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The Effect of Structure in Flipped Classroom Designs For Deep and Surface Learning Approaches

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ABSTRACT
A growing body of research is concerned with the implications of Flipped Classroom (FC) model at higher education institutions. There is a wide range of the opinions and experiences on FC model and the model is still being tested by the researchers and practitioners. For the purpose of examining best practices in FC models, the present study was conducted to investigate the effects of structure in the FC models on academic success of the students who adopt deep and surface learning approaches. The study was conducted quasi-experimentally with 119 students. A pre & post achievement test and a study process questionnaire were used to collect data. The results indicate that scores on academic success of students learning in structured FC model is significantly higher than the scores of the students in flexible-structured FC model and control group. In terms of study process approach, the students in FC models who adopt deep learning approach scored significantly higher on achievement test than the students in control group while there is no significant difference between experimental groups. The results are the same for the students who adopt surface learning approach. The outcomes of this study have implications for designing an FC model and strategies for the practitioners.
Keywords: Inverted classroom; flipped classroom; surface and deep approaches; structured and flexible-structured flipped classroom

INTRODUCTION
It is important to promote meaningful learning environments in all levels of education. With regard to higher education institutions, there has been increasing number of studies regarding leveraging deep learning of the students against the assumption that "most students in most undergraduate courses become increasingly surface and decreasingly deep in their orientation to learning", while the generic aim of teaching is to promote meaningful learning (Biggs, Kember, & Leung, 2001; pg. 5-6). As Beattie, Collins and Bill (1997; pg. 1) remark in recent years, deep learning has been a concern of evaluations of higher education relative to surface learning and these concepts which were developed in 1970s and 1980s are now well-founded in higher education literature. Today, in line with the discourses to engage the students with meaningful and effective learning experiences, information and communication technologies (ICTs) have been integrated into education underlined with the pedagogies such as active learning. A concrete and prominent example of this is Flipped Classroom (FC) model, which have two important pillars as technology and pedagogy of active learning, has been rapidly accepted mainly by higher education institutions (Estes, Ingram, & Liu, 2014). In this model, essentially, students are provided with pre-course materials to get ready for the course through systematic use of ICT and it is aimed to promote interaction and the meaningful learning activities that occur during the face-to-face time" (Bergmann, Overmyer, & Willie, 2012; np).

Deep and surface learning in higher education

Deep learning refers to high level of cognitive activities such as critical and creative thinking, problem solving skills and engaging the learning activities and content (Salmon, 2004; James, Chin, & Williams, 2014) while surface learning is associated with rote and temporary learning (Beattie et al., 1997). In the literature, students' approaches to learning concern individual traits such as motivation and attitudes (Beattie et al., 1997) and also a host of factors such as students' perceptions of task demands, instruction methods, classroom climate and so on (Biggs et al., 2001).

FC model as a kind of blended learning (Staker & Horn, 2012) has the potential to foster deep learning (James et al., 2014) as it is a comprehensive model consisting of the elements influencing the students' approaches to learning. It is remarked in the literature that as a kind of blended learning, FC model helps with managing cognitive load (Turan, 2015) possibly because of the reason that the resources are provided to the students prior to the course (Seery & Donnely, 2012) so that the students could process the knowledge beforehand, and the content is presented in chunks (Mayer & Moreno, 2003). In line with these finding in the literature, Garrison and Kanuka (2004; pg. 13) also provide a discussion of blended learning's potential to support deep and meaningful learning; however they suggest that "systematic evaluation of satisfaction and success of the teaching, learning, technology and administration of new course" is necessary. In terms of evaluating the different variables for providing the students with deep learning processes, it is important to examine learning experiences of the students who adopt surface learning and deep learning approach in an FC model. Biggs et al. (2001) refer to two learning approaches of students as deep and surface approaches. This identification is important in the context of an FC model in understanding its effectiveness on the students who adopt different learning approaches. Yilmaz and Orhan (2011) articulate that the students with surface approach tend to perceive learning tasks (e.g. assignments) as a burden, and to narrow their focus to the learning activities connected with the assessment of the course. Given the facts that FC model is inherently carried out with the learning responsibilities (such as assignments) materialized out-of-class times, and usually specific tasks (such as watching videos) are given to the students; the experience and success of these students need to be examined. On the other hand, it could be assumed that FC model could be best suited with the students who adopt deep approach as this approach enables students to learn from the educational materials. When considering that the relationship between deep approach and high academic success was established in the literature (Yilmaz & Orhan, 2011), it is expected that in a course designed with FC model the students with surface learning approach might not perform better than the students with deep learning approach.

Against this background, to sum up, taking a surface learning approach is one of the problems experienced in higher education today, and learning technologies along with an active learning pedagogy have been adopted in education as a promising medium in education in order to engage students with active and meaningful learning. At this point, it is believed that FC model has the potential to promote deep learning associated through systematic use of ICT and meaningful interaction time in class. However, given the fact that there are also students who adopt a surface learning approach, it is important to design an FC model helping surface learners engage in meaningful learning experiences.

Learning Structure and learning approaches in FC models as a blended learning

Drawing on the literature, Kalelioğlu (2011) defines structure as a way of designing the learning environment using instruments such as planning and organising the activities, roles, teacher support, aims, instructions, rules, group formations and resources. Moore (1993) defines the structure as an extent where an education program meets individual learning needs of the students (cited by Yilmaz, 2014). According to Moore, if learning activities are not designed in a flexible structure and unable to meet learning needs of the students, the transactional distance, "communication and psychological distance (not geographical distance) between instructors and students" (cited by Chen, Wang, Kinshuk, & Chen, 2014, pg. 19), would be increased.

