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To cite this article:

Unal, B., Kavanoz, S., & Aydemir Altas, E. (2024). Unlocking potential: Assessing motivation, learning strategies, and cognitive load in flipped learning during online teaching in higher education. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 12*(4), 1006-1031. https://doi.org/10.46328/ijemst.4219

International Journal of Education in Mathematics, Science and Technology

2024, Vol. 12, No. 4, 1006-1031 https://doi.org/10.46328/ijemst.4219

Unlocking Potential: Assessing Motivation, Learning Strategies, and Cognitive Load in Flipped Learning during Online Teaching in Higher Education

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Article Info

Article History

Received:
21 January 2024
Accepted:
25 June 2024

Keywords

Flipped learning
Motivation
Learning strategies
Satisfaction
Cognitive load

Abstract

Flipped learning has become the focus in many educational contexts especially with the integration of technological tools in learning space for the last decade. In flipped learning, learners perform surface learning at home, whereas deep learning such as problem-solving, critical thinking exercises etc. is covered in the classroom which potentially increases motivation and satisfaction of learners. Cognitive load, the assumed load of the working memory caused by the processing of tasks, has also attracted attention in online learning settings which pose different processing demands. This study took place in the extraordinary settings of education during the Covid-19 pandemic which required online education for all education levels. A fourth-year course of an ELT program was delivered through a flipped learning approach during online education. Learners' motivation, use of learning strategies, satisfaction and cognitive load levels were calculated at the end of the intervention and their perceptions regarding the experience were investigated through an open-ended questionnaire. The results showed that their motivation and satisfaction levels were quite high as well as their strategy uses whereas cognitive load levels were comparatively low. Inferential statistics showed that relationships exist between and among the motivation, learning strategies and cognitive load at various levels. Motivation emerged to be a significant predictor of course satisfaction whereas time spent for the flipped lectures predicted course achievement. Learners' perceptions of flipped learning process were generally positive while they also articulated some drawbacks of it like instructional tools-related and individual learner-related problems.

Introduction

Education is open to change and improvement in its nature. These changes and improvements might happen or accelerate due to advancements in literature, experimental studies, technology or unexpected incidents such as Covid-19, a new type of coronavirus that has caused a pandemic affecting the entire world since the end of 2019 (Du Toit, 2020; Zhou et al., 2020). The virus also had an impact on the education systems throughout the world

and led to rapid changes and decisions which resulted in a shift from traditional instructional delivery to remote learning and teaching as of the first quarter of 2020 (Moser et al., 2021).

Bozkurt and Sharma (2020) pointed out that as online learning was adopted due to an unexpected global crisis and was not previously planned, it could be considered as emergency remote teaching. In this respect, schools and universities, not knowing how long the pandemic would last, put tremendous effort on the continuation of education by applying various digital tools and technologies. However, whether it is online or traditional instructional delivery, getting learners to show up in the lesson does not necessarily mean that they actually benefit from the content delivered (Greener, 2020). Capitalizing the significance of active participation in the lesson, Bandura's Social Cognitive Theory pointed out that 'being there' does not ensure learning (Bandura, 1986). In this particular case, attendance of learners in online classes does not indicate that they are learning. Therefore, in order to overcome this undesired situation, Tang et al. (2020) stated that particular practices of flipped learning might improve online learning as it makes use of live connection between lecturers and learners throughout live sessions. Quite similar to the traditional flipped learning (e.g. Bergmann & Sams, 2012; Tucker, 2012), learners are required to watch video lectures, which generally involve quizzes, at home in order to be able to do the relevant practices to be covered in the lesson; however, in online flipped learning, students and teachers do not convene physically, yet they meet in online learning platforms (Stöhr et al., 2020). The time spent in online lessons is devoted to helping learners participate in collaborative activities and be active in order to practice the content delivered via video lectures. Furthermore, as flipped learning benefits from online resources, blending online teaching with flipped learning might result in a new blended learning model, which may boost the efficiency and success of online learning (Valiathan, 2002).

Literature Review

Flipped learning is roughly defined as a pedagogical approach requiring learners to study on their own or the learning materials shared with them prior to lesson in order to obtain new knowledge and to actively participate in various in-class activities enabling them to practice the newly acquired knowledge (Bergmann & Sams, 2012). Basically, flipped learning flips the teaching/homework model so that learners have the opportunity to engage with content normally delivered in class by their teacher prior to the in-class time, and the in-class time is devoted to active learning where the main role of the instructor is being a facilitator and a proactive guide (Strelan et al., 2019).

Flipped learning has been implemented across different grades such as elementary school, high school and higher education (Chao et al., 2015; Tsai et al., 2015; Ünal & Kavanoz, 2022) and studied in various subjects such as chemistry (Ryan & Reid, 2015), statistics (Peterson, 2016), language (Aydemir Altas & Mede, 2020; Hung, 2015; Moran & Young, 2015), and science (Jeong & González-Gómez, 2016). The relevant literature revealed that it increases the engagement of learners (Doyle, 2015; Hung, 2015) and in-class interaction (Hung, 2015; Lai & Hwang, 2016), enables them to study at their own pace (Almasseri & AlHojailan, 2019), ensures individualized learning (Hamdan et al., 2013), improves academic achievement (Huang & Hong, 2016; Tsai et al., 2015) and motivation levels of students (Baepler et al., 2014; Sahin et al., 2015).

The value given to individualized learning and student-centered course designs has gained significance in recent years (Hannafin & Land, 1997), especially in higher education (Doo & Bonk, 2020; Stöhr et al., 2020). Particularly, flipped learning is claimed to cater for higher education settings due to the fact that it allocates more time for in-class discussion and maximizes the opportunities of activities requiring the use of higher order thinking skills such as critical thinking, creativity, and collaboration, which are crucial in the 21st century (Strelan et al., 2019).

