

Flipped Classroom with Problem Based Activities: Exploring Self-regulated Learning in a Programming Language Course

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ABSTRACT

This study intended to explore the development of self-regulation in a flipped classroom setting. Problem based learning activities were carried out in flipped classrooms to promote self-regulation. A total of 30 undergraduate students from Mechatronic department participated in the study. Self-regulation skills were discussed through students' and the instructor's experiences including their opinions and behaviours. Qualitative data was collected with an observation form, discussion messages and interviews with selected participants. As a result, in terms of self-regulated learning, the goal setting and planning, task strategies and help seeking skills of the students were high in the face to face learning designed with problem based activities through flipped classroom model, their goal setting and planning, task strategies and help seeking skills were appeared moderately. In the home sessions, environment structuring, goal setting and planning skills were developed in high level while task strategies, help seeking, time management, monitoring, self-efficacy and self-evaluation skills were moderate and monitoring skills was lower. Consequently, it is hoped that the study may provide some suggestions for using problem based activities in flipped learning.

Keywords

Flipped classroom, Problem based learning, Self-regulated learning

Introduction

In recent years, researchers reported that students in many higher education programs cannot have opportunity for being active namely applying theoretical knowledge on real problems in the classrooms (NMC, 2015). In this sense, problem solving, collaborative group works, self-evaluation, peer tutoring as the active learning strategies become more preferable for making students active in the environment (Kim et al., 2014; McLaughlin et al., 2015). In this sense instead of traditional teaching methods, it is suggested to create learning environments including active learning strategies for problem solving (Barak et al., 2007; Marbach-Ad & Sokolove, 2002).

On the other hand, programming language course is one of the prominent courses in which active learning strategies may be conducted. Since learning programming is generally difficult including programming structures and syntax, critical thinking, and acquire problem solving which are considerably related to problem solving (Kelleher & Pausch, 2005). Thus, programming instructors work on various approaches in order to make students active in learning process. Strayer (2012) asserted that, it is not easy for the teachers to balance presentation and active learning strategies in face to face (F2F) settings. At this point, one such approach gaining popularity in recent years is flipped classroom model (FCM) or flipped learning. This study focuses on teaching programming via FCM by providing problem based activities. Students' experiences are analysed through understanding how they act during FCM in terms of self regulation.

Flipped learning

Flipped learning suggests students studying through interactive technologies such as watching videos at home online and preparing themselves to apply active learning strategies in the classroom (Bergmann & Sams, 2012; Herreid & Schiller, 2013; Roach, 2014). Students take notes and prepare questions about the topics with the theoretical knowledge on the videos at home. They electronically share their questions with the teacher at home and receive instant feedback in F2F settings (Bergmann & Sams, 2012). Teacher classifies the questions regarding the qualifications of the students and can prepare for discussions and feedback in the classroom (Fulton, 2012). Teacher and student roles in FCM are briefly summarized in Figure 1.

Since, FCM includes both F2F and online settings, the focuses of the research studies are somewhat different from typical F2F settings. In this regard, academic achievement (Al-Zahrani, 2015; Giannakos et al., 2015; Wanner & Palmer, 2015) and the attitude (Davies et al., 2013; Roach, 2014) were frequently investigated in FCM studies. In this regard, FCM was found to promote the participation of the students, enhance their problem solving abilities in group work (Berrett, 2012) and give opportunity to the teacher for individual guidance (Mok,

2014). Some other studies analysed students' perceptions, motivation and their self-efficacies (Findlay-Thompson et al., 2014; Kong, 2014; Mason et al., 2013).

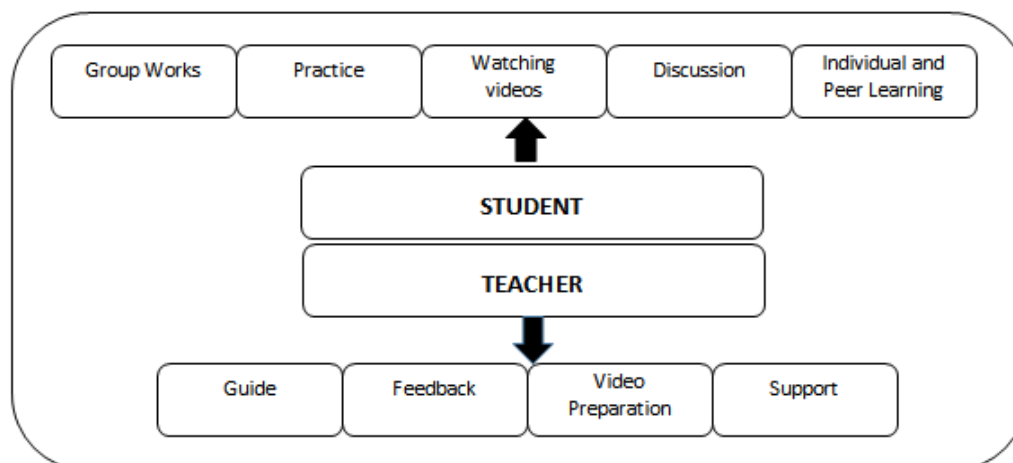


Figure 1. Teacher and student roles in the flipped classroom model

On the other hand, self-regulation is another issue addressed in online learning environments (Tabak & Nguyen, 2013; Yukselturk & Bulut, 2009). Self-regulation is generally considered from the point of revealing students' control skills about what, when and how to study (Cunningham & Billingsley, 2002). In this sense, self-regulation has a remarkable place in FCM whereas majority of learning in FCM occurs in online learning settings.