There has been increasing literature over the past ten years aiming at reaching the best practices of FC models in higher education. If it is aimed to promote meaningful and active learning experiences in blended learning systems such as an FC model, it is important to consider the amount of learning structure. Drawing on the literature, Salter and Conneely (2015) argue that providing structure to students might have a different level of impact on student engagement, and critical engagement has the potential to lead deep thinking, interactive activities and educational experiences. Also, usually in a flexible learning design students are regarded as active participants and they are supported by deep learning (Drennan, Kennedy, & Pisarski, 2005). Here, structure is one of the key aspect of distance education systems. Chen et al. (2014) note that in flipped classrooms transactional distance is changing constantly and in the situations which the students watch videos at home, transactional distance is high due to the lack of communication between the students and the instructor. Chen et al. (2014) stress that high transactional distance might have negative effect on learning experiences such as poor learning and in that sense, Moore and Kearsley (2011) recommend to increase dialogue as well as to decrease pre-determined structures. They point out the proper combinations of structure and dialogue which has the potential to engage students with effective learning.

On a closer look at the relationship with the learning structure in distance and blended learning systems and deep learning experiences, there are controversial debates on the extent of a learning structure and likely consequences of the structures. For instance, in a flexible-structured discussion forum, when students are allowed to dictate what they want to learn, then they are inclined to explore the course topics more broadly whereas they "may not know to how create a dialogue that is engaging and involved" (Salter & Conneely, 2015, pg. 20). On the other hand, there are findings in the literature which support the view that putting the structure into the learning environments can help obtain positive learning experiences. In their study, Cadwick and Ralston (2010) identified that when the structure is provided in the student discussions, students' higher order perspective-taking and learning is correlated with each other in structured discussions. In line with this, Kalelioğlu (2011) reports that the participants in her study performed critical thinking skills mostly in the structured/guided environment.

A further point in regard to the structure in distance and blended learning is concerned with the individual differences. Researchers point out that individual differences and students' approaches to learning should be taken into account in learning environments (Hall, Ramsay, & Raven, 2004; Wilson & Fowler, 2005; Yilmaz & Orhan, 2011). However, on a closer examination, in some studies, there is no significant statistical result found in relation to the individual differences and learning structures in blended learning environments. According to a study by Zheng, Flygare and Dahl (2009), there is no significant difference between the students with different cognitive styles in well-structured and ill-structured online learning environments, whereas students showed different levels of performance based on the mean average. Also, as reported by Yilmaz and Orhan (2011; pg. 1028), there is no significant difference in "academic achievements, web material using behaviors, and attendances to face to face and Web based learning environments" between the students who adopt surface and deep learning approach. However, returning to the point raised by Moore (1993) suggesting that individual differences should be taken into account due to the transactional distance in distance learning systems and influence of individual differences on students' performance in different learning environments as presented earlier, there is a need to further examine learning experiences of the students with various individual differences. In the scope of the present study, as a type of individual difference, students' academic success with deep and surface learning approaches will be examined in FC model as an emerging model in education based on the learning structure.

RESEARCH PROBLEM

Biggs (2003; pg. 31) assumes that "surface and deep approaches to learning are not personality traits, as is sometimes thought, but are most usefully thought of as reactions to the teaching environment". In the same fashion, Bonwell and Eison (1991) point out that many individuals adopt learning styles which best suit with pedagogical techniques rather than lecturing. In that sense, providing deep and surface learners with suitable learning environments consistent with their learning characteristics would enhance their learning experiences. Given the varying effects of different levels of structures on the students, it is important to investigate learning experiences of the learners who adopt surface and deep learning approaches. At this point, Hung (2015) suggests that there is a need to examine effects of structured versus flexible-structured flip lessons on student learning. In this context, the main purpose of this research is to compare the academic success of the students who learn with deep and surface learning approach in structured and flexible-structured FC models. Against this background, following hypotheses were generated:

H1: The students learning in structured FC environments have significantly higher academic success than the students learning in flexible-structured FC environments and traditional learning environment.

H2: The students with deep learning approach in the structured FC environment have significantly higher academic success than the students with deep learning approach in flexible-structured FC environment and traditional learning environment.

H3: The students with surface learning approach in the structured FC environment have significantly higher academic success than the students with surface learning approach in flexible-structured FC environment and traditional learning environment.

METHODOLOGY

Designing the research site

A quasi-experimental research was carried out with 119 first year students enrolled in Computing I course. In the course, it was aimed to teach word processing, spreadsheet and presentation software to the students studying at a faculty of education in Turkey.

Participants of the research

Table 1 below summarises the number of the participants based on the departments.

Table 1. Participants of the research based on the departments

Departments	Frequency	Percentage
Psychological Services in Education	41	34.45
Elementary Mathematics Education	40	33.61
Social Science Education	38	31.93
Total	119	100.0

Participants in this study were 119 first year students from 3 different departments taking Computing I course. As a result of random assignments, Experimental Group I (EG I) consists of the students in the department of Psychological Services in Education; Experimental Group II (EG II) consists of students in the department of Elementary Mathematics Education and Control Group (CG) consists of students in the department of Social Science Education.

Study process

The study process consists of two stages. At the first stage, the research was designed based on the research questions and a technical infrastructure was built up. In the second stage, experimental procedures were carried out and then data were collected.

