



Designing and Validating a Flipped Learning Pattern to Enhance Problem-Based Teaching in Higher Education Instructors for Teaching the English Language

Shila Soleymani^{1*}, Khadijeh Aliabadi², Ismail Zaraii Zavaraki³,
Ali Delavar⁴

^{1*} Ph.D. Student, Department of Instructional Technology, Faculty of Psychology and Education, Allameh Tabataba'i University, Tehran, Iran, soleymani.shila@yahoo.com

² Associate Professor, Instructional Technology Department, Faculty of Psychology and Educational Sciences, Allameh Tabataba'i University, Tehran, Iran, aliabadikh@gmail.com

³ Professor, Department of Instructional Technology, Faculty of Psychology and Educational Sciences, Allameh Tabataba'i University, Tehran, Iran, ezaraii@yahoo.com

⁴ Professor, Department of Evaluating and Measuring, Faculty of Psychology and Educational Sciences, Allameh Tabataba'i University, Tehran, Iran, delavarali@yahoo.com

Article Info

ABSTRACT

Article Type:

Research Article

Received:

18/07/2021

Accepted:

27/02/2022

This study provides a framework for identifying, designing, and validating a flipped learning pattern to enhance problem-based teaching approach in higher education instructors in teaching the English language. Also, this endeavors to offer a general blueprint for designing a pedagogical pattern as an improvement strategy in teaching and learning English. The present study is an applied and mixed-method research. In the qualitative phase, a systematic review of 137 written and electronic documents was performed to identify the components of the pattern. Besides, in-depth interviews with 32 available and purposeful experts were done to collect data. As a methodology, researchers used inductive qualitative content analysis. To confirm the obtained components, CVR and CVI were performed in a quantitative part with 25 available experts. The final influential elements in pattern formation were determined and approved in 6 main components (selected code), 18 sub-components (pivot code), and 94 properties (open code). Based on the results of CVR = 0.9, CVI = 1, and the reliability of the questionnaire $r = 0.83$, all 118 components were confirmed. The activities before, during and after the class were separately approved along with the independent activities of the teacher and learner. The results indicated the acceptability of the pattern indicators. It showed that choosing the correct and principled teaching method with conscious design can solve English teaching-learning problems according to the experts' perspectives. Besides, it not only helps English instructors and learners how to plan, but also encourages them to use it in various fields.

Keywords: Learning, FLP, Teaching, PBT, English Language

Cite this article: Soleymani, S., Aliabadi, K., Zaraii Zavaraki, I., & Delavar, A. (2022). Designing and validating a flipped learning pattern to enhance problem-based teaching in higher education instructors for teaching the English language. *Journal of Modern Research in English Language Studies*, 9(3), 73-100.

DOI: 10.30479/jmrels.2022.15926.1927

©2022 by the authors. Published by Imam Khomeini International University. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution 4.0 International (CC BY 4.0) <https://creativecommons.org/licenses/by/4.0>



1. Introduction

Flipped Learning Pattern (FLP) has become a famous and thematic alternative to teacher-dominated teaching in various fields of education (Van Alten et al., 2020), especially in the second language (Mehring & Leis, 2018) with Problem-Based Teaching Approach (PBTA) (Schallert & Lavicza, 2020). FLP, in terms of PBTA, has now normalized as a part of the educational process that experts emphasize (Yadav et al., 2011). Although this approach was not the first trial to solve the problems of traditional patterns, many educators support the flipped learning pattern. They dedicate class time to active learning approaches and use advanced technologies for outdoor classroom events, in which students can access learning content before the class (Bergmann & Sams, 2012). Innovative educators follow teaching methods that enhance learning and motivate students to try harder to be better than their classmates (Johnson et al., 2014).

Flipped learning has emerged as an educational strategy or pattern and as a unique approach for teaching and learning that reverses the role of class assignments and activities (Bergmann & Sams, 2014; Khonamri et al., 2020). This way of learning has been improved by using new technologies and further interaction between teacher and learner relationships (Karshki et al., 2014; Rotellar & Cain, 2016). It facilitates deep learning through participation and interaction in the classroom learning activities, improves the efficiency of learners' performance through cooperative learning, and creates more knowledge in their minds (Dinarvand, 2018; Fethi & Marshall, 2018; Golzari & Attaran, 2016; Haghani et al., 2016; Moffett, 2015; Nemati, 2019; Prashar, 2015; Strayer, 2012).

In the flipped learning approach, more attention is paid to learners' understanding of high-level learning styles, skills, and performance (Ahmed, 2016; Chou, 2017; Karimi & Hamzavi, 2017). Access 24 hours a day, seven days a week to information and communication technology in this model provides flexibility for learning resources and content for learners with different functions (Ankeny & Krause, 2014; Mok, 2014).

The flipped learning pattern by using new educational media and technologies has led to individual teaching (Bergmann et al., 2011; Sproz, 2016). It provides the ability to repeat or stop teaching for a more comprehensive understanding (Sproz, 2016) and covers more resources and content (Mason et al., 2013). The new information technology and educational media used in this pattern make it possible to continuously review, modify, and update content for this learning method, too (Karshki et al., 2014).

This pattern makes more use of class time (Lage et al., 2000; Papadopoulos & Roman, 2010; Wallace, 2014) and leads to high satisfaction

(Chen et al., 2019; Guerrero, 2017; Khoshnoodi et al., 2019). Learners are more prepared to attend the class (Jungić et al., 2015; McLaughlin et al., 2013) with high motivation (Golzari & Attaran, 2016; Khaknejad & Mardkhodai, 2019; Kheirābādi, 2017; Namdar Ahmadabad et al., 2019). In this way of learning, digital films and web-based technologies provide the opportunity for learners to have the time needed to take notes, solve their problems (Ankeny & Krause, 2014; Mok, 2014), and try to get a higher score (Chu et al., 2019; Sarani et al., 2014). Attracting learners' attention to their learning responsibility (Karshki et al., 2014), having a positive impact on their metacognitive development (Shih & Huang, 2018), and helping self-assessment (Moffett, 2015) are other notable aspects of flipped learning. Flipped learning reduces learners' anxiety in doing homework (Sproz, 2016), and helps to educate mental conflict and increases their thinking power (Barghi et al., 2019; Bergmann et al., 2011). It is also a good strategy in the present age for new ways of learning and technological education. (Abolhasani & Safaei Movahhed, 2019). Being interactive, paying attention to the needs of learners, providing feedback (Haghani et al., 2016; Shafiee & Shahbazi, 2018), placing content in long-term memory, and making the lesson attractive (Alikhani & Nili, 2015) and more skillful adaptation of learners in acquiring problem-solving skills (Mason et al., 2013; Rotellar & Cain, 2016) are other attributes that can be said the flipped learning pattern improves learning.

There have been many studies on changing teaching methods. These changes and transformations will not happen unless instructors design a plan and blueprint in advance based on appropriate principles and strategies for education, teaching, and learning. Achieving English learners' desired educational goals, obtaining the set points, and the optimal realization of learning does not occur without designing a pattern. Therefore, in this research, researchers try to identify, design, and validate FLP to enhance PBT in higher education instructors for teaching the English language.

2. Literature Review

2.1. Flipped Learning Pattern (FLP)

Speakers must learn a variety of skills, including linguistic and non-linguistic elements (Dincer & Dariyemez, 2020). Therefore, choosing an appropriate method for teaching English and creating such a lesson plan is a step in learning (Fathi Vajargah et al., 2020) and covers the requirements to overcome an initial concept (Meyer & Land, 2006). Flipped learning is portrayed as creating a unique transformation of educational approaches and aims to improve the quality and efficiency of the teaching and learning process (Kronholz, 2012).