Study framework

This study focuses on self-regulation in the problem based activities. It considerably goes around the aspects of FCM, problem based learning and self-regulation including the framework summarised in Figure2.

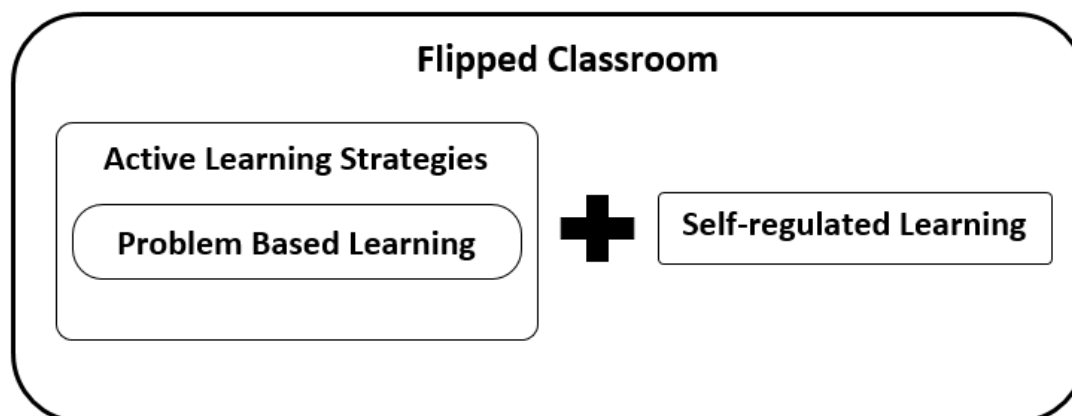


Figure 2. Study framework

Problem solving contributes to develop real life problem solving skills, creativity, productivity and flexibility (Lazakidou & Retalis, 2010). It also comprises student engagement, critical thinking, self-directed learning, authentic learning, group skill development (Klegeris & Hurren, 2011; Capon & Kuhn, 2004). In problem based learning (PBL), generally unstructured problem cases are provided for students. Students define the problem, collect data, and conduct group discussions for analysing data and produce solutions in a collaborative work (Pease & Kuhn, 2011). Roach (2014) pointed out that, when conducting FCM, if the tasks at school are organized as problem based activities, students may benefit from the potential of collaboration. Because, students study on problems at home through online platforms and they perform PBL activities, projects or homework in F2F sessions. As a matter of fact, some researches asserted that FCM may provide quality learning outcomes in which problem solving skills are taken into consideration (Berrett, 2012; Missildine et al., 2013).

On the other hand, Bland (2006) asserts that self-regulation is required for meaningful learning where the students densely have their own learning control in PBL environments. SRL is metacognitive, motivational,

behavioural active participation of the students to their learning processes (Zimmerman, 1989). Accordingly, the self-regulated learner establishes his own objectives, actively controls learning process by planning activities, organize the content and follow self-learning process (Artino & Stephens, 2009; Tabak & Nguyen, 2013; Zimmerman & Schunk, 2011). SRL also provides a theoretical framework in the evaluation of learning process (Herreid & Schiller, 2013).

Evaluating self-regulated learning

Various aspects were provided for evaluating SRL. Pintrich et al. (1993) discuss self-regulation in three types of strategies. Cognitive strategies are regarded as rehearsal and organizational strategies (Pintrich & De Groot, 1990). Metacognitive and self-regulative strategies are planning, monitoring, and regulating (Zimmerman & Martinez-Pons, 1990). Resource management strategies are time management, control of the environment and help-seeking (Ryan & Pintrich, 1998; Zimmerman & Pons, 1986).

Zimmerman and Martinez-Pons (1990) consider SRL strategies as self-evaluation, organization and transformation, goal setting and planning, seeking information, keeping records, monitoring, environment structuring, self-consequences, rehearsing and memorizing, seeking social assistance and reviewing records. In addition, Barnard et al. (2009) pointed out some specific characteristics for online learning environments. Since FCM includes both in and out of school activities, this study drew on the framework suggested by Barnard et al. (2009), Pintrich et al. (1993) and Zimmerman and Pons (1990).

Aim of the study

The aim of this study is to explore how the SRL skills of the students develop in a flipped learning environment in which problem based activities were used. The research question “To what extent did the students develop SRL skills in the flipped classroom with problem based learning?” guided to the research.