First stage: The research design

At this stage, the Experimental groups were formed and digital materials (e.g. quiz, videos, readings and guidelines) were produced and then placed on Moodle. A learning group consisting of students were formed on Facebook for communication purposes.

Drawing on the research problems, two experimental groups were formed and an FC model was adopted in these groups. In addition, one group was formed as a control group and the course was run in face-to-face session without the digital materials produced for the experimental groups whereas syllabus remained the same.

Experimental groups were formed as flexible-structured and structured FC model. Moore (1993) defines the structure as curriculums' potential to meet individual learning needs of the students and drawing on this definition (cited by Yilmaz, 2014), it was aimed to examine which FC model best suits with the students adopting deep and surface learning approaches. In the next section, formation of experimental groups based on the course structure will be expanded.

Experimental Group I (EG I). Flexible-structured flipped classroom model

Chen (2003; pg. 25) argues that "in order to make one aspect of the instruction flexible, usually other aspects have to be made more structured". In the case of present study, the assessment, tasks and digital resources were structured so as to guide the students with clear targets, in other words, they were informed about assessment, learning tasks to be fulfilled and digital resources to be utilised for learning online before in-class time.

In line with this, Chen (2003) suggests that in a commonly accepted flexible learning definition, students must be provided with flexible access at least one of the following learning elements: time, place, pace, learning style, content, assessment and pathways. In the case of EG I, in terms of time, the students were allowed not to attend to the class but they were required to submit their assignments before the subsequent week begins. In terms of place, they could watch online videos anywhere including the computer labs. In regard to the element of learning style, as Chen (2003; pg. 25) remarks that flexible learning by definition requires students to actively engage in learning process "and that students should be more independent and more responsible for their own learning". In the case of EG I, during in-class time, the students were asked to fulfil hands-on tasks in the computer laboratories and submit their assignments. When they failed to perform the tasks before the course hours ended, then supportive videos on how to perform the tasks were provided to them online and they could submit in a week time. The tutor was also in the laboratories to assist students with their tasks but the interaction between the students and the tutor were limited with the time and student/tutor ratio. Therefore, rather than tutor-student interaction in face to face sessions, the teaching and learning methodology of the course was informed by peer interactions. When the course was structured in this way, it helped the students to empower their learning experience with peer collaboration, self-regulated learning via digital materials and also feedback from their tutor, otherwise the huge number of the students working in a computer lab with limited number of computers would constrain the tutor's teaching practices within these conditions. Thus, EG I's learning experience was underlined by characteristics of flexible learning as collaboration with peers, support of learning resources, context-sensitive learning experience and teacher as a facilitator (Chen, 2003).

However, in a flexibly designed FC model it is important to examine learning experiences of the surface learners because although the students with deep learning orientation might take an active role by engaging in digital resources before the class and "come to most classes with questions in mind" (Biggs et al., 2001), the students with surface learning orientation might merely follow what they are asked to do without a deep engagement with the course content. Although a week time is assigned for students to study on the weekly course content and submit their assignments, these students might minimize the time to learn the content on surface rather than allocating more time for deep learning. Therefore, their academic success must be examined in a flexibly designed FC model.

Experimental Group II (EG II). Structured flipped classroom model

In distance education systems which are usually delivered mainly via instructional videos and these are the environments where there is not significant amount of feedback and interaction mechanism, the structure of these courses is described as structured course (Yilmaz, 2014). Usually what makes a course structured is all about unchangeable course goals, a single teaching and learning method and limited options of assessment (Yilmaz, 2014). Also, unlike flexible learning, these courses are teacher-centered.

Learning tasks and learning resources given to the students in EG II are similar to the tasks in EG I, Although these tasks and learning resources in EG II are more structured. The students were expected to watch the videos before the class and instructed by the teacher. The students were required to attend in-class time courses. As learning and teaching methods, question and answer methods as well as didactic teaching methods were adopted; thus source of the interaction mainly relied on the dialogue between the teacher and the students. The assignments were due on the same day of the in-class course and the students were not given extra time unlike in EG I.

In regard to the structured learning models as mentioned above, Moore and Kearsley (2011) remark that the more an educational program is structured the less it has the potential to accommodate individual needs of the students as the students are provided with limited number of alternatives. From this point of departure, it is expected that students who adopt surface approach to learning might not be actively involved in learning process due to high structure of the course and hence their learning experience needs to be examined.

It is important to note that in both of the groups, same syllabus, learning tasks, technology and assessment methods (e.g. marking assignments and achievement tests) were employed. Among flexible learning elements, teaching and learning methods, time and place were applied differently in order to examine how to best accommodate learning needs of the deep and surface learners.

Other designing issues on FC model

As Kim, Kim, Khera and Getman (2014) suggest "The design of flipped classrooms has often been limited to the concept of replacing in-class instruction with videos and using class time for homework" while FC concerns "flipping conventional events both inside and outside of the classroom and supporting them with digital technologies" (Hughes, 2012, pg. 38). In that sense, it was aimed in this research to promote students' learning before the class by videos and supporting digital materials such as e-books and presentation documents.

Videos were produced for the purpose of teaching students the basics of the course content as well as showing them how to fulfil the hands-on activities. As an example of hands-on activities, the students were given a list of fictional students whose two exam results were presented on a spreadsheet as a working sheet. A guideline was given on the spreadsheet and they were asked to calculate scores of the fictional students by calculating 40% of the first exam results and 60% of the second exam results. Two videos were located on Moodle and on the social network site to help students on this activity. The first video was concerned with the spreadsheet software in general and how to fulfil basic functions on the software. In the second video, some instructions were given on how to calculate the exam results by using formulas and functions on the spreadsheet.