Although the principles of reversing the classroom and learning have been for many years (Lage et al., 2000; Mazur, 2009; Novak, Patterson, Gavrín, & Enger, 1998), most studies have examined the impact of the flipped learning, its benefits, obstacles, and challenges of its implementation. A few numbers of systematic studies pay attention to design a pattern and enhance Problem-Based Teaching (PBT) in higher education instructors for teaching the English language, so this variable should be considered in pattern design.

Dimensions and characteristics introduced in a study (Pinos-Vélez et al., 2020) indicated that flipped learning patterns are only relevant before and during the class. They additionally pay attention to the reference to provide educational videos for learners. Ramadhani and Fitri (2020) mentioned the activities before and during the class. Chou et al. (2019) emphasize four factors in their pattern. They include institutional support, Technology Self-Efficacy (TSE), Teaching Strategies (TS), and teachers' beliefs. Merrill (2013) emphasizes that learners learn through doing and guidelines that increasingly challenge them to solve a problem.

Song and Kapur (2017) introduced the dimensions and characteristics of their Traditional Flipped Classroom (TFC) pattern arranged in three stages: before, during, and after the class. However, the activities are only in the first stage, outside the classroom (pre-class preparation). They emphasize the previewing and watching of short videos with educational content at home for learners. The second stage of active classroom learning happens in the class involving discussing video questions in the group, solving the problem(s), doing worksheets facilitated by the teacher or peers, and exposing misconceptions or doubts. In the third stage outside the classroom, learners' knowledge integrates and prepares for the next session, and they will be ready for the next session. In the Productive Failure-based Flipped Classroom (PFFC) pattern of Song and Kapur, three stages: before, during, and after the class arranged again. However, the activities only in the second stage are active learning in the classroom, including active participation in questioning and exploring, discussion in groups, explaining, problem-solving, sharing knowledge and information. In the third stage, after the class (integration), learners' knowledge integrates by watching the video and doing the worksheet.

According to Lo's (2017) flipped learning pattern, engagement, exploration, explanation, and evaluation are the steps of out-of-class. Nevertheless, according to the designer, the main focus in the classroom should be on engagement, elaboration, and evaluation. In Hamdan et al.'s (2020) pattern, attention is paid to the steps before, during and after the class. The pre-class stage is watching online lecture videos and taking a short test by the learner. Learners engage in group activities in the classroom, for

instance presenting content, problem-solving, and role-play. Learners' application and self-assessment are after the class.

In another pattern carried out by Estes et al. (2014), digital platform, video watching, modeling, and reassignment happen before the class. Some activities are done in the classroom, such as collaborative activities, clarifying contents, and problem-solving. Returning to the platform, task, schedule, and transfer is a unique set of after-class activities that must do so that the class can be learner-centered. Abeysekera and Dawson (2015) describe the flipped classroom as follows. The extracurricular activities are for information transfer only. During the class, learners actively participate in student-centered learning activities. To participate in classroom activities, learners must do both pre-and post-classroom activities.

In a similar vein, Alsowat (2016) emphasized the lesson, choosing to reverse. In learning outputs, two levels of learning consider in two categories. One of them is the low level of Bloom's classification, including remembering, understanding, and applying. The latter is a high level of cognition that includes analysis, evaluation, and creation. In the next stage, according to these two categories of learning levels, the activities are prepared and presented to the learners before the next session so that they can read the assigned materials, watch the video, listen to the audio materials, and prepare the concepts of the required lesson outside the class. Learners should discuss, learn, do pair/group work and collaborative learning in the classroom. The instructor should support classroom activities. Finally, learners' projects, presentations, and assignments evaluate summatively.

Fauzi and Hussain (2016), to solve practical problems in the content of the new learning environment, have developed a framework for flipped learning instructional design that includes executive instructions outside the classroom, inside the class, and Significant components at each stage.

2.2. Problem-Based Teaching Approach (PBTA)

John Dewey begins the problem-solving process by finding the factors that caused the problem. These factors are 1. identifying the problem, 2. guessing or determining the causes of the problem, 3. considering possible solutions, 4. choosing the best of them, and 5. implementing the answers (Safavi, 2014). In Polia's pattern (2013), there are four main stages for solving each problem: 1) understanding the problem. 2) map design, 3) map implementation, and 4) revision. Problem-solving individuals can learn appropriate individual and strategic skills within this framework and develop their knowledge. It should note that all components of this pattern interact with each other.

The KWDL pattern, developed at the University of Mississippi, has four stages designed to organize problem-solving in a math classroom based on teamwork. These four steps are: what I know, what I want to find out, what I did, and what I Learned (Mortazi Mehrabani, 2003). Merrill's (2013) problem-based teaching pattern focuses on four activities of the instructors: activation, demonstration, application, and integration. Janson (2000) mentioned four educational stages, including activation, display, application, and composition.

In a similar way, Schwartz et al. (1999) found that instructors must look forward to being in line with the goals and content of learning. They also should provide an opportunity for learners to articulate their solutions and defend their ideas. Stein and Bransford (1993) introduce a pattern called ADEAL, including identifying problems and opportunities, defining goals, exploring possible strategies, anticipating outcomes and acting, and looking back and learn). In another study, Goldfried and Davison (1976) emphasize the five stages of problem identification, definition, and formulation, creating alternative solutions, decision making, and proving being effective in solving the problem(s).

Although many studies have previously examined the flipped classroom (Cheng et al., 2019), there is still a need to discover different ways to reverse a class and deal with the obstacles and challenges of implementing it (Otten, de Araujo & Sherman, 2018). In this study, researchers want to identify, design, and validate FLP to enhance PBT in higher education instructors for teaching the English language. By exploratory adjustment of design, the outline of this pattern and the following two research questions are discussed in this article:

1. How should the flipped classroom pattern be designed to reinforce problem-based teaching in English higher education instructors?
2. To what extent does the proposed exploratory design support English higher education instructors in developing the flipped classroom designs?
3. To what extent does the proposed design heuristic support higher education English teachers in developing their flipped classroom lesson plans?

3. Method

3.1. Participants

The sample used in this study was separately into two parts: qualitative and quantitative.

3.1.1. Qualitative

According to research variables (FLP and PBTA) and among the total documents (N=223), there were criteria for the sample selection. Inclusion flipped learning criterion should at least include using audio, video, and printed materials for classroom preparation of learners, use of a platform or social media outside the classroom to explain and discuss learning activities, and both face-to-face and online meetings regularly. Criteria for not entering or leaving were classes held only online, in person, or a lack of learners' access to the teacher or other classmates outside the classroom. Content is done traditionally in the class, and homework at home. Documents published from December 1994 to December 2020 were accepted. Printed and electronic documents that were not published in the year or were earlier than this date excluded. Experimental and review studies on flipped learning in educational settings entered and the ones on sites and blogs discarded. The accepted language for the documents was Persian and English, and other languages were excluded. Written and electronic documents of the flipped learning used in topics other than education, they were based on teaching methods other than learning, or based on components other than research components.

There were two sets of keywords to search for research articles. The first group consists of the flipped learning-related keywords, including inverted learning, flipped classroom, inverted classroom, reverse classroom, transpose classroom, backward classroom, flipped teaching, flipped instruction, reverse instruction, and flipped approach. The second group includes Problem-Based Teaching (PBT) and Learning (PBL)- related keywords, including Problem-Based Instruction (PBI) and inquiry-based teaching and learning. The Boolean "AND" operator had to merge two sets of keywords, and the "OR" operator had to connect inside the set (Cooper, 2010).