Based on the mentioned benefits of flipped learning, it is also expected to have an impact on the learner autonomy and motivation levels of learners relatedly. Various studies have investigated the impact of flipped learning on language learners' autonomy (Zainuddin & Perera, 2017). It was found out that flipped learning improved academic achievement, learning attitude and participation levels of learners (Hung, 2015) and taking more responsibilities regarding their own learning process resulted in perceiving themselves as quite autonomous and intrinsically motivated learners (Zainuddin & Halili, 2016). Motivation is defined as an inner power urging people to make decisions, set a goal and take actions in order to reach their aims (Harmon-Jones et al., 2013). As flipped learning allows learning lesson content prior to the lesson more autonomously, it could also encourage learners to become more motivated to communicate and manage their own learning process (Lin & Hwang, 2018; Wu et al., 2017).

Flipped learning provides learners with greater control over their learning process. This autonomy fosters the development of self-regulated learning skills, including goal setting, time management, and monitoring of comprehension. Learners actively plan and regulate their learning, leading to improved utilization of effective learning strategies (Strayer, 2012). It is considered that the use of learning strategies is associated with increased achievement (Warr et al., 1995) and as such certain interventions, such as flipped learning, can guide strategy use which in the end alter learning. Avdic and Akerblom (2015), for instance, showed that flipped classroom offered means to promote active engagement, responsibility and a critical approach on the part of students. Also, in their study, Çakıroğlu and Öztürk (2017) focused on self-regulation skills in a flipped learning environment, exploring the experiences, opinions, and behaviors of both students and the instructor. Their findings revealed that students exhibited high levels of goal setting and planning, task strategies, and help-seeking skills in flipped model of learning. Based on the findings, they recommend incorporating problem-based activities in flipped learning to enhance self-regulation skills.

Additionally, it is pointed out that flipped learning might result in learner satisfaction as a well-designed flipped class increases engagement level and possibly leads to improvement in learning performance (Enfield, 2013; Fritz, 2013; Mason et al., 2013; Hung, 2015; O'Flaherty & Phillips, 2015; Martínez-Jiménez & Ruiz-Jiménez, 2020). Innovations in technology have led to changes in learning environments, lesson and material designs with the aim of achieving success and learner satisfaction. In this regard, flipped learning is one of the options which might facilitate learner satisfaction and efficiency (Lin et al., 2021). Satisfaction can be regarded as the element indicating effective learning outcomes which measures learners' attitudes regarding flipped learning (Kim et al., 2021). Satisfaction has been perceived as the level of contentment of learners (Bedggood & Donovan, 2012), and is used to evaluate and assess the efficiency of learning in both blended (Arbaugh, 2014; Rahman et al., 2015) and

flipped learning models (O'Flaherty & Phillips, 2015). Therefore, it can be stated that the more active students are in the learning process, the more satisfied they are likely to feel (Astin, 1999). Additionally, satisfaction of learners is not only the expected outcome of flipped learning but also the element displaying the quality of the design of the flipped learning (Lin et al., 2021; Zhai et al., 2017).

Cognitive load is defined as the resources utilized by a person's working memory at a particular time and from the learning perspective, the whole mental effort put forth in working memory when completing learning activities is referred to as cognitive load (Sweller, 1998). Considering the significant impact of cognitive load on the learning process (Karaca & Ocak, 2017), cognitive load is claimed to create negative pressure on the cognitive system (Sweller et al., 1998). Based on the literature, flipped learning might help with the reduction of mental struggle experienced during learning tasks, which could potentially enable a more effective learning process and reduce the level of cognitive load experienced by the learners (Conner, 2021). Learners are able to adjust the pacing of the videos in accordance with their needs (Clark et al., 2005), which might help them deal with the cognitive load. Additionally, providing the input out of the classroom could also lead to a better management of cognitive load (Abeysekera & Dawson, 2014).

Cognitive load theory is based on how different types of 'load' are experienced during the learning process and is divided into three categories: intrinsic, extraneous and germane (Clark et al., 2005; Sweller et al., 1998). Intrinsic load is defined as the internal difficulty or connectivity of a particular, which usually cannot be shifted via instructional treatments (De Jong, 2010). However, it could be declined when learners are provided with ample prior knowledge to complete a task as cognitive resources are slightly needed to remember this prior knowledge (Van Merriënboer & Sweller, 2005). As for the extraneous load, it is the stress imposed on working memory due to less efficient or effective display of the content; therefore, it is more probable to decrease extraneous load compared to intrinsic load via instructional design (Tonkin et al., 2019). Considering the fact that both intrinsic and extraneous loads are additive, instructional design has utmost importance when teaching challenging subjects (Van Merriënboer & Sweller, 2005).

Finally, germane load is defined as the load inflicted by the learning process itself, which could be elaborated as the construction and subsequent control of mental schemas (Tonkin et al., 2019). With this regard, it is stated that learning is generally more successful when the germane load is larger than the intrinsic load and extraneous load (Sweller et al. 1998). Therefore, the same content could lead to experiencing diverse cognitive loads in learning environments where various learning strategies and designs are implied (Brünken, et al., 2003; Kılıç-Çakmak, 2007).

Although a plethora of empirical research has been conducted regarding the implementation of flipped learning, there are still inconsistent results, especially considering the impact of flipped learning on the academic achievement of learners. Some studies demonstrated results in favor of flipped learning (Huang & Hong, 2016; Schultz et al., 2014), whereas others revealed no significant improvement at all (Chen et al., 2014; Clark, 2015). Strelan et al. (2020) also added that although there is a notable increase in the number of studies related to the effect of flipped learning on academic achievement, they are quite disparate. Therefore, as an attempt to address

this gap, this study aims at investigating how learning environments created by the flipped learning model are likely to impact learners' motivations, learning strategies, course-related satisfaction, cognitive load levels and achievement. Even though the implementation of flipped learning usually involves two physical environments: the learners' home and the public classroom, the only physical environment in this study was the learners' home since it was implemented during the lockdown amid Covid-19 pandemic. Still, it adopts a flipped model of learning as there were two modes of learning that took place synchronously (face-to-face online sessions over Zoom) and asynchronously (video lecture assignments). Therefore, we thought it to be discussion-worthy how this mode of flipped learning can impact learning.

