and career skills. In similar studies, results indicated that students were pleased with collaborative and problem based learning approaches. Hatısaru and Güler-Küçükturan (2009) found that problem based learning was advantageous in terms of working on problems from real life, the active participation process, and increasing interest toward the course. In their study on the effectiveness of the problem based approach on nursing students, Yuan et al. (2011) found that this approach developed communication and collaboration skills, was a key factor in configuring information, simplified the transfer of theoretical information to real life, and increased motivation in learning. In their work on PBL among engineering students, Biber and Başer (2012) found that this approach ensured active participation, prompted individual and group work, and developed various skills (communication, leadership, collaboration, responsibility, etc.) . As for elementary students, İnel and Balım (2010) found that the PBL approach increased motivation, ensured active participation, and that working on problems was beneficial. Thus, the results of this study overlap with research results in literature.

The negative sides of this learning environment were considered access to Internet, the use of the technologies for the first time, learning programming, the amount of other work in other courses and problems faced while creating the groups. However, Internet access was more about the resources of the individual students. Difficulties with using the dynamic web tools for the first time were overcome with the user manuals. Similarly, their work and obligations in other courses may have led to difficulties such as inability to participate in meetings, delays in weekly sharing, problems with coding, and so forth. This meant students had to put in more effort. Occasionally, it was seen that students did not fulfill their responsibilities during the collaborative learning process; at times, this situation led to disruptions in the process. Literature review showed that the difficulties and problems faced in a learning environment supported by dynamic web technologies were listed as accessibility, difficulty of use (Malhiwsky, 2010), problems with Internet access, difficulties using dynamic web tools for the first time, and difficulties with planning group work (Korucu, 2013.) Thus, the results of the study overlap with research results in the literature.

When students' views on a learning environment supported by dynamic web technologies and collaborative problem solving methods are evaluated, it is seen that these learning environments have many benefits for learning activities in community colleges. In particular, it was thought that these learning environments may be a solution for the difficulties faced during the learning process in community colleges. According to the students' views, these environments also support the social constructivist learning principles. This is because dynamic web technologies are seen as beneficial in terms of social interaction, active learning, and collaboration. Thus, the course overlaps with the social constructivist learning principles.

SUGGESTIONS

We suggest the following for implementation and further research based on the conclusions obtained from the study:

Suggestions for Implementation

The collaborative problem solving method was seen as beneficial by the students in the Object Oriented Programming I-II class. Therefore, this method can be implemented in learning environments in community colleges. Courses in the programs of community colleges of higher education aimed at teaching information and experience related to daily life problems can be prepared using ill structured problems from

daily occurrences. In this way students can be taught using problem solving methods prepared according to the challenges they face daily and thus their learning will be more easily facilitated. As using both dynamic web technologies and collaborative problem solving method provide many advantages for students, it can be concluded that dynamic web technologies will enrich and simplify the learning process in community colleges. Dynamic web technologies must be provided in a way that enables students to interact with other students, the instructor, course content, and other elements. Also, there must be exercises that increase dynamic web technology use by students.

Suggestions for Research

This research was conducted during the Object Oriented Programming I-II course in the department of computer programming at a community college. Similar studies could be conducted using different classes and departments. The different variables in a learning environment supported by dynamic web technologies and collaborative problem solving method could be researched (academic success, effort, permanence, students' attitude toward the class, motivation, self-regulatory skills, etc.)

REFERENCES

Adıgüzel, O. (2014). Mesleki ve teknik eğitim: Temel sorunlar ve çözüm önerileri [Vocational and technical education: Basic problems and solution propositions]. *The Journal of Toprak Employers Union, 102*.

AECT Definition and Terminology Committee. (2008). Definition. In A. Januszewski & M. Molenda (Eds.), *Educational technology: A definition with commentary* (pp. 1-14). New York: Lawrence Erlbaum Associates.

Afyon Kocatepe Univesity Bologna Information System. (2017). Bilgisayar programcılığı bilgi paketi [Department of computer programming information package]. Retrieved from http://obs.aku.edu.tr/oibs/bologna

Akpınar, Y., & Altun, Y. (2014). Bilgi toplumu okullarında programlama eğitimi gereksinimi [The need for programming education in the information society schools]. *Elementary Education Online, 13*(1), 1-4.

Albion, P. R. (2008). Web 2.0 in teacher education: Two imperatives for action. *Computers in the Schools, 25*(3-4), 181-198.

AlJeraisy, M. N., Mohammad, H., Fayyoumi, A., & Alrashideh, W. (2015). Web 2.0 in education: The impact of discussion board on student performance and satisfaction. *TOJET: The Turkish Online Journal of Educational Technology, 14*(2), 247-259.