The search terms used in this present study are as follows: ("flip", "reverse", "inverted", "transpose", or "backward"), ("classroom", "learning" or "instruction"), ("teaching" or "educating" the English languages or other sciences), ("Pre-university levels" or "academic levels"), ("teaching" or "learning "based on problem-solving"), ("teaching" or "learning" based on questions) from the reputable databases of Scopus, Proquest, Eric, Web of Science, Wiley, Science Direct, Normags, MagIran, Springer, Sage, Civilica, Iran Doc, Comprehensive Portal of Humanities, Barakat University System, Iran Index, University Jihad and Treasure Base Search. Finally, 137 electronic and printed documents as samples of this study were selected and entered into the research through a systematic review.

Besides the systematic review of FLP in Figure 1, in-depth interviews, voice recording, and expert meetings with a panel of professors, instructional experts, and specialists, fields of instructional technology, educational management, curriculum planning, medical education, and English language conducted to complete the indicators of the pattern as the second qualitative section. The participants were from Iran and were selected based on a criterion-based sampling method. Criteria include having research, teaching, and a history of scientific activities or having an executive background in various professional categories. Other exclusion criteria of the specialists and experts in the instructional center were the specialty in fields other than English or did not have sufficient knowledge of flipped learning excluded. In this case, 32 out of 143 instructors in the 2018-2020 academic year were selected in an accessible and purposeful manner. Table 1 shows the demography of qualitative participation.

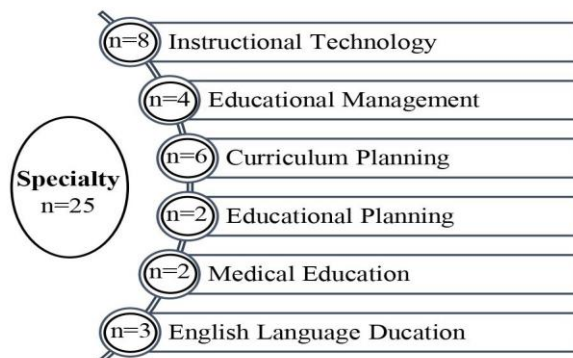
Table 1

Demography of Qualitative Participation

Components	Dimensions	F	Percent
Gender	male	18	% 0.56
	female	14	% 0.44
Level	Teacher	7	% 0.22
	Instructor	7	% 0.22
	Assistant Professor	4	% 0.13
	Associate Professor	11	% 0.34
Degree	Professor	3	% 0.09
	Ph.D. candidate	9	% 28
	Ph.D. graduated	23	% 72

Figure 2

Majors of Quantitative Participation



3.1.2. Quantitative

To check the internal validity indicators of the pattern, 25 out of 32 experts volunteered to participate in the second quantitative section of this research. The number of experts and their majors are in figure 2.

3.2. Materials and Instruments

The data of this mixed methods sequential design study came from different sources. Researchers passed three steps to collect data for designing a pattern quantitatively and qualitatively. Each phase had its instruments.

3.2.1. Instrument 1

A wide range of databases was from December 1994 to December 2020. The first flipped learning article entitled "inverting the classroom: A gateway to creating an inclusive learning environment" was done by Lage et al. in 2000, and the first problem-based teaching approach article was conducted by Moore, Block, Style, and Mitchell in 1994, entitled "The influence of the new pathway curriculum on Harvard medical students". Since then, very little research in this area, with zero to two or three, has been published a year until 2015. Since 2015, these two topics have attracted more attention among English language teaching researchers, and most of the articles on this subject were in 2016. Among them, 42 research related to using flipped learning and problem-based teaching in English language teaching, and 138 studies associated with other sciences. Sixteen of the studies had designed the pattern. This trend reflects the increasing attention paid to several English language courses that have converted to the flipped format after 2000. Noting was used in this part. To provide more detailed and precise components of designing FLP, face-to-face interviews, interview recordings, and taking-note used, too.

3.2.2. Instrument 2

Designed pattern and 29 Likert-type questions, consisting of 5 points in descending order, were as follows: 5: strongly agree; 4: agree; 3: no idea; 2: disagree, and 1: strongly disagree. It was to measure different aspects and components of the pattern. The first part of the questionnaire consists of 18 items to assess the appropriateness of the pattern components (before, during, and after the class). The following three cases are related to the general opinion of experts on the appropriateness of the components in the three divisions of activities. The other three items also check out the appropriateness of selecting the pattern components in each section to influence learners' learning levels. The last five items assessed the degree of suitability of arrangement, the relationships drawn between the indicators, and the relevance of the components to the research topic.

The pattern and items of the questionnaire for ease of understanding by experts were translated into Persian. After taking the previous appointment, the researchers distributed the questionnaire among the selected population and explained it in attendance.

3.3. Procedure

The FLP refers to new teaching and learning strategy that reverses what happens inside and outside the classroom. It integrates traditional teaching and learning strategies with other learning approaches such as the social inquiry learning approach, PBLA, etc. Flipped learning coding scheme based on patterns performed by Ramadhani and Fitri (2020), Chou, Hung, Tsai, and Chang (2020), Pinos-Vélez et al. (2020), Song and Kapur (2017), Lo (2017), Hamdan, McKnight, and Arfstrom (2020), Estes, Ingram, Liu (2014), Abeysekera and Dawson (2015), Alsowat (2016), and Fauzi & Hussain (2016), and also problem-based teaching approach based on the patterns done by John Dewey (Safavi, 2014), Polia (2013), the KWDL pattern (Mortazi Mehrabani, 2003), Merrill (2013), Janson (2000), Schwartz, Lin, Brophy, and Bransford (1999), the ADEAL pattern (Stein and Bransford, 1993), Goldfried and Davison (1976) because of the comprehensiveness of their patterns.

After obtaining the primary components from searching the presented patterns, printed and electronic, and qualitative content analysis of interviews, the researchers arranged the indicators in two tables separately. One table was about the qualitative content analysis of the components extracted from the printed and electronic sources, including 6 principal indicators (selected code), 18 sub-components (pivot code), and 92 properties (open code). The other one was about those elicited from qualitative content analysis of interviews, including 6 principal indicators (selected code), 18 sub-components (pivot code), and 68 properties (open code). Finally, the researchers found the latest components of the FLP. Then, they arranged the indicators in principal indicators (selected code), sub-components (pivot code), and properties (open code). After that, the researchers mixed two tables in an independent table and coded the items. Next, they marked the items stated in each one with a checkmark. Once the researchers identified the components, they designed the conceptual and process pattern of the flipped learning. Finally, to express experts' opinions on the position of the components, the designed model with the researcher-made questionnaire provided by researchers was given to them.

3.4. Data Analysis

This research is based on the purpose of development-applied type. It is in the category of descriptive-analytical research. To implement and evaluate the FLP environment, this exploratory study used a design-based research method. Throughout the design, a qualitative data collection through inductive qualitative content analysis of documents and in-depth interviews of experts and their experiences in the FLP environment was used to extract the pattern components. The researchers used CVR, CVI, and Cronbach's alpha coefficient to collect data and validate the pattern, as implemented in SPSS (version 22.0).

Due to the focus on the design of the present research pattern, the time classification expansion model was used in the exploratory design. In this study, the definition of Design-Based Research (DBR) was applied.

DBR is a systematic but flexible approach. It aims to improve teaching methods through iterative analysis, design, development, and implementation based on collaboration between researchers and environmental reports and leads to sensitive design principles (Wang & Hannafin, 2005). According to Lou and Hugh (2017), design-based research studies conducted over a long time can reveal ambiguities in the patterns. It also leads to the use of FLP in experimental research projects effectively. FLP components are designed to address some educational challenges and can solve them.