Within this framework, the main purposes of the study were to investigate the motivation, learning strategies, satisfaction, and cognitive load levels of the participants as well as their overall perceptions after taking a subject-matter course in online flipped learning style during a 14-week period. The following research questions were posed in this research:

1. What are the learners' motivation, learning strategies, course satisfaction and cognitive load levels upon taking a flipped course in an online education setting?
2. Do relationships exist between or among the motivation, learning strategies, course satisfaction, and cognitive load levels of learners?
3. To what extent do flipped learning, motivation levels, and learning strategies explain the course satisfaction levels of learners?
4. What are the learners' perceptions of flipped learning process in an online education setting?

Method

This study was an attempt to explore the application of flipped learning into an online education course in a Turkish university and adopted an explanatory sequential mixed-design approach. To do so, the syllabus of one of the core subject courses at the English Language Teaching (ELT) department was re-designed in accordance with the principles of flipped education. Bligh (1998) suggests that since lectures are generally more appropriate for the information transmission, interventions such as flipped learning can suit more for courses which require the applications of theories or skills. The course content lends itself easily to flipping with the theoretical bases of the background and application of testing and assessment techniques and methods. There were 67 senior ELT students enrolled in the course but since participation in the study was voluntary and the completion of all phases of intervention was obligatory, in the end a total of 53 students were included in the sample group. All participants were pre-service EFL teachers whose native language is Turkish, and the age range was between 19-22.

Each participant was given the voluntary informed consent form and signed it before the intervention started. They were assured that their status of participation in the study would not affect their course scores and that they had the right to withdraw from the study any time they desired. Pseudonyms were used during the coding and data analysis in order to ensure the confidentiality and anonymity. Furthermore, this study adheres to the Data Protection Act (1998) in terms of the legal requirements of data storage and use.

Data Collection Procedure

Data collection process took place throughout the 14 weeks of a semester including the orientation to the flipped course model, the implementation of the Survey of Motivation and Learning Strategies at the beginning and at the end of the semester. The Course Satisfaction Survey was administered only at the end of the term as it requires learners' being exposed to the model to be able to gauge their satisfaction levels. Google Classroom was used as the learning management system (LMS) of the course in which classroom announcements were made, course-related materials were shared, and tasks and assignments were submitted. The LMS platform also served as the communication tool between the instructor and the students as well as among the students. Edpuzzle was the platform where the learners watched the video lectures. In total, twelve videos were created using Quicktime Player. The duration of the videos ranged from 07 min 42 sec to 22 min 14 sec and the average duration of the video lectures was 16 minutes. The videos were created by recording the screen while the teacher delivered the lectures on PowerPoint slides through voice over recording technique. One week before each lesson, the videos were uploaded on Edpuzzle and at least one question was inserted in each of them at a random point to make sure that all the students watched them for they needed to answer the question to proceed with the video. Also, skipping was prevented so that everyone watched the lectures from beginning to end. This, in a way, ensured that students actively watched the video and answers to these questions constituted 20 % of the overall course grade.

As the lectures were assigned before the course, class time which took place on Zoom was spared for discussion over the week's topic and for some practical applications. Students could monitor their progress through Edpuzzle gradebook which was automatically connected to the chosen LMS and through the formative feedback given to the in- and out-of-the class assignments. Immediately after each video-lecture, participants took a cognitive load survey developed by Leppink et al. (2013). Each lesson started with a short discussion guided by the teacher's referential and inferential questions on the particular week's video lecture. In the second half of the virtual class, the teacher grouped the students and assigned each group with a task that can be completed based on that week's topic. Through collaboration within the groups, they furthered the discussion on the video lectures. During the 14th week, the participants took the Survey of Motivation and Learning Strategies again along with a Course Satisfaction Survey through a Google forms link shared with them on the LMS (see Table 1).

Table 1. Implementation of Flipped Learning

Week 1	Introduction to the flipped model Survey of Motivation and Learning Strategies Assigning the following week's lecture on Edpuzzle
Week 2-13	Before the class: Watching the assigned video lecture on Edpuzzle and Completing the cognitive load survey In-class: Class discussion and practice activities After the class: Mini-assignment related to the weekly topic, Assigning the following week's lecture on Edpuzzle

Week 14	Before the class: ---- During the class: Review session After the class: Survey of Motivation and Learning Strategies, Course Satisfaction Survey, and Open-ended survey of flipped learning perceptions

Instruments

As a self-report instrument, the Motivated Strategies for Learning Questionnaire (MSLQ) is comprised of two parts: Part I-Motivation and Part II-Learning Strategies and designed to measure subcomponents of self-regulated learning which are motivation, metacognition and behavior (Pintrich, 2004). In the motivation part, there are 31 items aiming to evaluate goals and value beliefs towards a course, beliefs about success in a course, and anxiety felt for the tests in a course whereas the 50 items in the learning strategies part include 31 items concerning the use of different cognitive and metacognitive strategies together with 19 items related to the management of different learning resources of the learners. On a 7-point Likert scale, the participants are asked to rate items from 1 (not at all true of me) to 7 (very true of me). The mean score pertinent to each of the six motivational subscales and nine learning strategies subscales is calculated by taking the mean of the items in that respective scale. The internal consistency values of each subscale are calculated by using Cronbach's Alpha (α) and are listed as follow: for the motivation scales; Intrinsic Goal Orientation= .54, Extrinsic Goal Orientation= .67, Task Value= .82, Control of Learning Beliefs= .52, Self-Efficacy for Learning and Performance= .88, Test Anxiety= .77, and for the learning strategies; Rehearsal= .77, Elaboration= .75, Organization= .7, Critical Thinking= .79, Metacognitive Self-Regulation= .79, Time & Study Environment Management= .75, Effort Regulation= .5, Peer Learning= .63, and Help-Seeking= .57.