Method

This case study is based on students’ and the instructor’s perceptions and experiences in an introductory programming course. Development of SRL skills were also observed during ten weeks period.

Participants

Participants were 30 students (25 male, 5 female) enrolled in Mechatronics department of a public university in Turkey. They received introductory programming course for the first time. They had basic knowledge to follow videos on the LMS but they had no experience about flipped learning.

Procedure

One of the researchers was instructor and the other was observer in the classroom. In the first four weeks, Algorithm topic was taught in F2F instruction. The students were divided into six groups according to Algorithm test scores at the end of the four weeks. In the following five weeks, the main issues in C++ programming language were delivered via FCM. Students followed the videos weekly at home and discussed on various problems. In the F2F session, students in the groups collaboratively provided solutions for the problems and the instructor guided the students about the problems. Generally; at the end of the lessons, a selected student presented the solution of the problem in the classroom. The implementation is summarised in Figure 3.

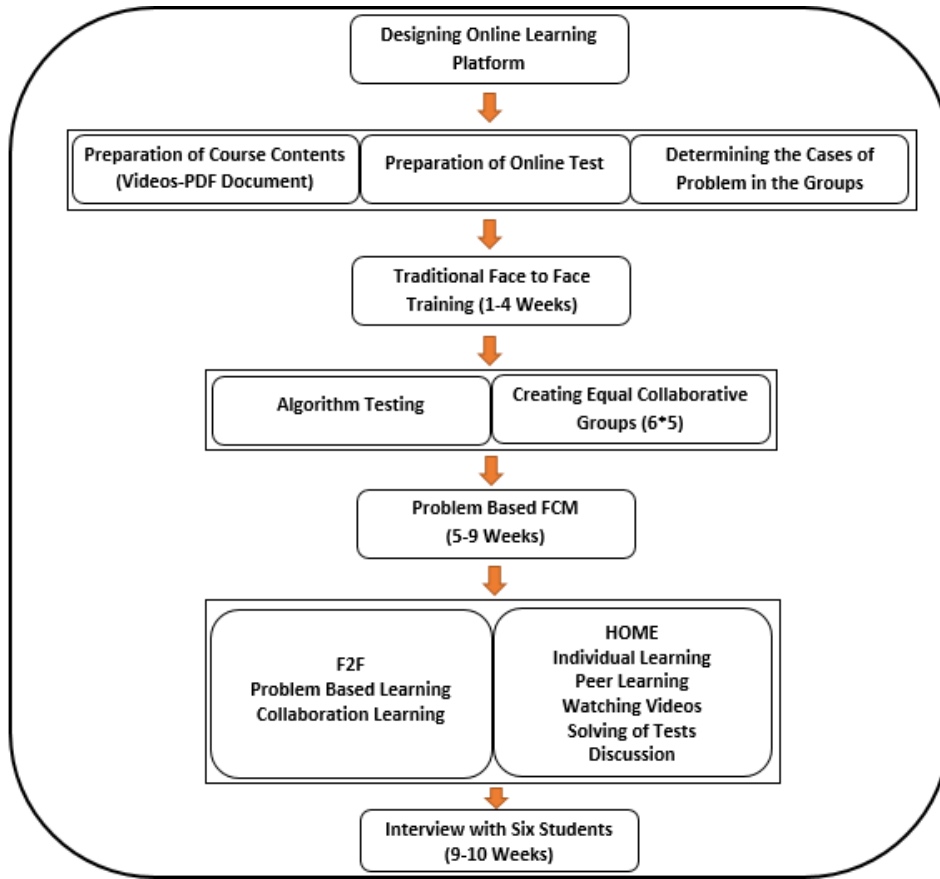


Figure 3. Procedure followed in the study

Online learning platform

Online Learning Platform (OLP) has three main modules: Course, Test and Task developed by the researchers.

Course module

The course videos were prepared through capturing display images through the Dev C++ Editor and two videos were weekly uploaded in this module. Students asked questions to the instructor and their peers by using comment section. At the end of the videos, each group was given problems about the related topic. Group members discussed about the problems before meeting in F2F lesson. Course module is shown in Figure 4.

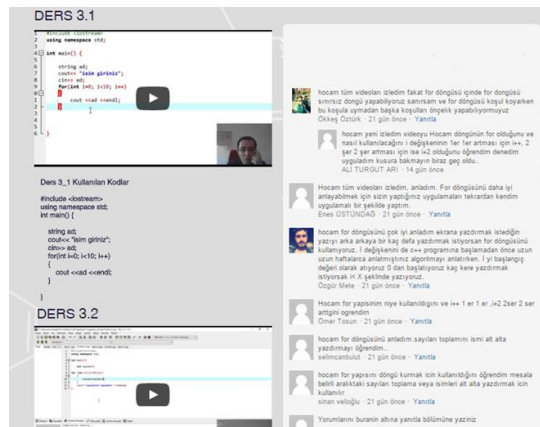


Figure 4. Course module

Test module

Students answer questions after watching videos in this module. Anyone who failed at the end of the test was directed to watch the videos again. The test statistics including students' achievements in the tests and the number of the tests they answered were kept by OLP. Instructor shared the statistics in F2F sessions.