4. Results and Discussion

4.1. Results

A systematic review was to achieve objectives for designing and validating FLP to enhance PBT in higher education instructors for teaching the English language. In the first stage, 180 printed and electronic reports were identified. Among them, 93 cases that were directly related to the title of the study were examined (Figure 1). The components of the flipped learning pattern were identified through qualitative content analysis. In the next step, in order to complete the pattern indicators, experts and specialists (Table 1) were interviewed in-depth. Then, using qualitative content analysis of the content expressed during the interviews, other influential elements for designing the flipped learning pattern were obtained.

The main themes extracted from the results of the interviews with matching the primary codes (main and sub-components) provided in the collection of written and electronic documents were used for qualitative content analysis. Then the items were coded. After sorting the codes, and

specifying the categories and subcategories, the final components were eventually obtained, which is the first step to extract the components of the pattern. The components were then made available to specialists and experts (figure 2). They were asked to express their views on the extent that the mentioned factors and components are in line with the objectives of the research. To confirm the components of the final pattern, a 27-item questionnaire was created according to the 5-point Likert scale related to the components of the model with the help of the supervisor, advisors, and a number of experts. It was published in paper and electronic form. Then, it was distributed among 25 experts volunteered to participate. After that, the completed questionnaires were collected and reviewed. Corrective changes were made based on the opinion of experts and final components appeared.

All of six main components (selected code), 18 sub-components (pivot code), and 94 properties (open code), extracted from the qualitative content analysis of printed and electronic documents as well as from the results of interviews, were accepted with a few changes. The researchers obtained minimum acceptable with $CVR = 0.9$ and $CVI = 1$ that indicates the acceptance of all components. Then, they designed the final conceptual pattern based on the suggestions provided according to Figure 3.

In any training program, a pattern can be considered a guide to clarify the path and steps of work. It can be a framework for accelerating planning, designing, and regularly performing the program activities. In other words, knowing the components of a program and activities alone cannot help to discover its relationship with other indicators, so it can be considered in the form of a process model (Figure 4) and examined. (Nowruzi & Razavi, 2011)

Figure 3

The Conceptual Pattern of FLP

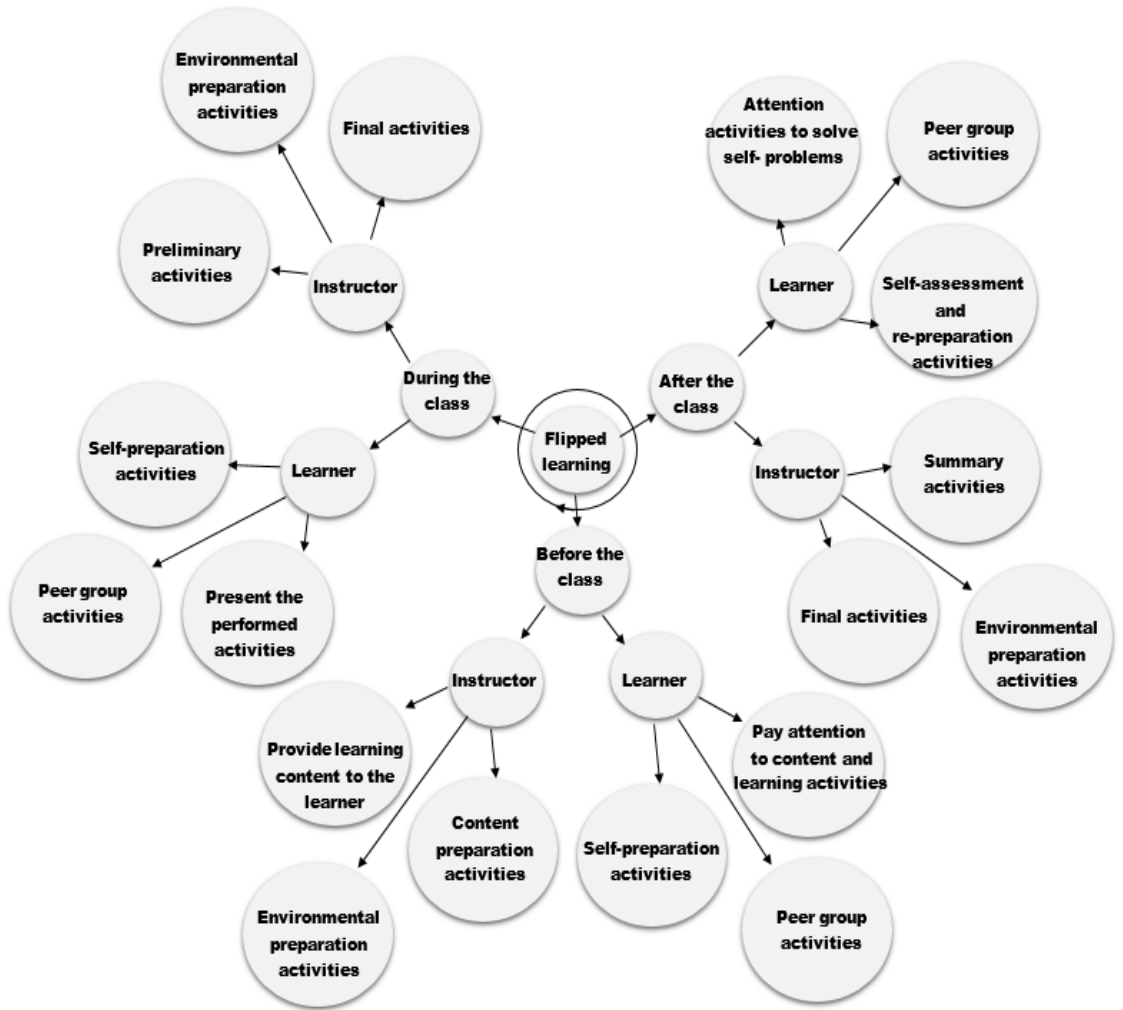


Figure 4

The Process Pattern of FLP in Terms of PBTA

Journal of Modern Research in English Language Studies 7(x), xx-xx, (2020)