Alkan, R. M., Suiçmez, M., Aydınkal, M., & Şahin, M. (2014). Meslek yüksekokullarındaki mevcut durum: Sorunlar ve bazı çözüm önerileri [Current situation in vocational schools: Issues and some suggested solutions]. *Journal of Higher Education and Science, 4*(3), 133-140.

Arıcı, N., & Kıdıman, E. (2008). Mesleki orta öğretimde probleme dayalı öğrenme yönteminin akademik başarıya ve öğrenmenin kalıcılığına etkisi [The effect of the problem based learning method on the academic success and retention of the knowledge learned in the environment of vocational and technical high school]. *eJournal of New World Sciences Academy, Social Sciences Education Sciences Series, 3*(1), 44-53.

Arslan, R. Ş., & Şahin-Kızıl, A. (2010). How can the use of blog software facilitate the writing process of English language learners?. *Computer Assisted Language Learning, 23*(3), 183-197.

Barrows, H. S. (1996). Problem based learning in medicine and beyond: A brief overview. *New Directions for Teaching and Learning, 68,* 3-12.

Batdı, V. (2014). A meta-analysis study comparing problem based learning with traditional instruction. *Electronic Journal of Social Sciences, 13*(51), 346-364.

Binici, H., & Arı, N. (2004). Mesleki ve teknik eğitimde arayışlar [Seeking new perspectives in technical and vocational education]. *Gazi University Journal of Gazi Educational Faculty, 24*(3), 383-396.

Biber, M., & Başer, N. E. (2012). Probleme dayalı ögrenme sürecine yönelik nitel bir degerlendirme [A qualitative evaluation of problem based learning]. *Journal of Hasan Ali Yücel Faculty of Education, 9*(1), 12-33.

Çetin, A. Y. (2010). Meslek yüksekokullarında yaşanan sorunlar ve çözüm önerileri [Issues and suggested solutions in community colleges]. (Report number: 7).

Demirel, M., & Dağyar, M. (2016). Effects of Problem-Based Learning on attitude: A meta-analysis study. *Eurasia Journal of Mathematics, Science & Technology Education, 12*(8), 2115-2137.

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 693-719). New York, NY: Macmillan.

Ekinci, E. D., Şahinoğlu, T., Çalmaşur, G., & Daştan, H. (2011). Meslek yüksekokullarının sorunlarına yönelik bir model önerisi [A model for problems in community colleges]. *The International Higher Education Congress: New trends and issues (UYK-2011)* 27-29 May, İstanbul, Turkey (pp. 2203-2211).

El Tantawi, M. M. (2008). Evaluation of a blog used in a dental terminology course for first-year dental students. *Journal of Dental Education, 72*(6), 725-735.

Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 6*(4), 50-72.

Franklin, T., & Van Harmelen, M. (2007). Web 2.0 for content for learning and teaching in higher education. Retrieved from http://www.webarchive.org.uk/wayback/archive/20140614142108/http://www.jisc.ac.uk/media/documents/programmes/digitalrepositories/web2-content-learning-and-teaching.pdf

Göktürk, İ. E., Aktaş, M. A., & Göktürk, Ü. (2013). Sosyal bilimler meslek yüksekokullarının eğitim sürecinde; uygulama açısından karşılaşılan sorunlar ve çözüm önerileri [In educational process of social sciences vocational high schools, the problems encountered in terms of application and solution proposals]. *EJOVOC: Electronic Journal of Vocational Colleges, 3*(4), 1-8.

Gu, X., Chen, S., Zhu, W., & Lin, L. (2015). An intervention framework designed to develop the collaborative problem-solving skills of primary school students. *Educational Technology Research and Development, 63*(1), 143–159.

Gülen, Ş. B., & Çakır, H. (2012). Öğretmen adaylarının eğitiminde blog ve wiki kullanımı: Literatür taraması [Use of blog and wiki in teacher education: A literature review]. *6th International Computer and Instructional Technologies Symposium*, Gaziantep, Turkey.

Gürsul, F., & Keser, H. (2009). The effects of online and face to face problem based learning environments in mathematics education on student's academic achievement. *Procedia - Social and Behavioral Sciences, 1*(1), 2817-2824.

Hatısaru, V., & Küçükturan, A. G. (2009). Student views on problem-based learning of 9th grade industrial vocational high school. *Procedia-Social and Behavioral Sciences, 1*(1), 718-722.

Hew, K. F., & Cheung, W. S. (2013). Use of Web 2.0 technologies in K-12 and higher education: The search for evidence-based practice. *Educational Research Review, 9,* 47-64.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review, 16*(3), 235-266.