Task module

Problems given at the end of the videos was separately shared in the Task module for each week. In addition, a Facebook group or emails were used to get in touch with the instructor and students each other. Three modules in this study is summarised in Figure 5.

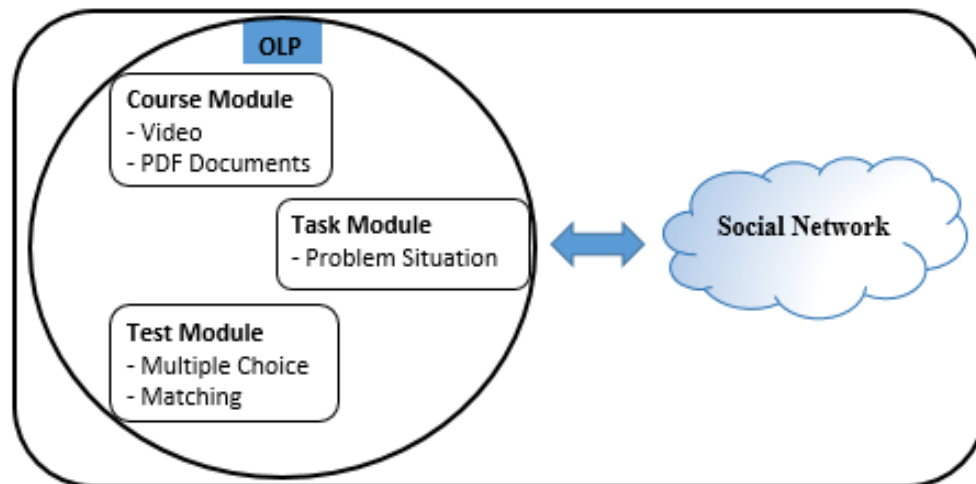


Figure 5. Online Learning Platform

Instruments

In this study, SRL skills were taken into consideration in F2F and in online environments. Accordingly, the items were referred from various scales to cover all the SRL skills in FCM. It was noticed that factors developed by Zimmerman and Pons (1986), and Pintrich et al. (1993) were generally employed in similar studies (Toering et al., 2012; Barnard-Brak et al., 2010; Cho & Jonassen, 2009). In this sense, for F2F sessions items in the scales of (Zimmerman & Pons (1986) and Pintrich et al. (1993)) were used. Also definitions of Barnard et al. (2009) were referred for SRL in online video sessions. The SRL dimensions referred in the instrument were briefly shown in Figure 6.

Figure 6 indicates that, “Environment structuring, Goal setting and planning, Help seeking” are common dimensions in three definitions. “Time management, Rehearsal, Organization, Monitoring, and Self-evaluation” are common at least in two definitions. Although “Transformation, Memorizing, Self-efficacy, Task strategies, Elaboration, Regulating” are specific factors for three scales, they also have some common characteristics in terms of their content. For instance, Pintrich and Schrauben (1992) consider the factors of “Rehearsal, Organization, Elaboration, Regulating, Memorizing, Transformation” under the topic of “Learning Strategies” while Barnard et al. (2009) analyzed them as a different factor as the “Task Strategies.” Also, “Self-efficacy” was analyzed as a separate factor. Considering the common and prominent dimensions, the analysis was directed through the scope of eight sub-dimensions: “Environment structuring, Goal setting and Planning, Task strategies, Help seeking, Time management, Monitoring, Self-efficacy and Self-evaluation.” The following instruments were used to collect data in order to explore the developments of SRL skills.

Observation Form: In order to notice the development of SRL skills, an observation form was developed and used by one of the researchers in the process. The form consisted of the factors “Environment structuring, Goal setting and planning, Help seeking, Task Strategies, Monitoring, Time Management, Self-efficacy, and Self-evaluation.” While addressing the items in the form, the observations about the behaviors, perspectives, and interactions were coded as positive or negative. For example, the items such as “I allocate extra studying time for my online courses because I know it is time-demanding,” “I try to schedule the same time every day or every

week to study for my online courses, and I observe the schedule” were negatively or positively recorded in the observation form for the factor of “Time Management” depending on the status of the students in terms of conducting those attitudes. Researcher filled the form for both F2F and home sessions.