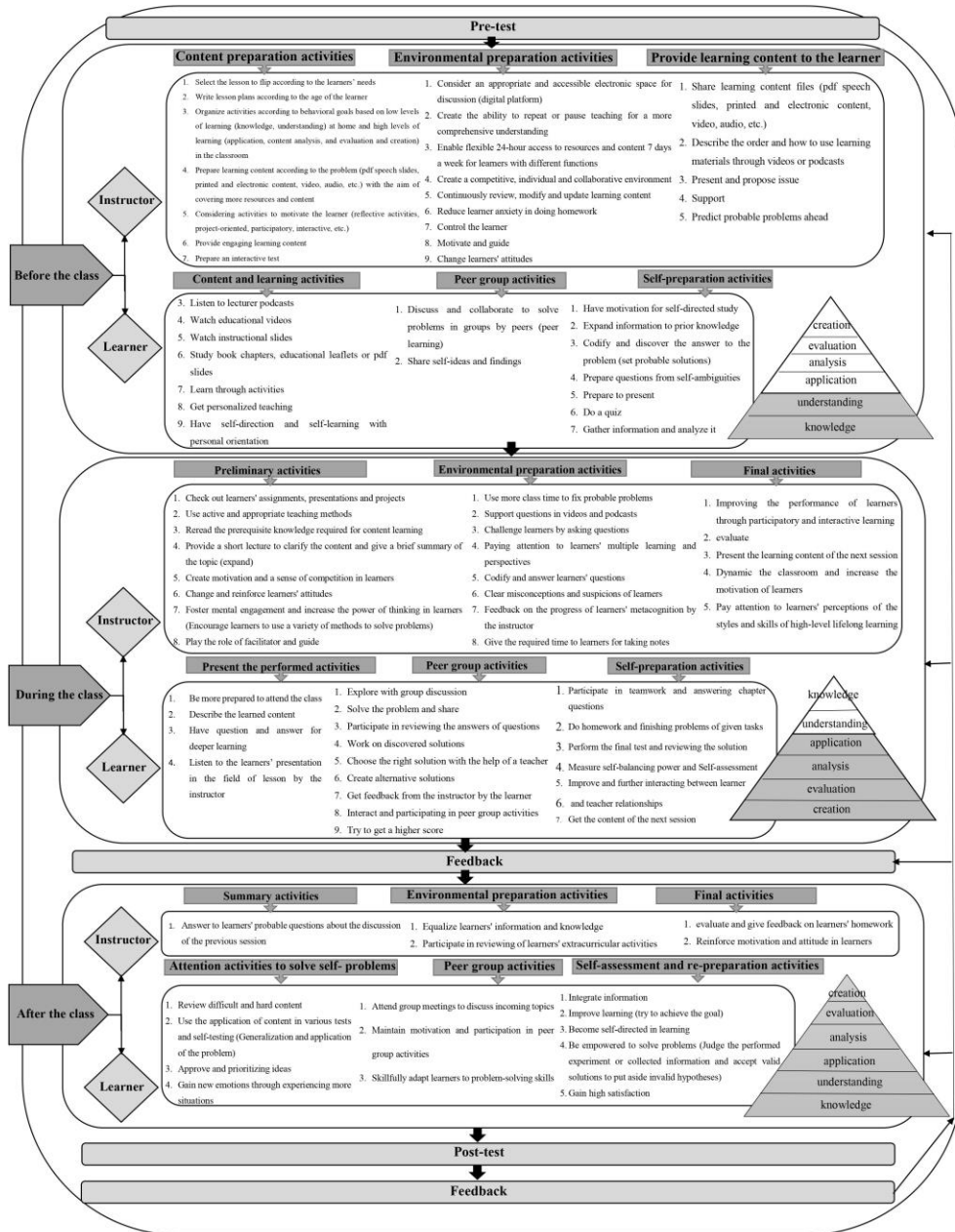


Table 2

Acceptable CVR Based on the Number of Scoring Experts to Open-Source Research Based on Re-Surveys of Experts

Index	Zero- trivia code	One-important cod	Result	Index	Zero- trivia code	One-important cod	Result
A1	3	17	0.7	H3	0	20	1
A2	2	18	0.8	H4	0	20	1
A3	0	20	1	H5	0	20	1
A4	0	20	1	H6	2	18	0.8
A5	1	19	0.9	H7	1	19	0.9
A6	1	19	0.9	H8	1	19	0.9
A7	2	18	0.8	K1	2	18	0.8
B1	0	20	1	K2	3	17	0.7
B2	0	20	1	K3	3	17	0.7
B3	0	20	1	K4	4	16	0.6
B4	2	18	0.8	K5	1	19	0.9
B5	1	19	0.9	L1	3	17	0.7
B6	1	19	0.9	L2	3	17	0.7
B7	2	18	0.8	L3	3	17	0.7
B8	3	17	0.7	L4	2	18	0.8
B9	3	17	0.7	M1	1	19	0.9
C1	4	16	0.6	M2	1	19	0.9
C2	1	19	0.9	M3	3	17	0.7
C3	3	17	0.7	M4	3	17	0.7
C4	3	17	0.7	M5	4	16	0.6
C5	3	17	0.7	M6	1	19	0.9
D1	2	18	0.8	M7	2	18	0.8
D2	1	19	0.9	M8	2	18	0.8
D3	1	19	0.9	M9	0	20	1
D4	3	17	0.7	N1	1	19	0.9
D5	3	17	0.7	N2	1	19	0.9
D6	4	16	0.6	N3	0	20	1
D7	1	19	0.9	N4	2	18	0.8
E1	2	18	0.8	N5	5	15	0.5
E2	2	18	0.8	N6	5	15	0.5
F1	0	20	1	O1	0	20	1
F2	1	19	0.9	P1	1	19	0.9
F3	1	19	0.9	P2	0	20	1
F4	0	20	1	R1	3	17	0.7
F5	2	18	0.8	R2	3	17	0.7
F6	5	15	0.5	S1	2	18	0.8
F7	5	15	0.5	S2	2	18	0.8
G1	0	20	1	S3	1	19	0.9
G2	1	19	0.9	S4	3	17	0.7
G3	0	20	1	T1	2	18	0.8
G4	3	17	0.7	T2	0	20	1
G5	2	18	0.8	T3	0	20	1
G6	0	20	1	X1	1	19	0.9
G7	0	20	1	X2	1	19	0.9
G8	1	19	0.9	X3	2	18	0.8
H1	1	19	0.9	X4	0	20	1
H2	2	18	0.8	X5	0	20	1

Experts then answered the CVI questionnaire, which identified each item with a four-part, irrelevant, need, relevant but need to review, and relevant. The number of specialists who chose options 2 and 3 was divided into the total number of specialists to obtain the approval or disapproval of the pattern components. The researchers removed the item when the value was less than 0.7. They should review it if it was between 0.7 and 0.79, and if it was more than 0.79, it is acceptable. According to table 3, all components are approved.

To answer the second question, one can refer to the results obtained from Cronbach's alpha coefficient, combined reliability techniques, CVR, and CVI. Researchers used the analysis of the variance-based structural modeling approach to calculate the indicators. Cronbach's alpha coefficient and combined reliability indicate the high measurement accuracy of the category and subcategory of FLP and the reliability of this tool. Based on this test, they found that the researcher-made pattern has acceptable reliability.

Cronbach's alpha coefficient and combined reliability of 83% were to evaluate the reliability. With this result, there were the value and acceptable components and indicators identified. Then, CVR and CVI were used to obtain the relative coefficients and content validity index. They depend on the logical analysis of the content of a test and its determination based on subjective and individual judgment (Jahangiri et al., 2021). Researchers asked experts to examine each item based on the triviality of code zero and the importance of code one to determine the CVR. After that, they collected the answers and calculated them according to the following formula.

Cronbach's alpha coefficient, relative content validity coefficient, content validity index, and combined reliability indicate the high measurement accuracy of the tool under the categories of "flipped learning pattern based on problem-solving teaching approach" and thus the reliability or reliability of them. Factor loads related to all subcategories and references of this pattern are in good condition. In other words, researchers overestimate the correlation between the main categories and subcategories related to this concept. Therefore, they can conclude that the tools related to this concept have factor validity.