Hou, H. T., Yu, T. F., Wu, Y. X., Sung, Y. T., & Chang, K. E. (2014). Development and evaluation of a web map mind tool environment with the theory of spatial thinking and project-based learning strategy. *British Journal of Educational Technology, 47*(2), 390-402.

Hung, W., Jonassen, D. H., & Liu, R. (2008). Problem-based learning. In J. M. Spector, J. G. van Merriënboer, M. D., Merrill, & M. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 485-506). Mahwah, NJ: Erlbaum.

Hwang, S. Y., & Kim, M. J. (2006). A comparison of problem-based learning and lecture-based learning in an adult health nursing course. *Nurse Education Today, 26*(4), 315-321.

İnel, D., & Balım, A. G. (2010). Fen ve teknoloji öğretiminde probleme dayalı öğrenme yöntemi kullanımına ilişkin öğrenci görüşleri [Students' views about the use of problem based learning method in science and technology education]. *Western Anatolia Journal of Educational Sciences, 1*(1), 1-13.

İsmail, M. N., Ngah, N. A., & Umar, I. N. (2010). Instructional strategy in the teaching of computer programming: a need assessment analyses. *The Turkish Online Journal of Educational Technology, 9*(2), 125-131.

Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional design theories and models, Vol. II* (pp. 215-239). Mahwah, NJ: Erlbaum.

Jonassen, D. H., & Reeves, T. C. (1996). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 693-719). New York, NY: Macmillan.

Kadir, Z. A., Abdullah, N. H., Anthony, E., Salleh, B. M., & Kamarulzaman, R. (2016). Does problem-based learning improve problem solving skills?: A study among business undergraduates at Malaysian Premier Technical University. *International Education Studies*, *9*(5), 166-172.

Karaman, S., Yıldırım, S., & Kaban, A. (2008). *Öğrenme 2.0 yaygınlaşıyor: Web 2.0 uygulamalarının eğitimde kullanımına ilişkin araştırmalar ve sonuçları [Learning 2.0 is spreading: The research and results of use of web 2.0 in education].* Paper presented at XIII Conference on Internet in Turkey, Orta Doğu Teknik Üniversitesi, Ankara.

Karami, M., Karami, Z., & Attaran, M. (2013). Integrating problem-based learning with ICT for developing trainee teachers' content knowledge and teaching skill. *International Journal of Education and Development Using Information and Communication Technology, 9*(1), 36-49.

Kaya, A. (2014). Meslek Yüksekokulunda Öğrenim Gören Öğrencilerin Eğitim Öğretim ve Geleceğe Yönelik Düşünceleri [Thoughts of junior technical college students about their training and teaching and their future]. *Ondokuz Mayis University Journal of Faculty of Education, 33*(2), 349-356.

Kayır Ö., & Kılıç H. (2008). *Meslek Yüksek Okulları araştırması* [A study of community colleges]. İstanbul, Turkey: Maya.

Korucu, A. T. (2013). *Problem temelli işbirlikli öğrenme ortamında dinamik web teknolojilerinin akademik başarı ile akademik uğraşıya etkisi [In the environment of problem-based collaborative learning the effect of dynamic web technologies on academic achievement and academic engagement].* (Unpublished doctoral dissertation, Gazi University, Graduate School of Educational Sciences, Ankara).

Külekçi, M. K. (2010). Meslek yüksekokullarında yaşanan sorunlar ve çözüm önerileri [Issues and suggested solutions in community colleges]. (Report number: 4).

Liao, Y. C., & Bright, G. W. (1991). Effects of computer programming on cognitive outcomes: A meta-analysis. *Journal of Educational Computing Research, 7*(3), 251-268.

Magnuson, M. L. (2012). *Construction and reflection: Using web 2.0 to foster engagement with technology for information literacy instruction.* (Unpublished doctoral dissertation, The University of Wisconsin, Milwaukee).

Malhiwsky, D. R. (2010). *Student achievement using web 2.0 technologies: A mixed methods study.* (Unpublished doctoral dissertation, Faculty of The Graduate College, University of Nebraska).

McParland, M., Noble, L. M., & Livingston, G. (2004). The effectiveness of problem-based learning compared to traditional teaching in undergraduate psychiatry. *Medical Education, 38*(8), 859-867.

The Group of Restructuring Vocational Education. (2014). *Mesleki eğitimin yeniden yapılandırılması çalışma grubu raporu. [The report of the Group of Restructuring Vocational Education.]* Ankara, Turkey: Republic of Turkey Ministry of Development.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.

Nelson, L. M. (1999). Collaborative problem solving. In C. M. Reigeluth (Ed.), *Instructional design theories and models, Vol. II* (pp. 241-269). Mahwah, NJ: Erlbaum.