When students attended to the face to face sessions, they were expected to be knowledgeable about spreadsheet software and how to make basic calculations by using formulas and functions. The duration of the videos was between 5-10 minutes length.

Second stage: Conducting the experiment
The course lasted in 13 weeks. In the first 2 weeks, the course was run in the class for all students and they were introduced with theoretical aspects of the course. The students in the experimental groups were made familiar with the Moodle. Discussions took place on FC implications in Education so as to make the students familiar with the pedagogical approach in the course.

In Week 2, the pre-test (an achievement test) was administered to the students. During the remainder of the course, an FC model was implemented. In the final week, the post-test was administered in order to measure academic success of the students. The model of the research is presented in Figure 1.

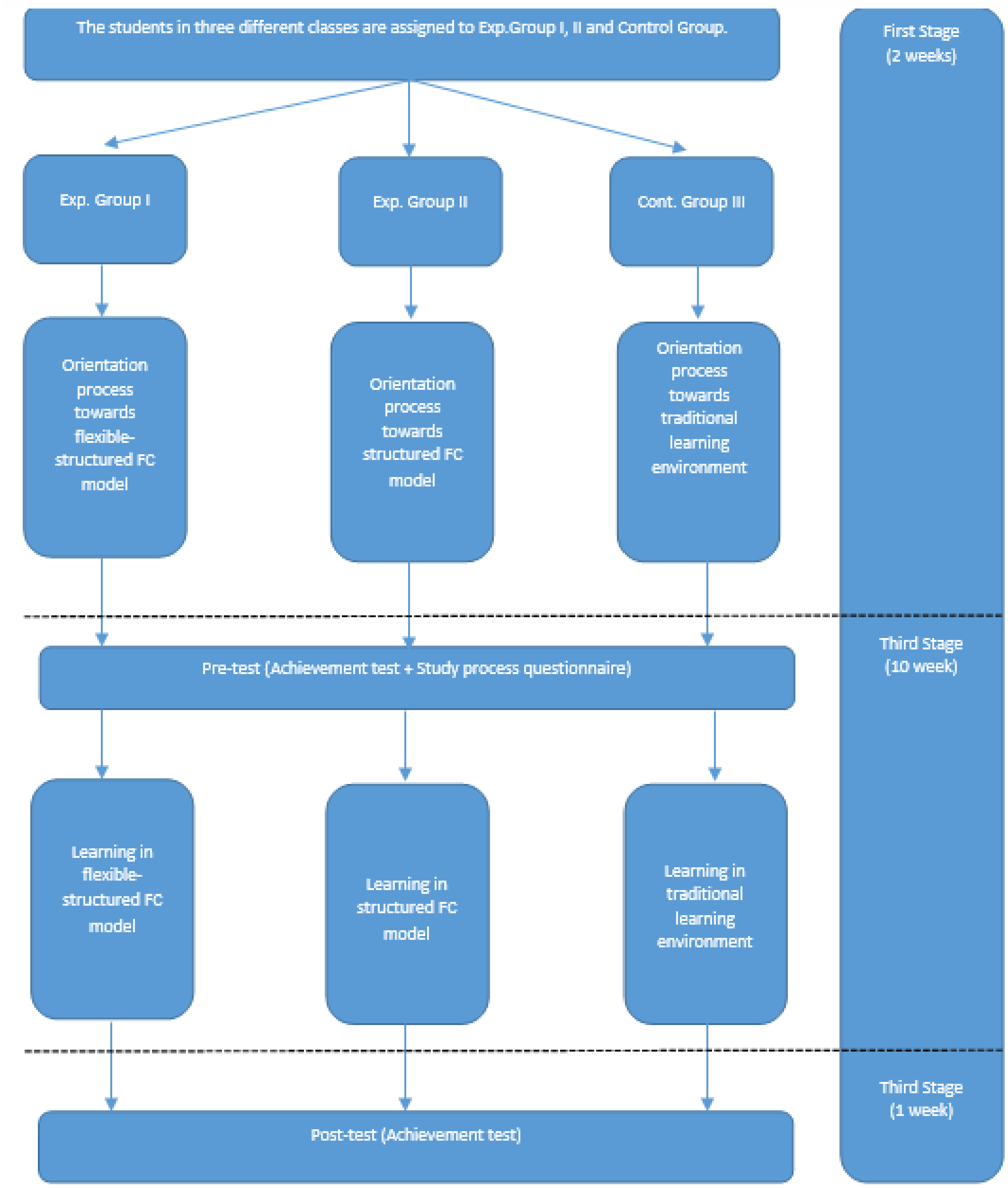

Figure 1. Procedure of the experiment

METHOD

The research was conducted as a quasi-experimental study and participants of the study consist of the students enrolled in Computing I course from 3 different teacher education departments in Turkey. The process that which department will form which group was determined randomly, in other words, students enrolled in two departments were assigned as the experimental group, while the students in the remaining department were assigned in the control group. Experimental Group I (EG I) consists of the students learning in the structured FC model in the department of Psychological Services in Education; Experimental Group II (EG II) consists of students in the flexible-structured group in the department of Elementary Mathematics Education and Control Group (CG) consists of students learning in the traditional environment in the department of Social Science Education. Quantitative data were collected via a scale and an achievement test examining the academic success of the students with different study process learning. The scales were administered online and the online system required the participants to answer all of the questions. Thus, emergence of missing data was avoided.