The satisfaction for online teaching environments section of the Course Satisfaction survey developed by Eryılmaz (2011) is designed to assess students' satisfaction related to the course content, design, learner expectations and interaction on a 5-point Likert type scale with options ranging from 1 (completely disagree) to 5 (completely agree). Originally containing 49 items, 43-itemed questionnaire was used as a three-factor model in this study. Six items were omitted since the factor loadings were below 0.3 (Field, 2013) and they did not fit in the distribution after the analysis of one-sample Kolmogorov-Smirnov test. The skewness and kurtosis values obtained confirmed that the normality assumption was met since the values were within the range of − 2.0 and + 2.0 (Kim, 2013) and the overall reliability of the scale was .94. The reliability coefficients for the subscales were calculated as follow: for learner characteristics r =.88; for system mechanics r = .87, and course content r = .88.

For determining perceived cognitive load levels of the learners, Leppink et al.'s (2013) subjective rating scale of cognitive load types was used. The survey contained 10 items to be rated on a scale from 0 to 10, in which '0' indicates 'not at all the case' and '10' indicates 'completely the case'. Leppink et al. (2013) conducted an exploratory factor analysis to understand the relationship between the different aspects cognitive load. There emerged to be a triarchic theory of cognitive load as all three factors (i.e. intrinsic load, extraneous load, and germane load) had independent robust factors, and this enabled the application of the varying factors of cognitive load separately. The overall reliability of the scale was reported to be Cronbach's α ranging between .75 and .82

(Leppink et al., 2013).

Lastly, a four-itemed open-ended course evaluation form was created and validated by the researchers consulting experts to assess the perceptions of learners towards the flipped application of the course. The questions were about the positive and negative aspects of the flipped-course, the areas that need improvement and other concerns about the overall experience. Like the other scales, the open-ended questionnaire was prepared as a Google form and given at the end of the semester through a link shared with the students on the LMS environment.

Data Analysis

First of all, descriptive statistical analyses were run on SPSS version 23 to calculate the means, standard deviations, minimum and maximum scores. Second, we ran Pearson-Product Moment Correlation analyses to see if the motivation, learning strategies, satisfaction, cognitive load scales, scores obtained from Edpuzzle and overall course achievement scores correlate with each other. Then, we ran a regression analysis to model the relationship between the predictor variables, namely flipped learning (as measured through total time spent on Edpuzzle), motivation, and learning strategies on the outcome variables (i.e. satisfaction, Edpuzzle score, overall course achievement and cognitive load).

Before running inferential statistics, assumptions for multiple regression, namely linearity, normality and homoscedasticity were checked. Outliers were removed, and we confirmed that the residuals were normally distributed and there was no collinearity among the variables. The linear relationship between the independent variables and the dependent variable was checked through the scatter plots. Multiple linear regression was used to test if learners' learning strategies, flipped learning experience, and motivation levels significantly predicted satisfaction. Based on Abeysekera and Dawson (2014) who put forward that self-regulated learning in flipped design can help reduce cognitive load which enhances learning, and Xiu and Thompson (2020) measuring the predictive ability of motivation on learning in a flipped design, we place motivation, learning strategies, intrinsic load (IL), extraneous load (EL), and germane load (GL), and total time spent on Edpuzzle platform as the predictive variables. As with Sointu et al. (2022), satisfaction with the flipped learning was set as one of the outcome variables together with the scores gained from Edpuzzle and overall course achievement.

For qualitative analyses of participants' written surveys, qualitative content analysis was used. Within this framework, we used an inductive approach in order to derive concepts and themes unfolding from the data. Using each open-ended question as a lens, we assigned codes to segments of texts as concepts emerge (Thomas, 2006). This recursive process of data analysis involved two stages (Cresswell & Clark, 2010). In the vertical analysis part, textual data was aggregated into small categories of information and a code was assigned. In the second stage that comprised of horizontal analysis, the codes were clustered into themes. The qualitative data was then transformed into quantitative results by counting codes in each theme and calculating frequencies. The researchers were separately involved in coding data and an inter-rater reliability of .87 was found among the raters which ensured consistency in coding and interpretation.

Results

In order to answer the first research question, descriptive statistics were run and the findings regarding the motivation, learning strategies, course satisfaction and cognitive load levels of the participants are given in Table 2.

Table 2. Descriptive Statistics of Satisfaction, Cognitive Load, and MLSQ

Name of the scale	M	SD	Min	Max
Course satisfaction scale total*	3.76	.58	2.14	4.9
Individual difference	3.77	.66	1.38	5
System mechanics	3.72	.58	2.41	4.94
Course content	3.79	.66	1.8	5
Cognitive load scale total1	4.71	.58	2.75	6.03
Intrinsic load	4.06	1.57	1	7
Extraneous load	3.11	1.6	1	7
Germane load	6.41	1.71	1	10
Motivation scale total2	5.11	.43	3.94	6.35
Intrinsic goal orientation	5.53	.49	4.25	6.75
Extrinsic goal orientation	4.94	1.21	3.25	7
Task value	5.59	.79	2.5	7
Control of learning beliefs	5.44	.51	4.25	6.5
Self-efficacy for learning and performance	5.19	.7	3.71	6.43
Test anxiety	4.08	.96	2	6
Learning strategies scale total3	5.3	.42	4.04	6.3
Cognitive and metacognitive strategies- Rehearsal	5.48	.69	3.75	7
Cognitive and metacognitive strategies- Elaboration	5.76	.59	4.17	7
Cognitive and metacognitive strategies- Organization	5.86	.72	4.5	7
Cognitive and metacognitive strategies- Critical thinking	5.21	.54	4.2	6.8
Cognitive and metacognitive strategies- Metacognitive self-regulation	5.33	.6	3.25	6.42
Resource management strategies-time and study environment	5.23	.59	3.5	6.75
Resource management strategies-effort regulation	5.14	.77	2.75	7
Resource management strategies-peer learning	4.28	.98	1.67	7
Resource management strategies-help seeking	5.04	.75	3	6.5

Notes. *Max. possible score: 5; 1Max. possible score: 10; 2Max. possible score: 7; 3Max. possible score: 7

Oxford (1990) maintains that on a 7-point-scale, scores between 4.9-7.0 indicate high levels, 3.5-4.8 medium levels, and 1.0-3.4 low levels. With this in mind, learners' motivation and strategies levels fall within the high levels in total. From the motivation scales, task value has the highest mean score among the subscales indicating

high levels with a mean score of 5.59. As for the learning strategies, cognitive and meta-cognitive strategies-organization has the highest mean score (M=5.3). For evaluating the course satisfaction levels, we took Landell's (1997) evaluation criteria in which points between 1.00 – 2.33 indicate low levels, points between 2.34 – 3.67 indicate medium levels, and points between 3.68 – 5.00 indicate high levels. From the course satisfaction scale, course content has the highest mean score among the variables (M=3.79). Regarding the cognitive load scales, germane load has the highest mean with a score of 6.41 indicating effective learning taking place in working memory.