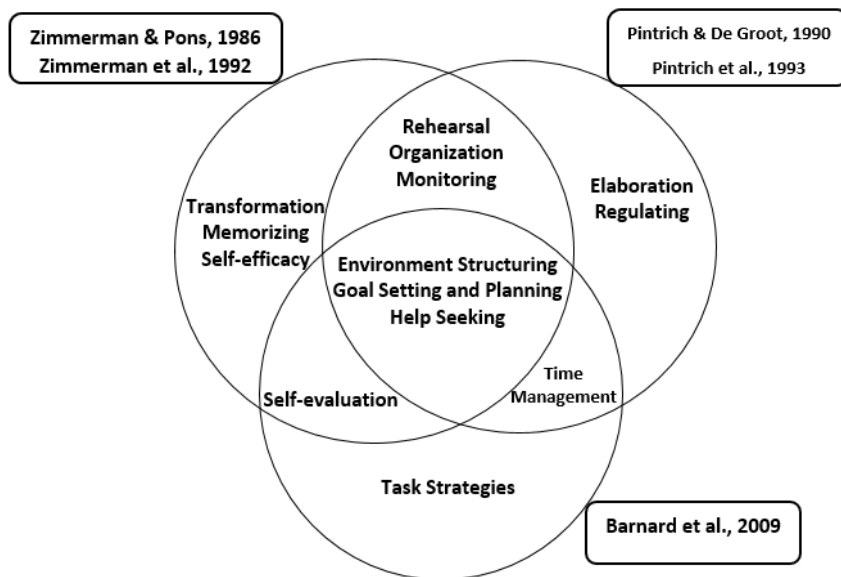


Figure 6. Self-regulated Learning Skills

Interviews: In order to explain the observations in detail, interviews were carried out with six selected participants. One student from each group was selected. Interviews were conducted by one researcher through a structured form including 8 factors of the SRL skills. The interviewees were selected because they had no absence throughout the academic year, participated in all of the exams, and they were volunteered to participate.

OLP Logs and Social Network Messages: For each student, the number of videos followed, the number of comments, and students’ scores from the online tests were recorded in OLP Logs. A Facebook group was employed to provide a faster communication among the students. Students’ SRL skills at home sessions were evaluated within the number of watching videos, messages on OLP or Facebook, the period of time they spent on OLP.

Analysis

The analysis of the process in the research is presented in Figure 7.

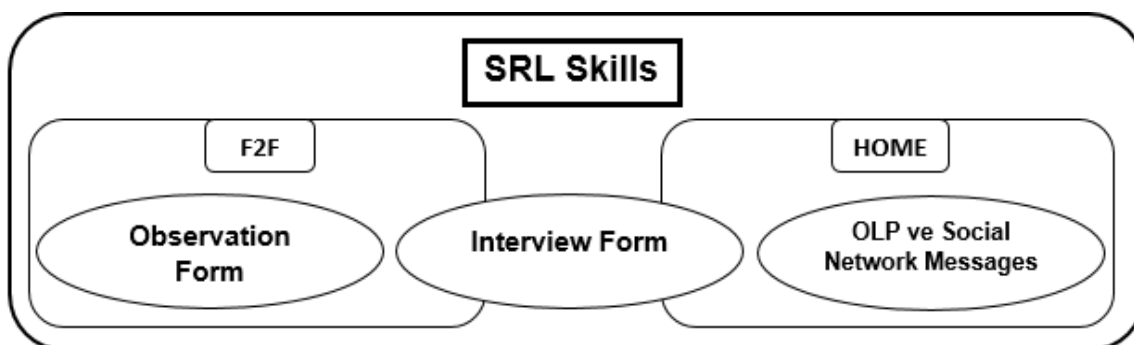


Figure 7. Data analysis

While determining the SRL skills in each week, eight factors of SRL skills and the frequency of the behaviors which were considered “positive” were taken as a basis. The observed frequencies and their durations were calculated and classified. The scores between “0 and 60” were regarded “Low,” those between 60 and 85 were regarded as “Medium” and the scores between 85 and 100 were assessed as “High.” Some other studies also provided similar classifications through the frequencies of students’ behaviors for interpreting data on observation form (Burgess et al., 2010). For example, the weekly frequency was observed through adding the

number of the students whose perspective was regarded “positive” for the factor of “Environment Structuring” in the Observation form.

The data obtained from the interview form was classified into the themes which are extracted due to eight factors of SRL skills. The observation data were elaborated and associated with the interview data.

Results

Results are organized as reporting SRL developments first, and then reporting the contributions of problem based activities.

Students’ SRL skills in the flipped learning

OLP logs and Facebook messages are evaluated together, and the developments of students SRL skills were outlined in Table1. The frequency is presented for the F2F and home sessions.

Table1. Development of students’ SRL skills

	5 Week		6 Week		7 Week		8 Week		9 Week		Average	
	F2F	Home	F2F	Home	F2F	Home	F2F	Home	F2F	Home	F2F	Home
Environment Structuring	M	M	M	H	M	H	M	M	H	H	M	H
Goal Setting and Planning	M	M	H	H	H	H	M	M	H	H	H	H
Task Strategies	M	L	H	M	H	M	M	L	H	M	H	M
Help Seeking	M	M	H	M	H	L	H	L	H	M	H	M
Time Management	M	L	M	M	H	M	M	L	H	M	M	M
Monitoring	M	L	M	H	M	L	M	L	M	M	M	L
Self-efficacy	L	L	M	M	M	M	M	L	M	M	M	M
Self-evaluation	M	L	M	M	H	M	M	M	H	M	M	M

Low: Self-regulated Learned Skills, 0-60% of Students

Medium: Self-regulated Learned Skills, 60-85% of Students

High: Self-regulated Learned Skills, 85- 100% of Students

The SRL skills developments were illustrated with frequencies which were determined through the data from OLP discussions, tests, Facebook messages and observation notes. For example, in Environment structuring dimension, the number of students who followed the videos were gathered from OLP reports, the number of students participated to collaborative activities or the number of students provided some arrangements at home were gathered via observation notes. For 5-9 weeks implementation, the average number of students for all weeks who showed indicators about SRL skills were determined and outlined in Figure 8.