Instruments

A Study process questionnaire and a pre & post achievement test were used to examine the research questions. It is important to note that in order to examine academic success of the students with different learning approaches, only the students who returned both the scale and pre & post tests were taken into account (N=119). The students who did not return any of the measurement tools were excluded for this stage of analysis so as to ensure robust data analysis.

Study process questionnaire

In order to examine the students' study processes, Two Factor Study Process Questionnaire (SPQ-2F) developed by Biggs et al. (2001) was used in the research. SPQ-2F aims to identify students' learning approaches as deep and surface approaches. Yilmaz and Orhan (2011) point out that, reported by Entwistle and McCune (2004), there are a variety of instruments in the literature to measure study approaches of the students such as Inventory of Learning Processes, Learning and Study Strategies Inventory, Inventory of Learning Styles, Approaches to Studying Inventory and Study Process Questionnaire and among these instruments, Study Process Questionnaire has some advantages over the others since the questionnaire contains small number of items, it is used in different cultures, with different variables and different teaching and learning process. For these reasons, SPQ is also used in the present study.

As the participants of the present research were Turkish students, Turkish translation of the scale was administered to the participants. The scale was translated into Turkish and adapted by Yilmaz and Orhan (2011). In their study, Yilmaz and Orhan (2011) report that the 20 item-scale has two factors as deep and surface approaches and its Cronbach alpha coefficients were 0.79 and 0.73. They conclude that Turkish version of SPQ is suitable for the Turkish university students.

Achievement test

In order to measure the students' academic success, an achievement test consisting of multiple answers was developed based on the goals of the course. In the first version of the test, there were 54 items. In order to ensure its construct validity, four experts' opinions were consulted and the test was revised according to their opinions. Experts have had teaching experience on the Computing I course. Subsequently, the test was administered to the 89 second year students who have already taken Computing I course in their first year so as to ensure its validity and reliability. In investigating the internal consistency of the test, Cronbach's coefficient alpha was found 0.73. In the Table 2 below, analysis results for each item is shown based on the item's difficulty index and discrimination power.

Table 2. Item's difficulty and discrimination power on the achievement test

QN	D	P	QN	D	P	QN	D	P
Q1	0.346154	0.326923	**Q19**	-0.03846	0.096154	**Q37**	0.5	0.557692
Q2	0.115385	0.75	**Q20**	0.076923	0.538462	**Q38**	0.307692	0.423077
Q3	0.461538	0.5	**Q21**	0.346154	0.288462	**Q39**	0.346154	0.480769
Q4	0.230769	0.5	**Q22**	0.269231	0.173077	**Q40**	0.230769	0.5
Q5	0.346154	0.519231	**Q23**	0.076923	0.153846	**Q41**	0.5	0.596154
Q6	0.269231	0.365385	**Q24**	0.384615	0.538462	**Q42**	0.346154	0.673077
Q7	0.192308	0.826923	**Q25**	0.153846	0.423077	**Q43**	0.307692	0.230769
Q8	0.115385	0.865385	**Q26**	0.384615	0.230769	**Q44**	0.384615	0.346154
Q9	0.269231	0.865385	**Q27**	0.115385	0.134615	**Q45**	0.153846	0.192308
Q10	0.153846	0.384615	**Q28**	0.269231	0.326923	**Q46**	0.307692	0.653846
Q11	0.269231	0.865385	**Q29**	0.230769	0.153846	**Q47**	0.269231	0.673077
Q12	0.115385	0.711538	**Q30**	0.230769	0.153846	**Q48**	0.115385	0.288462
Q13	0.423077	0.557692	**Q31**	0.307692	0.230769	**Q49**	0.384615	0.230769
Q14	0.115385	0.519231	**Q32**	0.461538	0.615385	**Q50**	0.307692	0.538462
Q15	0.384615	0.692308	**Q33**	0.192308	0.25	**Q51**	0.307692	0.576923
Q16	0	0.153846	**Q34**	0.346154	0.326923	**Q52**	0.346154	0.673077
Q17	-0.03846	0.096154	**Q35**	0.384615	0.653846	**Q53**	0.269231	0.403846
Q18	0.269231	0.711538	**Q36**	0.346154	0.442308	**Q54**	0.192308	0.326923

QN: Question Number, p: difficulty index, d: discrimination power

The items whose item difficulty index was below .50 and discrimination power was below .30 were removed from the test. Among the remaining items, 25 items were included by taking into account of equal distribution of the course content (e.g. it was aimed to include equal number of questions on spreadsheet, word processing and presentations). The final achievement test's average score for item difficulty index was found .49 and item discrimination power was found .34.

Data analysis

Kolmogorov-Smirnov test was used in order to ensure that the scores obtained from the Study Process Questionnaire meet the assumption of normality. As a result of the test, it was found that the data demonstrated normal distribution ($p>0.05$). Therefore, ANCOVA and ANOVA tests as parametric tests were used in analysing the data. Reliability rate of .05 was taken into account in data analysis.