Table 3. Correlation between MLSQ, Satisfaction, Cognitive Load, Edpuzzle Score and Achievement

	Scales	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Intrinsic Goal Orientation	-	.112	.412**	.345*	.448**	-.023	.112	.596**	.313*	.464**	.500**	.368**	.258	.412**
2	Extrinsic Goal Orientation	-	-	.124	.190	.130	.039	-.024	-.009	-.030	-.077	.028	.245	-.092	.190
3	Task Value	-	-	-	.348*	.617**	.103	.108	.310*	.254	.147	.465**	.439**	.360**	.556**
4	Control of Learning Beliefs	-	-	-	-	.382	.117	.264	.191	.207	-.008	.339*	.265	.090	.290-
5	Self-Efficacy for Learning and Performance	-	-	-	-	-	.232	.210	.401**	.314*	.278*	.385**	.428**	.387**	.461**
6	Test anxiety	-	-	-	-	-	-	.236	-.064	-.151	-.223	-.035	-.037	.143	-.264
7	Cognitive and metacognitive strategies-Rehearsal	-	-	-	-	-	-	-	.397**	.383**	.106	.489**	.303*	.062	.123
8	Cognitive and metacognitive strategies-Elaboration	-	-	-	-	-	-	-	-	.677**	.552**	.746**	.390**	.384**	.333*
9	Cognitive and metacognitive strategies-Organization	-	-	-	-	-	-	-	-	-	.468**	.653**	.456**	-.030	.205
10	Cognitive and metacognitive strategies-Critical Thinking	-	-	-	-	-	-	-	-	-	-	.341*	.167	.086	.075
11	Cognitive and metacognitive strategies-Metacognitive Self-regulation	-	-	-	-	-	-	-	-	-	-	-	.416**	.258	.326*
12	Resource	-	-	-	-	-	-	-	-	-	-	-	-	.182	.629**

	Management Strategies- Time and Study Environment									
13	Resource Management Strategies- Effort Regulation								-	.275
14	Resource Management Strategies- Peer Learning									

Table 3. Correlation between MLSQ, Satisfaction, Cognitive Load, Edpuzzle Score and Achievement (cont.)

	Scales	15	16	17	18	19	20	21	22	23
1	Intrinsic Goal Orientation	.351*	.283*	.266	.253	-.134	-.134	.158	.172	.095
2	Extrinsic Goal Orientation	-.022	.135	.023	.153	-.154	-.211	.143	.213	.125
3	Task Value	.285	.597**	.462**	.621**	-.092	-.173	.373**	.350*	.089
4	Control of Learning Beliefs	.084	.311*	.388**	.517**	-.121	-.209	.236	.137	.102
5	Self-Efficacy for Learning and Performance	.157	.440**	.493**	.428**	-.274*	-.045	.255	.261	.182
6	Test anxiety	.033	.160	.038	.090	.340*	.034	.013	-.132	-.053
7	Cognitive and metacognitive strategies- Rehearsal	.046	.139	.216	.104	-.052	-.015	-.081	-.131	.104
8	Cognitive and metacognitive strategies- Elaboration	.310*	.094	.189	.007	-.037	-.056	.013	-.079	-.068
9	Cognitive and metacognitive strategies- Organization	-.051	.131	.166	-.067	-.252	-.178	.090	-.198	-.200
10	Cognitive and metacognitive strategies- Critical Thinking	-.027	.104	.323*	.024	-.364**	-.162	.166	-.054	-.003
11	Cognitive and metacognitive strategies- Metacognitive Self-regulation	.285*	.269	.126	.102	-.003	-.078	.050	.007	-.019
12	Resource Management	-.073	.448**	.391**	.359**	-.257	-.135	.160	.155	.065

	Strategies- Time and Study Environment									
13	Resource Management Strategies- Effort Regulation	.542**	.398**	.342*	.378*	.193	-.004	.055	.331*	.098
14	Resource Management Strategies- Peer Learning	.261	.277*	.279*	.301*	-.161	-.052	.078	.215	.132
15	Resource Management Strategies- Help Seeking	-	.158	.010	.142	.233	-.060	-.021	.084	-.016
16	Satisfaction (Individual Differences)		-	.757**	.762**	-.178	-.232	.427**	.246	.275*
17	Satisfaction (System Mechanics)			-	.734*	-.254	-.287*	.494**	.199	.248
18	Satisfaction (Course Content)				-	-.136	-.362**	-.472**	.381**	.305*
19	Intrinsic Cognitive Load					-	-	-	-	-
20	Extraneous Cognitive Load					.532**	-	-	-	-
21	Germane Cognitive Load					-.472**	-.732**	-	-	-
22	EdPuzzle Score					-.279*	-.339*	.462**	-	.-
23	Achievement					-.160	-.249	.166	.393**	-

Note: *= p< .05; **p<.001

The table depicts that there are significant correlations between the subscales of motivation and learning strategies scales. Especially, elaboration and metacognitive self-regulation under the cognitive and metacognitive strategies correlate with almost every component of motivation and learning strategies. The correlations between the motivation and learning strategies, satisfaction, cognitive load scales and the score participants gained from the platform and their course achievement are scarce, though. The subscales of course satisfaction, i.e. individual differences, system mechanics and course content correlate altogether with task value, control of learning beliefs, self-efficacy for learning and performance, resource management strategies: time and study environment, effort regulation, and peer learning. In terms of the cognitive load felt during the implementation of the flipped course, there is a significant positive correlation between test anxiety and intrinsic cognitive load levels. The scores obtained from the platform correlate with task value, effort regulation, and satisfaction with course content as well as with the overall course achievement. Additionally, extraneous cognitive load has significant negative correlations with system mechanics-related and course content-related satisfaction as well as Edpuzzle scores. Germane load, on the other hand, has significant positive correlations with the individual differences-related and system mechanics-relates satisfaction and Edpuzzle score, whereas it has a negative correlation with the course content-related satisfaction.