Table 3

Acceptable CVI Based on the Number of Scoring Experts to Open-Source Research Based on Re-Surveys of Experts

Indicator	Irrelevant	Need	Relevant but need to review	Relevant	Result	Indicator	Irrelevant	Need	relevant but need to review	Relevant	Result
A1	0	0	0	25	1	H3	0	0	2	23	1
A2	0	0	0	25	1	H4	0	0	0	25	1
A3	0	0	1	24	1	H5	0	0	0	25	1
A4	0	0	1	24	1	H6	0	0	1	24	1
A5	0	0	2	23	1	H7	0	0	1	24	1
A6	0	0	0	25	1	H8	0	0	2	23	1
A7	0	0	1	24	1	K1	0	0	2	23	1
B1	0	0	1	24	1	K2	0	0	0	25	1
B2	0	0	2	23	1	K3	0	0	2	23	1
B3	0	0	3	22	1	K4	0	0	3	22	1
B4	0	0	3	22	1	K5	0	0	4	21	1
B5	0	0	4	21	1	L1	0	0	1	24	1
B6	0	0	1	24	1	L2	0	0	3	22	1
B7	0	0	3	22	1	L3	0	0	4	21	1
B8	0	0	4	21	1	L4	0	0	1	24	1
B9	0	0	1	24	1	M1	0	0	3	22	1
C1	0	0	3	22	1	M2	0	0	4	21	1
C2	0	0	2	23	1	M3	0	0	1	24	1
C3	0	0	3	22	1	M4	0	0	3	22	1
C4	0	0	2	23	1	M5	0	0	4	21	1
C5	0	0	0	25	1	M6	0	0	1	24	1
D1	0	0	1	24	1	M7	0	0	2	23	1
D2	0	0	2	23	1	M8	0	0	2	23	1
D3	0	0	3	22	1	M9	0	0	2	23	1
D4	0	0	4	21	1	N1	0	0	3	22	1
D5	0	0	3	22	1	N2	0	0	4	21	1
D6	0	0	4	21	1	N3	0	0	1	24	1
D7	0	0	1	24	1	N4	0	0	3	22	1
E1	0	0	3	22	1	N5	0	0	4	21	1
E2	0	0	3	22	1	N6	0	0	1	24	1
F1	0	0	3	22	1	O1	0	0	3	22	1
F2	0	0	2	23	1	P1	0	0	3	22	1
F3	0	0	0	25	1	P2	0	0	3	22	1
F4	0	0	0	25	1	R1	0	0	2	23	1
F5	0	0	1	24	1	R2	0	0	3	22	1
F6	0	0	1	24	1	S1	0	0	3	22	1
F7	0	0	2	23	1	S2	0	0	2	23	1
G1	0	0	3	22	1	S3	0	0	1	24	1
G2	0	0	2	23	1	S4	0	0	2	23	1
G3	0	0	1	24	1	T1	0	0	4	21	1
G4	0	0	1	24	1	T2	0	0	1	24	1
G5	0	0	2	23	1	T3	0	0	3	22	1
G6	0	0	1	24	1	X1	0	0	4	21	1
G7	0	0	1	24	1	X2	0	0	3	22	1
G8	0	0	1	24	1	X3	0	0	2	23	1
H1	0	0	2	23	1	X4	0	0	3	22	1
H2	0	0	1	24	1	X5	0	0	3	22	1

4.2. Discussion

The flipped learning pattern presented in this article had three objectives:

(1) Try to provide a blueprint for designing an instructional pattern as an improvement strategy in teaching and learning English that facilitates and guides learning performance.

(2) Develop a heuristic design for FLP curriculum planning scenarios.

(3) Contribute to a pattern with design principles to enhance learning through a problem-based teaching approach in flipped learning scenarios for higher education instructors in their teaching the English language.

The indicators and the activities were separately determined before, during, and after the class for designing the conceptual pattern of the research. It is consistent with the five-element flipped learning pattern of Lo (2017), Hamdan et al. (2020), the three-step model of Estes, Ingram, and Liu (2014), and Alsowat (2016). Also, the traditional flipped learning pattern and based on the constructive failure of Song and Kapur have been mentioned in these three parts. However, in the traditional flipped learning pattern, they paid more attention to the activities before and during the class. They also emphasized the activities during and after the class (2017) in the flipped learning pattern based on constructive failure. Pinos-Vélez et al. (2020) also consider only before and during the class activities in their model, but Fauzi and Hussain (2016) only pay attention during and outside the classroom activities.

The indicators must consider before, during, and after the class to succeed in implementing the pattern. It will give a mental arrangement to the teacher who decides to implement the pattern for the first time from where and how to design the class activities. According to the conceptual pattern of this research, in three steps before, during, and after the class, attention has been paid to the learners and teacher activities separately, which is in line with the flipped learning pattern of Ramadhani and Fitri (2020), Chou, Hung, Tsai, and Chang (2020), and Alsowat (2016). However, in their pattern, only the activities of the teacher were considered, and the attention was not on learners' activities. Alsowat (2016) only considered the activities without mentioning them to the instructor and learners separately before, during, or after the class.

In another pattern, the attention was only on learner activities, and no attention was to the activities of the teacher (Hamdan et al., 2020). Fauzi and Hussain (2016) also point to scattered teaching activities. According to the

results, flipped learning is a classroom that is the first step that can solve the problems of many teachers in terms of the high volume of textbooks and short teaching time (Moffett & Mill, 2014). Because of the division of activities and doing some of them before the class, instructors and learners have more time to discuss and solve learning problems inside the classroom.

Findings show that the three sections before, during, and after class are mentioned in most studied patterns, but the point that is less considered is the skillful design of the flipped learning pattern in which both teacher and learner activities are separate. In this study, researchers present a conscious design of a pattern along with the activities of each section in detail for teachers' and learners' activities and comprehensive activities so that the teacher who wants to design and implement the lesson with this teaching method can get the steps of organizing the activities. When designers pay attention to different parts of the pattern with accuracy, they allow learners to receive guidance on learning content individually. It leads to learners' advancement in self-regulation and academic self-directed. It also promotes learners' self-improvement by creating self-control, self-evaluation, self-motivation, goal setting, responsibility, and organizing as a skill. Therefore, the elements and components in instructional environments (teacher, assessment method, learning experiences, homework, encouragement, punishment, and educational goals) influence learners' attitudes about educational and academic achievement, the classroom environment, materials, and subjects (Arkhodi Ghalenoei et al., 2014).

5. Conclusion and Implications

In conclusion, the acceptability of the identified indicators of the designed pattern and attention to the components indicate their correct selection. Appropriate teaching methods with conscious design can have a good effect on learners' activities in their self-learning. In other words, correct teaching methods guarantee learners to learn. Therefore, choosing the well-suited teaching method is one of the main supporter of learning, and a significant aspect of a classroom situation is that learners interact with each other. According to this conclusion, creating an organized situation to increase the interpersonal relationships of learners seems necessary. Accurate identification of the dimensions and characteristics of FLP for teaching the English language can increase learners' interaction, sympathy, and interpersonal participation. In addition, it increases the growth of thought, the sense of competence and self-esteem, responsibility, criticism, innovation, and creativity of learners.

In general, technologies alone do not represent a panacea. They should use in educational centers with accurate planning and execution. The pattern of flipped learning has the role of a shortcut, interface, or mediator

among the subject of learning, the learner, and the teacher. Flipped learning and technology cooperate together in a variety of fields, but the key technology that can bring changes for flipped learning is significant. It also creates features such as emphasizing the ability to learn and autonomy independently, having an active, effective, and exploratory role during learning and fitting with learners' experiences and personal information, teamwork cooperation ability, team consciousness, learning teacher and learners from each other. Evaluation of the overall progress stage through the self-assessment process is in FLP. It initiates higher-level mental processes such as decision making, critical thinking, participating, problem-solving, and processing. It also enables learners to actively link what they already know with what they need to learn through classroom activities, interaction, discussion with peers, and mental scaffolding training. This pattern can increase satisfaction, accelerate learning, develop problem-solving and self-directed learning skills of learners. To implement this plan, teachers answer learners' questions and organize activities in the process. The specific proposals of this research are:

1. Instructors in the strategies of the flipped pattern implementation influenced the factors that are affected. In this study, these factors that affect the pattern include background (time management, instructional materials, and lesson plan) and intervening conditions (individual, instructional, organizational, and cultural factors). The researchers should pay attention to them in their design.