FINDINGS

In the scope of the study, first of all, students' study process approach was identified in the structured, flexible-structured and traditional learning environments through analysing the findings obtained from the Study Process Questionnaire. The findings are as follow;

- In Experimental Group I (EG I) consisting of the students from the Department of Psychological Services in Education, 21 out of 41 students (51.2%) adopt deep approach while 20 out of 41 students (48.8%) adopt surface learning approach.
- In Experimental Group II (EG II) consisting of students from the Department of Elementary Mathematics Education, 22 out of 40 students (55%) adopt deep learning approach while 18 of 40 students (45%) adopt surface approach.
- In Control Group (CG) consisting of students from the Department of Social Science Education, 20 out of 38 students (52.6%) adopt deep learning approach while 18 out of 38 (47.4%) adopt surface approach.

Drawing on the findings, it could be seen that the ratio of the students with deep and surface learning approach is more or less similar.

In an answer to the first hypothesis, while structured group's (EG I), flexible-structured group's (EG II), and control group's (CG) pre-test scores were stabilized, post-test scores of the groups were analysed in order to find out whether there was a significant difference between groups.

The students' post-test average scores are $\bar{x} = 80.68$ (sd=11.62) for EG I, $\bar{x} = 83.70$ (sd=7.87) for EG II and $\bar{x} = 67.05$ (sd=9.64) for CG. While students' pre-test achievement scores were taken under control, covariance analyse was used in order to analyse whether there is a significant difference between the groups' post-test scores as could be seen from Table 3.

Table 3. Covariance analysis result of the groups' post-test scores when their pre-test achievement scores are taken under control

Source of the Variance	**Sum Squares**	**Df**	**Mean Square**	**F**	**Sig.**	**Significant Difference Between Groups**
Pre-test achievement scores	822.156	1	822.156	9.062	.003	EG I-EG II EG I-CG EG II-CG
Groups	4480.125	2	2240.063	24.692	.000	
Error	10433.017	115	90.722			
Corrected Total	17352.874	118				

Table 3 shows that when pre-test scores of the groups were taken under control, there is a significant difference between the groups' post-test corrected average achievement scores [F(2,115)= 24.692; p= .000<.05; Cohen's *f*=.30]. In order to examine the source of this difference, Bonferroni test was run. The results reveal out that there is a significant difference between EG I and EG II; EG I and CG; and EG II and CG and this shows that the most successful group based on the post-test scores are the students in EG II in the structured FC environment. Therefore, H1 hypothesis is accepted.

In an answer to the second hypothesis of the research, within the EG I and EG II groups, and CG, the students' scores were examined based on their deep and surface learning characteristics. In other words, it was aimed to examine whether there is a significant difference between the students' average scores on the post-test based on their learning approach.

Post-test achievement test average scores of the students with deep learning approach are as follow respectively; $\bar{x} = 79.43$ (sd=10.53) for EG I, $\bar{x} = 83.86$ (sd=7.81) for EG II and $\bar{x} = 67.13$ (sd=10.44) for CG. ANOVA was used to analyse whether there is a significant difference between the post-test scores of the students as could be seen in Table 4.

Table 4. ANOVA results of the post-test scores of the students with deep learning approach

Source of the Variance	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Significant Difference**
Between Groups	3677.264	2	1838.632	20.256	.000	EG I-CG EG II-CG
Within Groups	6263.180	69	90.771			
Total	9940.444	71				

Table 4 shows that there is a significant difference between the post-test average achievement scores of the students with deep learning approach in different groups [$F(2,69)= 20.256$; $p= .000<.05$; Cohen's f=.61]. In order to identify the source of this difference, Scheffe test was run. The results reveal out that there is significant difference between EG I and CG; and EG II and CG. Drawing on the findings, it was found that there is no statistically significant difference between the scores of the students with deep learning approach in structured FC learning approach and the students in the flexible-structured FC environment, while post-test scores of the students with deep learning approach in the structured FC environments are found to be higher than the students with deep learning approach in the flexible-structured FC environment and traditional learning environment. Based on these findings, H2 hypothesis is partially rejected. Accordingly, hypothesis on "The students with deep learning approach in the structured FC environment have significantly higher academic success than the students with deep learning approach in flexible-structured FC environment" was rejected. However, the assumptions about "The students with deep learning approach in the structured FC environment have significantly higher academic success than the students with deep learning approach in traditional learning environment" and "The students with deep learning approach in the flexible-structured FC environment have significantly higher academic success than the students with deep learning approach in traditional learning environment" were accepted.

In the third hypothesis of the study, in which environment the students with surface learning approach are more successful was tested. Post-test average achievement scores of the students with surface learning approach are as follow; $\bar{x} = 82.00$ (sd=12.81) for EG I, $\bar{x} = 83.33$ (sd=8.33) for EG II and $\bar{x} = 66.93$ (sd=8.61) for CG. ANOVA test was run in these groups in order to examine whether there is a significant difference in post-test average achievement scores of the students as could be seen in Table 5.

Table 5. ANOVA results of the post-test scores of the students with surface learning approach

Source of the Variance	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**	**Significant Difference**
Between Groups	2488.102	2	1244.051	11.122	.000	EG I-CG EG II-CG
Within Groups	4921.600	44	111.855			
Total	7409.702	46				

Table 5 shows that there is a significant difference between the post-test average achievement scores of the students with surface learning approach in different groups [$F(2,44)= 11.122$; $p= .000<.05$; Cohen's f=.58]. In order to identify the source of this difference, Scheffe test was run.