The F-ratio in the ANOVA table tests whether the overall regression model is a good fit for the data. The table shows that the independent variables statistically significantly predict the dependent variables, satisfaction: F(6,

46) = 6.188, p < .005 and Edpuzzle total score: F(6, 46) = 5.681, p < .005; (i.e., the regression model is a good fit of the data).

Table 4. Regression Results for the Satisfaction Scale

Dependent Variable	Independent Variable	B	Standard Error B	Beta	t	p
	Constant	-.663	1.043		-.636	.528
	Total time spent	.000	.004	-.013	-.108	.915
	Motivation	.577	.196	.423	2.937	.005*
Satisfaction	Learning strategies	.121	.184	.088	.657	.514
	IL	.006	.049	.015	.114	.909
	EL	.013	.065	.036	.199	.843
	GL	.123	.063	.365	1.965	.055
R= .668	R2= .447	df: 6/46	F: 6.188	p=,000		

R can be considered to be one measure of the quality of the prediction of the dependent variable; in this case, satisfaction. A value of 0.668, in this example, indicates a moderate level of prediction. R2 value indicates the proportion of variation in the outcome variable satisfaction that can be explained by the model (Total Time Spent, Motivation, Learning Strategies, IL, EL, and GL). The R2 value of 0.447 shows that our independent variables explain 44.7 % of the variability of our dependent variable, satisfaction. Among these variables, only motivation statistically significantly predicted satisfaction, F(6, 46) = 6.188, p < .005, R2 = .447.

Table 5. Regression Results for Edpuzzle Total Scores

Dependent Variable	Independent Variable	B	Standard Error B	Beta	t	p
	Constant	17.541	27.759		.632	.531
	Total time spent	.401	.107	.459	3.755	.000*
	Motivation	5.854	5.228	.164	1.120	.269
Edpuzzle total score	Learning strategies	-4.431	4.893	-.124	-.905	.370
	IL	-1.714	1.306	-.178	-1.313	.196
	EL	1.960	1.724	.207	1.137	.261
	GL	5.236	1.671	.592	3.133	.003*
R= .652	R2= .426	df: 6/46	F: 5.681	p=.000		

The multiple regression run to predict Edpuzzle scores from flipped learning (total time spent), motivation, learning strategies, IL, EL and GL showed that flipped learning and germane load significantly predicted the scores, F(6, 46) = 5.681, p < .005, R2 = .652.

Table 6. Regression Results for Course Achievement

Dependent Variable	Independent Variable	B	Standard Error B	Beta	t	p
	Constant	71.946	25.982		2.769	.008
	Total time spent	.206	.100	.304	2.060	.045*
	Motivation	4.047	4.894	.146	.827	.413
Course achievement	Learning strategies	-3.561	4.580	-.129	-.777	.441
	IL	-.812	1.222	-.109	-.665	.510
	EL	-1.085	1.614	-.148	-.672	.505
	GL	.266	1.564	.039	.170	.866
R= .403	R2= .162	df: 6/46	F: 1.485	p=.204		

An R value of 0.403 for the outcome variable indicates a low level of prediction. R2 value indicates the proportion of variation in the course achievement that can be explained by the model (Total Time Spent, Motivation, Learning Strategies, IL, EL, and GL) is very low (0.162) and it explains 16 % of the variability of our dependent variable. For course achievement, only time spent on flipped learning was a significant predictor of success in the whole model.

The fourth research question sought to understand participants' perceptions of flipped learning experience regarding the benefits and challenges of the flipped learning along with their suggestions regarding the areas of improvement. The emerging themes for each open-ended item are given below.

Table 7. Positive Aspects of the Flipped Learning

Theme	Frequency	Percentage
Facilitating Learning	69	51.1%
Convenience	34	25.2%
Effective In-Class Learning	21	15.6%
Promoting Learner Autonomy	11	8.1%
Total	135	100%

Students were asked about the positive aspects of flipped learning model. The majority of the statements clustered around the opinion that flipped learning facilitates learning (51.1%). Regarding facilitating learning, preparing learners for the class, adaptability to the learner's pace, the existence of comprehension check questions, and the possibility of revisiting the course materials are listed as the major strengths of flipped-learning.

> P5-Because it [lesson] is pre-recorded, the feature of stopping the videos while watching makes it much easier to take notes compared to the classroom environment. This allows me to take more systematic and clear notes, and when I reread the notes, they become more understandable than the notes I take in the

classroom. I can ask my questions whenever I want and as much as I want.

The second theme that emerged as a positive outcome of flipped learning was its convenience (25.2 %). Participants' written responses suggest that they appreciated the accessibility and flexibility that this learning style offers.

P13-I don't always feel well during class hours. Even if I am sleepless, hungry or tired, I have to be there at that hour, but the videos have a certain time interval and I can watch them at a time when I feel more efficient.

The impact of flipped learning in learning in class was also highlighted as a benefit of this model. Participants thought that the teaching they encountered during flipped learning was more efficient (15.6%). They indicated that watching the video lectures at home allocated more time for in-class practice with more active participation of the learners in a cooperative learning environment.

P13-As we have completed the learning part, we could do different activities in this in the lesson. Thanks to flipped learning, we had the opportunity to work in collaboration with our classmates. Most of the tasks we did in the lesson were things that required communication with each other. When working in groups, we also had opportunities to learn from each other.