2. The active learning method used in the flipped classroom can indicate problems for teachers and learners who are not used to this teaching method. Therefore, the need to explain the reason and logic of work in justifying the implementation of this model and supporting the integration of technology with education for teachers and learners seems necessary. According to the research results, these reasons include two parts: internal and external motivations. The results indicated that the flipped approach usage causes the realization of internal motivations that are primarily related to the individual. In the flipped class, learners take responsibility for their learning based on their learning speed and habits. Another factor for accepting the flipped approach was external motivations that were in groups and learning groups. These factors include interacting in the group, receiving feedback, and participating in the learning process affect learning, and lead to the creation of desirable individual and educational outcomes.

3. Because instructors need to provide learning content to pre-class to make the most of the class time, and the instructor may not always have enough time to produce content before each class session, this discourages

them from using this pattern. In this case, creating databases for archiving instructional content and its continuous updating can be helpful. It also seems necessary to use successful senior instructors for implementing instructional technologies to guide professional learning communities and hold in-service courses for teachers to familiarize them with flipped learning and apply this method in their teaching. Holding regular meetings to share teachers' educational experiences in implementing this new teaching method is another factor that helps teachers to be motivated.

This study had several limitations that should pay attention to future studies. The first limitation is limited research in pattern design. Researchers conducted it in Iran for the first time, and there were no any of them in Iran. Besides, researchers in different fields with various experiences may have diverse aspects of designing FLP. In addition, learners with different grades and ages may need different types of flipped learning patterns and learning performance. Therefore, it is a fact that a lot of research is necessary to confirm these findings and implement them in different educational environments, areas, levels, majors, and courses. More extensive research in other fundamental variables affecting the proposed pattern is one of the research suggestions for future studies. The last limitation was the access to experts due to coronavirus, so more research with more views and opinions of experts can develop this pattern and its effects on different educational environments.

Acknowledgments

This article is extracted from the doctoral dissertation of instructional technology that was done in the Faculty of Educational Sciences and Psychology of Allameh Tabataba'i University of Tehran, Iran. Thank you to all the respected professors who have helped us in this research.

References

- Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. *Higher Education Research and Development*, 34(1), 1-14.
- Abolhasani, Z., & Safaei Movahhed, S. (2019). Providing a proposed framework for the work and technology curriculum of the middle school with emphasis on flipped classroom pattern. *Research in Curriculum Planning*, 16(61), 1-13.
- Ahmed, M. A. E. A. S. (2016). The effect of a flipping classroom on writing skill in English as a foreign language and students' attitude towards flipping. *US-China Foreign Language*, 14(2), 98-114.
- Alikhani, M., & Nili, A. M. (2015). Flipped classroom, new pedagogical model in e-learning. *The first international conference on new research in educational science, psychology and social studies in Iran*, Qom. <https://civilica.com/doc/498471/>
- Alsowat, H. (2016). An EFL flipped classroom teaching model: Effects on English language higher-order thinking skills, student engagement and satisfaction. *Journal of Education and Practice*, 7(9), 108-121.
- Ankeny, C. J., & Krause, S. J. (2014). *Flipped biomedical engineering classroom using pencasts and muddiest point web-enabled tools*. In 2014 ASEE Annual Conference & Exposition.
- Arkhodi Ghalenoei, M., Mirzaei, M. M., & Kareshki, H. (2014). *Investigating the basics of self-efficacy theory and its application in education*. The First National Conference on Educational Sciences and Psychology, Marvdasht. <https://civilica.com/doc/338729/>
- Barghi, E., Sahebyar, H., Gol-Mohammadnejad, G. R. (2019). Study the effectiveness of flipped classroom on students' interactive thinking in second year of high school in math, *Journal of innovation and creativity in humanities*, spring, 8(4), 33-62.
- Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day*. International Society for Technology in Education.
- Bergmann, J., & Sams, A. (2014). Flipping for mastery. *Educational Leadership*, 71(4), 24-29.
- Bergmann, J., Overmyer, J., & Willie, B. (2011). *The flipped class: What it is and What it is not*. The Daily Riff.
- Chen, Y. T., Liou, S., & Chen, L. F. (2019). The relationships among gender, cognitive styles, learning strategies, and learning performance in the flipped classroom. *International Journal of Human-Computer Interaction*, 35(4-5), 395-403.

- Cheng, L., Ritzhaupt, A. D., & Antonenko, P. (2019). Effects of the flipped classroom instructional strategy on students' learning outcomes: A meta-analysis. *Educational Technology Research and Development*, 67(4), 793–824.
- Chou, C. L., Hung, M. L., Tsai, C. W., & Chang, Y. C. (2019). Developing and validating a scale for measuring teachers' readiness for flipped classrooms in junior high schools. *British Journal of Educational Technology*, 51(4), 1420-1435.
- Chou, L. Y. (2017). The effect of flipped classroom on self-efficacy and satisfaction of computer auditing. In International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing. Springer.
- Chu, T. L., Wang, J., Monrouxe, L., Sung, Y. C., Kuo, C. L., Ho, L. H., & Lin, Y. E. (2019). The effects of the flipped classroom in teaching evidence based nursing: A quasi-experimental study. *Plos One*, 14(1), e0210606-e0210606.
- Dinarvand, A. (2018). *Investigating the effect of reverse education mode on the educational aspects of primary school students*. Fifth Psychology International Conference, Educational Sciences and Lifestyl. Qazvin, Iran.
- Dincer, A., & Dariyemez, T. (2020). Proficient speakers of English as a foreign language: A focus-group study. *IAFOR Journal of Education*, 8(1), 83-99.
- Estes, M. D., Ingram, R., & Liu, J. C. (2014). A review of flipped classroom research, practice, and technologies. *International HETL Review*, 4(7), 1-8.
- Khonamri, F., Azizi, M., & Kralik, R. (2020). Using interactive e-based flipped learning to enhance EFL literature students' critical reading. *Science for Education Today*, 10(1), 25-42.
- Fathi Vajargah, K., Karimi Sabet, M., Javanmardi, M., & Davoudi, S. (2020). A remedy to the misery of language learning efficacy: Flipped classroom. *Journal of English Language Teaching and Learning*, 12(26), 125-143.
- Fauzi, S. S. M., & Hussain, R. M. R. (2016). Designing instruction for active and reflective learners in the flipped classroom. *Malaysian Journal of Learning and Instruction*. 13(2), 147-173.
- Fethi, K., & Marshall, H. W. (2018). *Flipping movies for dynamic engagement*. In Innovations in Flipping the Language Classroom. Springer, Singapore.
- Goldfried, M. R., & Davison, G G. C. (1976). *Clinical behavior theory*. Holt, Rinehart & Winston.