The results reveal out that there is significant difference between EG I and CG; and EG II and CG. Based on the findings, it was found that there is no statistically significant difference between the post-test scores of the students with surface learning approach in structured FC environment and the students with surface learning approach in flexible-structured environment, while post-test scores of the students with surface learning approach in the structured environment are found to be higher than the student scores with surface learning in the flexible-structured FC environment and traditional environment. Therefore, H3 was partially rejected. Accordingly, the assumption that "The students with surface learning approach in the structured FC environment have significantly higher academic success than the students with surface learning approach in flexible-structured FC environment" was rejected. However, the assumptions that "The students with surface learning approach in the structured FC environment have significantly higher academic success than the students with surface learning approach in traditional learning environment" and "The students with surface learning approach in the flexible-structured FC environment have significantly higher academic success than the students with surface learning approach in traditional learning environment" were accepted.

To sum up, quantitative analysis shows that for both deep and surface learners, there is no significant difference between EG I and EG II groups while there is significant difference between both groups and the CG. When considering the post-test average achievement scores, both experimental groups' scores are higher than the control group's scores.

DISCUSSIONS

It was revealed in the study that the students were more successful in their achievement scores in the FC model compared to the control group. This finding is consistent with the research studies adopting FC model (e.g. Danker, 2015; Davies, Dean, & Ball, 2013).

On looking at the details of the academic success of the students learning with FC model, the students achieved better in structured group (EG II) than in flexible-structured group (EG I). The results of the research are consistent with the research findings in the literature. In their research, Kanuka, Rourke and Laflamme (2007) state that for a scientifically qualified discussion, the discussion should include structured activities in which responsibilities and tasks of students are well-defined and students can provide ideas against each other's thoughts. In their research, Gilbert and Dabbagh (2005) conclude that some rules on messaging and evaluation criteria such as directive instructions, evaluation instructions and message sending instructions all positively affect meaningful discourses. In line with these findings, Fitgerald et al. (2005) report that students are mostly satisfied with the structured environments and students want to clearly know what is expected from them. Researchers indicate that the more organised and structured the environment is, the shorter and more focused the discussions are.

In terms of individual differences of the students who adopt deep learning and surface learning approach, the present study reveals that there is no significant difference between the academic achievement scores of the students with deep and surface learning approach in structured and flexible-structured environments. As a result of the research, although the structure had no effect on learners who have deep and surface learning approaches, it was observed that the academic success of the group using structured FC environment was generally higher. Therefore, using the structure approach in designing FC environments and contents is thought to be crucial in increasing academic success.

CONCLUSIONS AND RECOMMENDATIONS TO PRACTITIONERS, DESIGNERS AND RESEARCHERS Structure in the FC models

In general, the structure provided to the FC model in this research is found to be helpful in obtaining effective learning results. On revisiting the concept of structure, Moore and Kearsley (2011) regard learning goals, content themes, teaching methods, case studies, projects, exercises and examinations as elements of a structure. In addition to these elements, Chen (2001) regards instructional materials, discussion questions, keywords bridging between the sub-topics, requirements to fulfil the tasks, resources about the units, quizzes and ideas and opinions discussed in the class as elements of a structure. Drawing on these points in the literature, the following factors could be taken into account and be clearly identified when designing an FC environment; and contents, goals and gains of the course (analysis phase), instructional contents and materials (design-development phases), educational situations (implementation phase), measurement and evaluation practices (evaluation phase).

Also, in providing a structure, it is important to divide the course into modules and organise the learning process in stages (Huang, 2002; Sandoe, 2005). At the beginning of the course, the students could be informed about the learning process and could be given a guideline and this, in turn, would help structuring the course (Moore, 1993). In this way, the students could be acknowledged about what to do in the course, better administer their learning process and some undesired situations such as facing with uncertainty and getting lost in the learning environment designed according to the FC model could be avoided (Yilmaz & Keser, 2015). This kind of structure should be given both online and face-to-face sessions of the course in the FC model.

Study process as an individual difference

On looking at the studies in the literature dealing with blended and online learning environments, there are different research outcomes about the effect of learning approaches as deep and surface learning on the academic success of the students depending on the context of the research. In their study, Ellis, Ginns and Piggott (2009) examine the relationship between academic success of the university students and their study process approach in a blended learning environment. According to the results of the study, a negative significant relationship was found between the students with surface learning approach and their academic success. In a study conducted by Buck (2008) consisting of 241 students enrolled in a physical therapy program, the effect of study process on academic success was examined. The results of the study reveal that the students with deep learning approach demonstrated higher academic success than the students with surface learning approach. However, structural equation modelling fit index which demonstrates this structure was found low in the study. In their study in a problem-based environment, Gijbels, Van de Watering, Dochy and Van den Bossche (2005) work with 133 sophomore students studying at a law school to explore the relationship between the students' approaches to learning and students' quantitative learning outcomes. The results of the study show that there is no significant relationship between students’ approaches to learning and the scores they obtained from a multiple-choice questions test. McParland, Noble and Livingston (2004) report from their study that the students learning in a problem-based learning group demonstrate significantly higher examination performance than the students learning in a traditional learning group whereas impact of a learning approach on the examination scores was not identified. Snelgrove and Slater (2004; pg. 496) work with 289 nurse candidates in their first year of the study in the UK and authors examine study approaches of the students and students’ academic success. The results of their study show that deep learning factor “correlated positively and significantly with grade performance average and sociology examination results” while they found a significant negative correlation between surface learning factor and nurse examination results. However, findings demonstrate a low significance level between .17 and .21. As for the relationship between the study approach and other examination results of the students, no significant relationship is found. In a study conducted by Yilmaz (2009), academic success of the participants was examined based on their learning approach in a blended learning environment. As a result of the study, it was reported that there is no significant difference found between academic success of the students and learning approach.