Promotion of learner autonomy (8.1%) was another aspect participants found beneficial with regards to this model. Encouraging learners to take the responsibility of learning, promoting autonomous learning, and its being student-centered are given as learner autonomy-related advantages.

P9-In this practice, the teacher was not the teaching one, we did the learning more. It is a student-centered application.

Among the disadvantages mentioned by the students (Table 7) are insufficiency of materials and presentations (44.5 %), limited interaction (20%), concentration problems (20%), teacher/student workload (8.2%), and constraints in access to technology (7.3%).

Table 8. Negative Aspects of the Flipped Learning

Theme	Frequency	Percentage
Insufficiency of Materials and Presentations	49	44.5%
Limited Interaction	22	20%
Concentration Problems	22	20 %
Teacher/Student Workload	9	8.2%
Constraints in Access to Technology	8	7.3%
Total	110	100%

In terms of materials and presentations in the video lectures, lack of hard-copy documents, the difficulty of taking notes simultaneously, the length of lectures, and lack of visuals emerged as the examples of negative points about this flipped-learning experience. Besides, as learners who are used to traditional lecture-type teaching, they found watching the videos demotivating and tiring sometimes.

> P37-Video times. Long videos tire and bore students. Students need to take notes while watching the videos and watch the parts they do not understand again. This way, videos that are already long, become longer.

That the platform lacked an interaction utility which enabled learners to interact with each other, and the instructor, ask questions and get immediate feedback as well as the lack of eye contact and learner participation are listed as interaction-related problems.

> P15-A disadvantage of the practice is that the teacher seems to have limited control over the students. Even in normal learning environments, teachers sometimes have trouble keeping students attentive and engaged. They may have more difficulty in encouraging students to study with such a practice.

The nature of digital learning environment which poses a number of distractors and cognitive overload due to multitasking are another set of negativities expressed by the learners.

> P33. Focus problem: Simultaneous sound, image, slide etc. Sometimes it can be difficult to focus.

Some students also indicated the heavy preparation load on the part of the teachers as prospective language teachers.

> P32. As a pre-service teacher, I can see how this learning might be difficult and labor-intensive for the teacher.

The fact that some students did not have strong and secure internet access and costs of internet are given as barriers to have full access to the tools used in the flipped learning.

> P37. Technological deficiencies. Not every student may have a computer or internet at home. For students who cannot reach these, this method has no effect and they drop out of the course.

The third open ended question elicited students' views on the possible areas of improvement. Mainly, they were asked to comment on what can be done to improve the negative aspects of flipped learning (see Table 9). Majority of comments were in the direction of offering suggestions to the flipped method in terms of interaction and feedback (36.2%). Students expressed a need for a more interactive platform enabling asking and answering questions.

P29. A platform that provides opportunities such as asking questions and making comments can be used and inserted just below the course videos. It is possible to record lectures with applications such as Zoom, where we can see the teacher (and even allow the use of blackboards).

Table 9. Suggestions for Improving Flipped Learning Experience

Theme	Frequency	Percentage
Interaction & Feedback	25	36.2%
Engagement	22	31.9%
Synchronization	18	26.1%
Monitoring Learning	4	5.8 %
Total	69	100%

For the video-lectures, more frequent use of visual supports, and a concise presentation via differing the styles of presentation are given as suggestions related to learner engagement.

P36. I think it may be possible to see the teacher in front of us as it is in YouTube videos and keywords can be displayed at certain points of the video. This will both appeal to the eye and make it more watchable.

Parallelism between the video lectures and in-class gatherings, provision of a wrap up of the videos during the class and enriching the content of the videos are listed as one of the recommendations.

P11. The topic in the video shared for that week's lesson can be discussed more and more classroom activities related to that topic can be done before moving on to a new topic in the lesson. Weekly videos can go in parallel with the face-to-face course content.

The requirement for compulsory attendance to face to face classes and active participation in class discussions are suggested by the students.

P27. If it is thought that this method should be used in theory-based lessons and teachers want to try it, it is important to prepare an impressive and entertaining lesson plan in order to make it a mandatory and desired activity for students to participate in the practice part.

Discussion and Conclusion

This study sought to explore the motivation, learning strategies, course satisfaction, cognitive load levels and achievement of participants upon taking a flipped course in an online education setting. In general, motivation, learning strategies and course satisfaction were found to be high along with the low levels of perceived cognitive load. Regarding satisfaction levels, course content-related satisfaction was the highest among all. The results of this study comply with the previous research indicating that flipped learning has a positive impact on the learner

satisfaction (Butt, 2012; Marlowe, 2012; Baepler et al., 2014; Hung, 2015; Roach, 2014; Låg & Sæle, 2019, Strelan et al., 2022). One explanation might be that the flipped learning model enables a more student-centered learning environment (Bergmann & Sams, 2012) and when the satisfaction levels of learners increase, an increase in their motivation levels and engagement is expected in the lesson (Østerlie, 2018; Ma & Guo, 2019; Østerlie & Kjelaas, 2019). Additionally, another factor supporting this result might be due to the fact that as learners are encouraged to have more control over their learning process thanks to flipped learning, they are more independent while selecting appropriate strategies and tasks for themselves and deciding on the changes and adjustments in their learning strategies during their learning process (Talbert, 2017).

As for the motivation levels of learners, the results of the MLSQ scale indicated that task value had the highest score among all. This indicates that as the quality of the tasks increase in a flipped classroom, learners are more motivated and satisfied. Our results corroborate the studies in which the task value scores of the participants were higher in the flipped classrooms compared to the traditional lecture-based classrooms. This confirms that flipped learning has a positive impact on improving the perceptions of learners regarding the task value (Aksoy & Gurdogan, 2022; Alsancak Sirakaya & Ozdemir, 2018; O'Connor et al., 2016). In other words, the more valuable the task is, the more satisfied and successful the learners are.