Figure 8 indicates that in the implementation, skills about goal setting and planning dimensions were quite high. The skills of environment structuring, task strategies, help seeking, time management, self-efficacy and self-evaluation were exhibited by most of the students. However, the number of students who exhibited monitoring skills was relatively lower than other skills.

It was observed that majority of the students developed their “Environment structuring” skills in F2F and home sessions. The students regularly watched the videos through using the OLP at home for 5-9 weeks. They generally participated to the collaborative group activities and organized their own learning in F2F setting. In this sense, S2 stated that “I attended the face to face courses after watching the videos regularly at home ...” It was also observed that the students came together with their group-mates and started to study when they entered in the F2F sessions. They conducted various arrangements at home in order to study more effectively while watching the videos in the home. S4 addressed that “...The noisy environments decrease my motivationI watched the videos related to the courses at home at peace and quiet. ...” Since, in the implementation, the collaborative group works were conducted in F2F environment. It was observed that the students employed different approaches related to the collaborative group activities. Also, some students in groups preferred individual activities. Some students in Group-3 and Group-5 focused on the problem case instead of cooperative group activities in F2F sessions.

Average Frequencies of SRL Skills

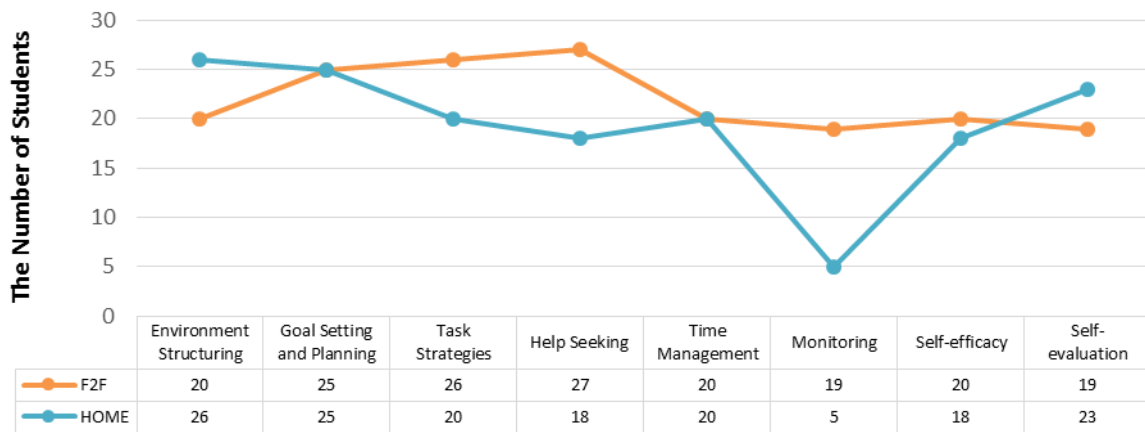


Figure 8. Average Number of Students who showed SRL skills

When goal setting and planning factor was analyzed, it was seen that SRL skills developed most commonly among the students. It was also observed that the students had necessary information about the problem case given to their group and they conducted discussions accordingly. They prepared for the given problem cases given to them. S4 expressed his opinion as follows; “After I had watched the videos, I knew what to do during the face to face lesson upon the problem cases is given. We conducted discussions with our group-mates related to the homework through social media...”. It was found that the students regularly studied on the contents of the courses they have to learn at home through the OLP environment and they came to F2F sessions after a preparation.

It was seen that majority of the students developed “Task strategies” skills in F2F and Home sessions. It was observed the students repeatedly watched the videos in order to understand the concepts in OLP environments at home. They took notes and applied the applications of the programming codes through their computers and gave their consideration to the problem case given to them. S5 explained the case as following; “...I watch the videos of the course, I tried to code after I watch. When I fail I watch the videos again ...”. It was seen that the students repeatedly watched the videos when required while they were studying on the problem case in F2F sessions and they analyzed the samples of coding in OLP. In the cooperative groups, the students primarily studied on the problems individually. Afterwards, they presented each other their suggestions for the solutions in discussions. Thus, they tried to reach to a conclusion.