Nuutila, E., Törmä, S., & Malmi, L. (2005). PBL and computer programming: The seven steps method with adaptations. *Computer Science Education, 15*(2), 123-142.

OECD (2010). Learning for jobs. Retrieved from http://www.oecd.org/edu/skills-beyond-school/Learning%20for%20Jobs%20book.pdf

O'Reilly, T. (2005), What is Web 2.0: Design patterns and business models for the next generation of software. Retrieved from O'Reilly Group http://www.oreilly.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

Özturk, C., Muslu, G. K., & Dicle, A. (2008). A comparison of problem-based and traditional education on nursing students' critical thinking dispositions. *Nurse Education Today, 28*(5), 627-632.

Podges, J. M., Kommers, P. A. M., Winnips, K., & van Joolingen, W. R. (2014). Mixing problem based learning and conventional teaching methods in an analog electronics course. *American Journal of Engineering Education, 5*(2), 99-113.

Ribeiro, L. R. C., & Mizukami, M. D. G. N. (2005). Problem-based learning: A student evaluation of an implementation in postgraduate engineering education. *European Journal of Engineering Education, 30*(1), 137-149.

Slavin, R. E. (1980). Cooperative learning. *Review of Educational Research, 50*(2), 315-342.

Smith, B. L., & MacGregor, J. T. (1992). What is collaborative learning? In A. Goodsell, M. Maher & V. Tinto (Eds.), *Collaborative learning: A sourcebook for higher education* (pp. 10-30). University Park, PA: National Center on Postsecondary Teaching, Learning, and Assessment.

Sungur, S., & Tekkaya, C. (2006). Effects of problem-based learning and traditional instruction on self-regulated learning. *The Journal of Educational Research, 99*(5), 307-320.

Şahin, İ., & Fındık, T. (2008). Türkiye'de mesleki ve teknik eğitim: Mevcut durum, sorunlar ve çözüm önerileri [Vocational and technical education in Turkey: Current situation, problems and proposition for solutions]. *The Journal of Turkish Social Research, 12*(3), 65-86.

Şencan, H. (2008). *Türkiye'de mesleki ve teknik eğitim sorunlar-öneriler [Vocational and technical education in Turkey: Problems and propositions for solutions].* (Research report number: 55). İstanbul, Turkey: Tavaslı.

Şendağ, S., & Odabaşı, H. F. (2009). Effects of an online problem based learning course on content knowledge acquisition and critical thinking skills. *Computers & Education, 53*(1), 132-141.

The Council of Higher Education. (1982). *The guide for academic organization at university.* Official Gazette Number: 17609.

The Council of Higher Education. (2010). *Yükseköğretimde yeniden yapılanma: 66 soruda Bologna Süreci uygulamaları [Restructuring in higher education: The implementations of Bologna Process in 66 questions].* Ankara: Yükseköğretim Kurulu.

Toraman, C., & ve Demir, E. (2016). The effect of constructivism on attitudes towards lessons: A meta-analysis study. *Eurasian Journal of Educational Research, 62,* 115-142.

Tsai, C.-W., Lee, T.-H., & Shen, P.-D. (2013). Developing long-term computing skills among low-achieving students via web-enabled problem-based learning and self-regulated learning. *Innovations in Education and Teaching International, 50*(2), 121-132.

Uzunboylu, H., Bicen, H., & Çavuş, N. (2011). The efficient virtual learning environment: A case study of web 2.0 tools and Windows live spaces. *Computers & Education, 56,* 720-726.

Wilson, B. G. (1996). What is a constructivist learning environment? In B. G. Wilson (Ed.), *Constructivist learning environments* (pp. 3-8). Englewood Cliffs, NJ: Educational Technology Publications.

Yıldırım. A., & Şimşek, H. (2013). *Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research methods in the social sciences]* (9th ed.). Ankara, Turkey: Seçkin.

Yin, K. Y., Abdullah, A. G. K., & Alazidiyeen, N. J. (2011). Collaborative problem solving methods towards critical thinking. *International Education Studies, 4*(2), 58.

Yuan, H. B., Williams, B. A., Yin, L., Liu, M., Fang, J. B., & Pang, D. (2011). Nursing students' views on the effectiveness of problem-based learning. *Nurse Education Today, 31*(6), 577-581.

Yükselturk, E., & Top, E. (2013). Web 2.0 teknolojisinin öğretmen eğitiminde kullanımı [The use of web 2.0 in teacher education]. In K. Çağıltay & Y. ve Göktaş (Eds.) *Öğretim Teknolojisinin Temelleri: Teoriler, Araştırmalar, Eğilimler* [The foundations of instructional technology: Theories, research, trends] (pp. 665-680). Ankara, Turkey: Pegem.