Furthermore, the findings also indicated that task value has positive correlations with all three dimensions of satisfaction scale and it also has significantly positive correlations with germane load and EdPuzzle achievement. One possible explanation could be that when the task value increases, the satisfaction levels of learners and their achievement scores, in this case their EdPuzzle achievement scores, increase in this respect. The findings related to the germane load encountered by the learners also validate the relevant studies stating that as flipped learning enables learners to self-pace their learning process and reinforces selective attention, the germane load experienced by them increases (Abeysekera & Dawson, 2014; Clark et al. 2005). Additionally, participants' EdPuzzle scores have significant negative correlations with intrinsic and extraneous cognitive load and a significant positive correlation with germane load. This result is also corroborated by qualitative findings as the participants indicated simultaneous presentation of audio and visual input while taking notes at the same time created some concentration problems for them. According to the relevant literature, the expected impact of flipped learning on cognitive load is that it lowers extraneous cognitive load (DeLeeuw & Mayer, 2008; Lujan & DiCarlo, 2006), manages intrinsic load (Karpicke, 2012; Musallam, 2010; Roediger & Pyc, 2012) and increases cognitive load (Akkaraju, 2016). Therefore, these inverse relationships between flipped learning and IL and EL are consistent with the results of prior studies.

Considering the learning strategies scale, the results revealed that among the cognitive and meta-cognitive strategies used by the learners during flipped learning, organization subscale had the highest score. One explanation might be that the flipped learning model increases self-regulated learning levels of learners (Kellogg, 2009; Warter-Perez & Dong, 2012), which in a similar manner might affect organization strategies of learners. This could be interpreted as when learners are in a learning environment in which they are encouraged to manage and regulate their own learning process, they tend to utilize organization strategies more efficiently in order to improve their learning.

Another significant finding revealed by this study is that Self-efficacy for Learning and Performance has positive correlations with all three dimensions of the satisfaction scale and a significant negative correlation with the intrinsic load perceived. This could be interpreted as the fact that the more satisfied the learners are, the more self-sufficient they feel. The results of the study comply with the relevant studies as flipped learning has a positive impact on the self-efficacy levels of learners (Hsiao, Hung, & Huang, 2021; Kurt, 2017), which in that vein improves their course satisfaction levels (Fisher et al., 2021). Additionally, as flipped learning enables sharing the course content prior to the lesson allowing the learners to be more prepared for the lesson without being overwhelmed by the new knowledge, this leads to a decrease regarding the intrinsic load experienced by the learners (Van Merriënboer & Sweller, 2005). Therefore, the results of the present study corroborate the previous studies in terms of the positive impact of flipped learning on the cognitive load of learners (Abeysekera & Dawson, 2014; Turan & Göktaş, 2016).

Our findings revealed a positive relationship between germane load experienced by the learners, their satisfaction levels and EdPuzzle scores. The qualitative results also are in line with these findings as participants stated that flipped learning facilitates learning and makes in-class learning more effective. These findings comply with the relevant studies as flipped learning is claimed to increase GL experienced by learners (Akkaraju, 2016) and improve active learning, learner engagement and satisfaction levels (Armbruster et al., 2009; Bonwell & Eison, 1991) and achievement scores of learners (Armbruster et al., 2009; Prince, 2004; Keengwe, 2014).

As for the motivation levels of learners, the findings indicated that motivation has predictive power on course satisfaction. In other words, when learners are highly motivated in a learning environment, their satisfaction levels are also expected to increase. One possible explanation might be that flipped learning increases the motivation levels of learners (Baepler et al., 2014; Sahin et al., 2015) by enabling them to learn at their own pace, manage the cognitive load, be active in the classroom, which ultimately leads to an estimation of increased satisfaction.

Finally, time spent for watching the video lectures (one dimension of flipped learning) predicted course achievement and scores obtained on EdPuzzle. To put it differently, as flipped learning allows learners to learn at their own pace by pausing and rewinding the videos, searching for extra information whenever they need a clarification (Bergmann & Sams, 2012), students are encouraged to regulate their own learning process by setting goals and deciding on when to study or how much time they need for it (Wiginton, 2013). Therefore, learners feel more responsibility over their own learning process, which motivates them to achieve success (Gannod et al., 2008) and leads to improved learning outcomes (Conner, 2021). Yet, results gained from the qualitative data indicated that the length of the videos, which increased the time spent for watching them, led to some problems for the learners in terms of attention and engagement. However, in some studies, similar to our participants, learners expressed the length of the videos and the existence of face-to-face discussion rooms as vital for the success of flipped learning (Avdic & Akerblom, 2015).

Recommendations

In terms of implications, our overall findings suggest that implementing a flipped learning approach in online

education settings can enhance learner motivation, satisfaction, and the use of effective learning strategies. Educators and institutions can consider integrating technological tools and resources to facilitate self-learning at home, while utilizing classroom time for interactive activities, problem-solving exercises, and critical thinking tasks to promote deep learning. The study underscores the significant role of task value in course satisfaction. Educators should strive to cultivate and sustain student motivation by designing engaging and relevant tasks which would add to the value. By aligning instructional activities perceived as with high task value on the part of learners, educators can enhance student engagement and overall satisfaction with the learning process by optimizing cognitive load. In order to address the challenges outspoken by participants related to instructional tools and the nature of flipped learning, support mechanisms which maintain quality learning should be established.

In order to pave way for more student-centered active learning, we set out to integrate flipped learning into higher education setting through a subject-matter course. Our results showed positive contributions of flipping the classroom to learner motivations, strategies, satisfaction, and learning outcomes. It is also found to be conducive to managing the cognitive load. Yet, care must be taken in the interpretations as the generalizability of the results are low due to the small sample size. A similar study with a quasi-experimental design including intact and larger groups can produce comparable results. There might also be confounding variables present stemming from the composite nature of flipped classroom such as the ability of teacher in implementing the flipped model, the design of the syllabus and materials and the technical facilities. Still, future studies can control for these extraneous variables building on design limitations emerging from earlier studies given that the easy-to-implement nature of this innovative model has the potential to transform future of online learning.

Acknowledgment

This research was supported by Yıldız Teknik University's Scientific Research Projects Unit under the project number SBA-2020-3795.

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