All these research findings regarding the learning approaches of the students and their academic success show that depending on the program, grade of education, field of instruction, students with different learning approach perform varying level of academic success. As for the results of the present study, regardless of the structure of the FC model, students are found to be more successful in the FC model than traditional learning environment. At the same time, students with surface learning approach are found to be more successful in the FC environment regardless of the structure of the FC model than in traditional learning environment. However, although the students with deep learning approach in structured FC model are found to be more successful than in the flexible-structured FC model, the difference is statistically not significant. Similarly, although the students with surface learning approach in structured FC model are found to be more successful than in the flexible-structured FC model, the difference is statistically not significant.

When considering the findings regarding both on structure of the FC model and on study process as an individual difference, research has shown that it is important to address individual differences of the learners when providing the learning environment with a structure (Moore, 1993; Lemak, Shin, Reed, & Montgomery, 2005). Also, according to Huang (2002) in order to address individual differences of the learners, there is a need to organise the learning environment in a way that enabling the students to easily access the learning materials and to engage with the learning activities. At this point, it is important to encourage the students to participate in the online discussions (Yilmaz, 2016) which could be possible with addressing reflective thinking enquiries by meeting some of their different individual learning styles (Karaoglan Yilmaz & Keser, 2016). A further point is concerned with supporting the students' collaborative learning activities in face to face session of the FC model with small number of the learning groups so as to help the students easily arrange their self-regulation behaviors in their collaborative work (Yilmaz, Karaoglan Yilmaz, & Kilic Cakmak, 2016). While assigning the students into groups for collaborative learning activities, dyads shape organisation (Noroozi, Biemans, et al., 2013; Noroozi et al., 2012; Strijbos et al., 2004) could be adopted in the face to face session of the FC model so as to provide a match between the students who adopt surface and deep learning approaches.

Overall, it was revealed in the present study that FC model was more effective in obtaining successful academic achievements in Computing I course than the traditional learning environment. Within the different levels of structure in the FC environment, the students in the structured learning environment were found to be more successful in their academic achievement scores than the students in the flexible-structured learning environment. In general, the results point out the importance of well-structured FC environments in obtaining successful learning outcomes.

Future studies and limitation of the study

The present study was carried out according to the quasi-experimental research design. While designing the control and experimental groups, first year students enrolled in Computing I course from different departments were taken into consideration. This situation has been regarded as the limitation of this research and in the future, this research can be repeated by randomly assigning students from different departments to form the control and experimental groups in experimental research studies. On the other hand, in this study, academic achievements of the students with deep or surface learning approaches in a structured and flexible-structured FC designs were compared. According to the findings obtained from the scale designed to identify study approaches of the students, it has been observed that number of students with deep and surface learning approaches in the control and experimental groups were quite identical and this situation contributes to the generalizability of this research which is carried out with regard to the quasi-experimental pattern.

Also, according to the findings in the literature, the difference between academic success of the students in a Computing course and self-efficacy perception of the teacher candidates is generated from their knowledge and experience (Torkzadeh & Koufteros 1994; Aşkar & Umay 2001). In the study by Akkoyunlu and Kurbanoğlu (2003), while the computer self-efficacy of the students in the department of Computer Education and Instructional Technologies (CEIT) was identified as higher compared to those of students in other departments, there was no significant difference between other departments resulting from the differences in the departments. Moreover, according to the research, as the grade of the education increases, students tend to be more knowledgeable and experienced; thus, self-efficacy levels of teacher candidates in year 4 were considerably different compared to those of year 1 students. From this point of departure, the fact that in this research the study groups consist of the students from three programs different than CITE, and that the students have similar knowledge and experience since the length of the course is same for all groups (4 hours per week) contributes to the generalizability of the research. However, according to the previous studies (Usta & Korkmaz, 2010), it was concluded that there was no significant difference in computer success and proficiency of the teacher candidates with regard to the departments attended. In their research, Cura and Özdener (2008) concluded that there was a significant and positive relationship between the academic achievement scores of the teachers about information and communication technologies (ICT) applications and the scores obtained from a scale measuring their attitude towards ICT. This finding leads us to assume that the attitude towards ICT implications has an effect on their academic success in a Computing course. However, according to the previous studies, it was observed that there was no significant difference between the departments other than the department of CEIT with regard to the attitude towards computer (Deniz, 1995; Kutluca & Ekici, 2010). Also this situation contributes to the generalizability of the results of this study which is carried out with regard to the quasi-experimental pattern resulting from departmental differences.

In terms of future research studies, today it is observed that the FC model approach has been used in a variety of learning institutions from universities to primary schools. In the future studies, the effectiveness of flexible-structured FC designs, which is used especially for very young students, could be examined. Furthermore, it is also experienced that FC approaches have been used in quantitative subjects such as mathematics and physics, as well as qualitative subjects such as history and literature. From this perspective, depending on the situation whether the subject is qualitative or quantitative, the flexible-structured or well-structure design of FC and the effect of deep or surface study approach on the students can be analysed. Future studies could deal with examining the most suitable learning environments for knowledge construction process when considering the existing research results (Kirschner, 2015) in regard to use of Facebook in student discussions and knowledge constructions in an FC model. As well, the effects of structured and flexible-structured environments on individual characteristics such as self-regulated learning skills could be examined in future studies.

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