- Golzari, Z., & Attaran, M. (2016). Flipped learning in higher education: Narratives of a Teacher. *Journal of Theory & Practice in Curriculum*, 7(4), 81-136.
- Guerrero, W. (2017). *Flipped classroom and problem-based learning in higher education, Latin-American context*. In Conference Proceedings of the Future of Education.
- Haghani, F., Rezaei, H., & Eghbali, B. (2016). Flipped classroom: A pedagogical method. *Iranian Journal of Medical Education*, 16, 104-119.
- Hamdan, N., McKnight, P., & Arfstrom, K. M. (2020). *The flipped learning model: a white paper based on the literature review titled a review of flipped learning*.
https://www.researchgate.net/publication/339339697_A_WHITE_PAPER_BASED_ON_THE_LITERATURE_REVIEW_TITLED_A_REVIEW_OF_FLIPPED_LEARNING
- Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). NMC horizon report: 2014 K-12 edition. *The New Media Consortium*.
- Jungić, V., Kaur, H., Mulholland, J., & Xin, C. (2015). On flipping the classroom in large first year calculus courses. *International Journal of Mathematical Education in Science and Technology*, 46(4), 508-520.
- Karimi, M., & Hamzavi, R. (2017). The effect of flipped model of instruction on EFL learners' reading comprehension: Learners' attitudes in focus. *Advances in Language and Literary Studies*, 8(1), 95-103.
- Karshki, H., Arkhondi, G. M., Mirzaei, M., (2014). *Investigating the theory of self-efficacy and its application in education*. National Conference of Educational Science and Psychology.
- Khaknejad, H., & Mardkhodai, R. F. (2019). Teaching in reverse class mode on motivation for students' achievement in English of tenth class of Roshtkhar. *Journal of New Achievements in Humanities Studies*, 2(15), 85-94.
- Kheirābādi, R. (2017). The impact of flipped classroom model on teaching English grammar at 10th grade of high school. *Educational Innovations*, 16(4), 141-162.
- Khoshnoodi Far, M., Mohajerpour, R., Rahimi, E., Roshani, D., & Zarezadeh, Y. (2019). Comparison between the effects of flipped class and traditional methods of instruction on satisfaction, active participation, and learning level in a continuous medical education course for general practitioners. *Scientific Journal of Kurdistan University of Medical Sciences*, 24(1), 56-65.
- Kronholz, J. (2012). Can Khan move the bell curve to the right? *Education Digest*, 78(2), 23-30.

- Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, 31(1), 30-43.
- Lo, C. K. (2017). Toward a flipped classroom instructional model for history education: A call for research. *International Journal of Culture and History*, 3(1), 36-43.
- Mason, G. S., Shuman, T. R., & Cook, K. E. (2013). Comparing the effectiveness of an inverted classroom to a traditional classroom in an upper-division engineering course. *IEEE Transactions on Education*, 56(4), 430-435.
- Mazur, E. (2009). Farewell, Lecture? *Science*, 323, 50-51.
- McLaughlin, J. E., Griffin, L. M., Esserman, D. A., Davidson, C. A., Glatt, D. M., Roth, M. T., Gharkholonarehe, N., & Mumper, R. J. (2013). Pharmacy student engagement, performance, and perception in a flipped satellite classroom. *American Journal of Pharmaceutical Education*, 77(9), 196-196.
- Mehring, J., & Leis, A. (2018). Innovations in flipping the language classroom. *Innovations in Flipping the Language Classroom: Theories and Practices*. Springer.
- Merrill, M. D. (2013). *First principles of instruction: Identifying and designing effective, efficient and engaging instruction*. Pfeiffer.
- Jahangiri, P., Saberi, M. K., & Vakilimofrad, H. (2021). Development and psychometric evaluation of the cloud computing acceptance questionnaire for academic libraries. *The Journal of Academic Librarianship*, 47(5), 102395.
- Meyer, J., & Land, R. (2006). *Overcoming barriers to student understanding: Threshold concepts and troublesome knowledge*. Routledge.
- Moffett, J. (2015). Twelve tips for “flipping” the classroom. *Medical Teacher*, 37(4), 331-336.
- Moffett, J., & Mill, A. C. (2014). Evaluation of the flipped classroom approach in a veterinary professional skills course. *Advances in Medical Education and Practice*, 1(5), 415-425.
- Mok, H. N. (2014). Teaching tip: The flipped classroom. *Journal of Information Systems Education*, 25(1), 7-11.
- Morteza Mehrabani, N. (2003). Introducing the L-D-W-K model for organizing problem solving in the classroom, *The Growth of Math Education*, 20(15), 22-74.
- Namdar Ahmadabad, H., Yousefi Tabari, S., & Hosseini, S. H. (2019). Evaluation of teaching immunology through flipped-classroom model from students' perspective in NKUMS. *Educational Development of Judishapur*, 10(3), 197-208.
- Nemati, M. (2019). Investigating the effect of flipped teaching-learning method on Persian language learners' reading and writing

- skills. *Journal of Teaching Persian to Speakers of Other Languages*, 8(18), 251-266.
- Novak, G. M., Patterson, E. T., Gavrin, A., & Enger, R. C. (1998). Just-in-Time Teaching: Active learner pedagogy with WWW. In *IASTED International Conference on Computers and Advanced Technology in Education*.
- Otten, S., De Araujo, Z. & Sherman, M. (2018). *Capturing variability in flipped mathematics instruction*. Proceedings of the 40th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education.
- Papadopoulos, C., & Roman, A. S. (2010). *Implementing an inverted classroom model in engineering statics: Initial results*. In 2010 Annual Conference & Exposition.
- Pinos-Vélez, V., Quinde-Herrera, K., Abril-Ulloa, V., Moscoso, B., Carrión, G., & Urgilés, J. (2020). Designing the pre-class and class to implement the flipped learning model in a research methodology course. *IEEE Revista Iberoamericana de Tecnologías del Aprendizaje*, 15(1), 43-49.
- Prashar, A. (2015). Assessing the flipped classroom in operations management: A pilot study. *Journal of Education for Business*, 90(3), 126-138.
- Ramadhani, R., & Fitri, Y. (2020). A Project-based learning into flipped classroom for ePUB3 electronic mathematics learning module (eMLM)-based on course design and implementation. *Universal Journal of Educational Research*, 8(7), 3119-3135.
- Rotellar, C., & Cain, J. (2016). Research, perspectives, and recommendations on implementing the flipped classroom. *American Journal of Pharmaceutical Education*, 80(2), 34-34.
- Safavi, A. (2014). *General teaching methods and techniques*. Contemporary Publications.
- Sarani, H., Ayati, M., & Naderi, F. (2014). The effects of teaching English language course via phone and email on learning and achievement's motivation. *Quarterly Journal of Research and Planning in Higher Education*, 20(3), 141-159.
- Schallert, S., & Lavicza, Z. (2020). *Implementing augmented reality in flipped mathematic classrooms to enable inquiry-based learning*. In Conference on Technology in Mathematics Teaching–ICTMT 14.
- Shafiee, S., & Shahbazi, M. (2018). *Representation of experienced curriculum in an inverted classroom of a higher education complex*. The 5th national conference on management and humanities research in Iran, Teran, <https://civilica.com/doc/787843/>

- Shih, H. C. J., & Huang, S. H. C. (2018). *The development of EFL learners' metacognition in a flipped classroom*. In Proceedings of the 8th Centre for Language Studies International Conference.
- Song, Y., & Kapur, M. (2017). How to flip the classroom-" productive failure or traditional flipped classroom" pedagogical design? *Educational Technology & Society*, 20(1), 292-305.
- Sproz, M. A. (2016). Reverse learning in math classroom. *Growth Magazine of Tomorrow School*, 13(1), 11-12.
- Stein, J. D., & Bransford, B. S. (1993). IDEAL problem solver: A guide for improving thinking, learning, and creativity. W. H. Freeman and Company.
- Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, 15(2), 171-193.
- Van Alten, D. C., Phielix, C., Janssen, J., & Kester, L. (2020). Self-regulated learning support in flipped learning videos enhances learning outcomes. *Computers & Education*, 158, 104000.
- Wallace, A. (2014). Social learning platforms and the flipped classroom. *International Journal of Information and Education Technology*, 4(4).
- Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53(4), 5-23.
- Yadav, A., Subedi, D., Lundeberg, M. A., & Bunting, C. F. (2011). Problem-based learning: Influence on students' learning in an electrical engineering course. *Journal of Engineering Education*, 100(2), 253-280.