It was addressed that majority of the students developed “Help seeking” skills in F2F and home sessions. Students identified that they received support from their peers or instructors related to the content of the course learning environments at home. At home, they directed their questions through comments section of the OLP or through Facebook group in the weekly periods. Moreover, they shared their solutions for the tasks in weekly groups at the end of each F2F lesson in the Facebook group. They asked questions generally to the instructor through OLP and they get in touch with their group mates through private messages. S6 stated that; “...Initially, I asked the questions about the issues I failed in comprehending to my peers. I asked the instructors if I can't find the correct answer...”. Also, students got help from their peers, web and the instructor respectively in the F2F sessions. The instructor didn't directly give answers to the questions asked by the students, he guided the students to do researches and discuss the problems with their peers in their group. Moreover, the students were also helped each other.

Majority of the students also developed “Time Management” skills in F2F and home sessions. The time management of the students is seen as the time which the students allocated especially to watch the videos regularly OLP environment at home. S2 stated; “I regularly watched the videos every week. I allocated about 30-45 minutes a week in average...”. S1 emphasized that they had time left for practicing and added; “...We obtained some information about the issue through videos and come to the classroom. I only deal with the problem cases given to us. Thus, we have free time to make exercises related to the issue we have just learned...”. It was observed that the students conducted the task given to them on time in the F2F environment and completed them within the related lesson.

When the monitoring factor is analyzed, it was found that the SRL skill developed least in the OLP environment at home. It was observed that the students didn't study much on the problem case given to their groups in the

OLP environment at home. S5 stated that "... I conducted the application of the codes given in the videos. However, I didn't study the problems at home..." The students studied the problem cases in the F2F sessions. However, it was found that they didn't study on the problem cases of other groups and the solutions for them. Thus, it was concluded that they didn't prefer watching their own learning levels through studying on the different problem cases. The students studied on the codes which were explained in videos and they mostly did the homework related to the application of the codes in different occasions, mostly in F2F environment.

Majority of the students also developed their "Self-efficacy" skills in F2F and Home sessions. It was found that the students experienced no problem in learning the contents in the OLP environment at home. S1 emphasized that, "...I generally understand the issues taught in the videos. If I encounter problems, I watch them again....." while S6 emphasized that "... I can make codifications given in the videos by myself..." On the other hand, the students mostly had difficulty when level of difficulty of the given problem cases increased. S2 stated that "... I had difficulty in doing homework when he level of difficulty for the issues increased in the course of time. For that reason I tried to do my homework after I received help from my friends or the instructor...". It was also observed that the students worked with group-mates since they faced difficulties in studying individually in F2F sessions.

In addition, majority of the students developed "Self-evaluation" skills in F2F and home sessions. The students wrote down whatever they perceived from the content and their questions on the comment section under the videos which they regularly used and through the encouraging of the instructor OLP environment at home. Moreover, they regularly solved the online tests in OLP environment. When they failed, they solved online tests after they removed their deficiencies. S6 stated that; "After I solved the questions in the test module, I was directed to watch the videos again when I got a score under a definite level. The harder the issues got the more I had difficulty in accomplishing the test only once..." In the F2F sessions, the students shared their solutions with other groups at the end of the lesson. Thus, it was observed that the students were able to analyze the solution for the different problems.

Overall, the data obtained from the observation notes and interviews indicate that, the levels of "Goal setting and planning, Task strategies, Help Seeking" skills were considerably high in F2F learning environments among the students. Also, their "Environment structuring, Time management, Self-efficacy, Self-evaluation, and Monitoring" skills may be considered at medium level... In home sessions, while "Goal setting and planning, Environment structuring" skills were high, "Task strategies, Help Seeking, Time management, Self-efficacy, Self-evaluation" skills were medium and the "Monitoring" level was low.

Discussion and conclusion

In this study, the problem based learning in the flipped classroom was analyzed within the SRL framework. In the study, problem solving activities were given prominence in F2F setting in FCM which contains problem based learning when compared to other learning activities. At this point, the Course module in OLP became prominent so that the students watch the videos and they wrote down their questions and whatever they understood. Students used Test module for self-evaluation. Using the Task module, they acquired information about the problems given to them weekly for the F2F learning environment. Students worked collaboratively in F2F learning environment related to the problem event given to their group.

The occasion of executing the Environment structuring skills of the students through the problem based FCM was higher at home when compared to F2F learning environment. Almost all the students watched the course videos regularly. They provided some arrangements in their learning environment in order to benefit efficiently from the videos. It was found that the students planned their own learning activities through Problem based FCM, they motivated themselves for studying and arranged the learning environment as suggested by Artino and Stephens (2009). Most of them confirmed that they worked collaboratively in the F2F learning environment. Especially, successful students preferred to work individually. But when they work collaboratively, they took responsibility in the group activities more than the other students. Students having difficulty in understanding the content preferred collaborative environment, because they received help from peers and motivated each other.

According to Wanner and Palmer (2015), the students mainly prefer collaborative learning activities in F2F environment although they conduct the learning activities through online platforms in FCM. Similar to this idea; students were responsible to organize the learning environments at home and the collaborative environment in the classroom was formed through the guidance of the instructor. Thus, the difference between the Environment structuring skills of the students in the F2F and home environment may be resulted from those cases.

Setting up the objectives in problem based environments is regarded as one of the indicators of SRL skills among the students (Loyens et al., 2008). In this study, the executing the skills of Goal setting and planning among the students were found to be high in both F2F and at home. The students employed OLP weekly at home systematically and they planned their works. They had information about the content and objective of the videos in OLP they use at home. On the other hand, they were aware of the problems case given to them for F2F learning environment. Thus, the characteristics of the learning environment somehow affected the SRL skills of the students. As a matter of fact, the students came to F2F sessions knowing what they would do in the F2F environment although they didn't work on the problem case much at home. So, problems provided for students may be concluded to contribute on the point of determining and planning the objectives of the students.

It was found that the students had higher rates for Task strategies in the F2F environment than watching the videos at home. The results indicated that the students encountered difficulties in explaining the meaning of the given problems when they could not provide adequate effort for the theoretical knowledge at home. As seen in similar studies, students in this study tried to overcome the deficiencies at this point through the supports from the instructor and peers through discussing and repeating in the F2F setting (Touchton, 2015; Artino & Stephens, 2009). The opportunity to watch the videos more than once provided much contribution when the students needed to associate with the previous issues. Upon the students learn the content to a certain extent in the F2F setting; they were able to take an active role in learning in the classroom as seen in some studies which conducted similar applications related to problems in the classroom (Love et al., 2014).

In the dimension of help for seeking skills, students mostly preferred F2F learning environment to receive help on the topics they had difficulty. They asked questions to other members and the instructor through OLP or Facebook. As a matter of fact, the students asked for help more in the classroom when they failed in understanding the content at home. The instructor conducted applications for learning at home through FCM provided contributions to the students at the point of learning through solving problems. The role of the instructor was similar to another study who effectively applied the problem solving through FCM and collaborative activities (Al-Zahrani, 2015).

Time management skills of the students were developed similarly both in F2F and learning at home. Since the students came to class having certain knowledge, they gained time to conduct applications in F2F setting and it provided opportunities to use the time at home efficiently. To that end, it helped in reducing the time which passes with teaching in classroom as seen in the FCM; thus, a top-level learning was provided (Steed, 2012).

Monitoring skills among the students were lower at home. A few students were able to apply the knowledge they obtained personally to different cases. Very few students could apply the knowledge they learned at home into a different case. The students didn't need it since they would study on the problem case given to their groups in the F2F learning environments. In some cases, it was pointed out that the students were able to learn at the application level and higher in F2F learning environment (Touchton, 2015; Seamen & Gaines 2013).

Through problem based activities majority of the students felt qualified within the context. However, it is also recognized that self-efficacy of the students decreased during the weeks when they had difficulty in perceiving the issues. In that case, they can receive help in the F2F setting from their peers and instructors. The students were generally able to perform the tasks in the activities about the topics which are explained in the videos. Although they could not find the absolute solutions for the given programming problems, they were able to bring proposals forward. In this sense, problem based activities has positive contributions to the self-efficacy among the students (Wiginton, 2013).

The students measured their level of knowledge regularly using the test module in the OLP at home. According to the result coming from this result, they watched the videos again or thought about the given problem case. As Artino and Stephens (2009) pointed out that the students gained opportunities to evaluate themselves, seeing their deficiencies and making regulations in this way, students in this study forwarded the sections they couldn't understand to the instructor of their peers in OLP, Facebook or F2F learning environment.

Some researchers argue that SRL skills were in relation with problem solving skills (Veenman, 2006; Veenman & Beishuizen, 2004). According to Lazakidou and Retalis (2010), problem based learning is a process which SRL strategies are implemented to achieve solution for the given problem. From this point of view, it is thought that SRL skills may be developed since PBL and SRL strategies are provided together. Generally, it is considered difficult for students to develop their SRL skills in the online learning settings (Sun & Rueda, 2012), so FCM may enable active learning strategies through its hybrid structure. Thus, the results of the research provided an insight that students SRL skills may be developed through Problem based FCM.

It was found that the Goal setting and planning, Task strategies and Help seeking skills were high in the F2F setting. In addition, their Goal setting and planning, Task strategies and Help seeking was appeared moderately. In the home sessions, students skills of Environment structuring, Goal setting and planning were high level while Task strategies, Help seeking, Time management, Monitoring, Self-efficacy and Self-evaluation skills were moderate and Monitoring skill was lower. A conclusion may be drawn that the problem based activities in FCM could provide positive contributions to the students' Self-regulated Skills. On the other hand, the opportunity of repetition at home has enabled students to perform applications through collaborative group activities in the F2F settings and facilitate learning programming which require problem solving skills.

Consequently, this study is hoped to provide an insight for using problem based activities in flipped learning. Although the study is limited to the use of problem solving and collaborative group activities among the active learning strategies in FCM; for future studies, other active learning strategies may be taken under consideration. Moreover, monitoring skills which is one of the crucial dimension in SRL was found low in this study and it may be specifically analyzed in FCM. Furthermore, the relationship between SRL, PBL and FCM model in different disciplines may be examined.

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