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Research trends in flipped classroom empirical evidence from 2017 to 2018

A content analysis

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Abstract

Purpose – This paper aims to analyze the trends and contents of flipped classroom research based on 48 selected empirical articles published during 2017 and 2018.

Design/methodology/approach – The inductive content analysis was used as a methodology to investigate the content of flipped classroom research, including subject-specific areas, methodological approaches, technology tools or platforms, the most frequently used trending searches, countries of research, positive impacts and challenges.

Findings – The results of the analysis were interpreted using descriptive analysis, percentages and frequencies. This analysis found that various subjects were implemented in flipped classroom learning, and some technological tools were also used to enhance teaching and learning. Analysis of the impact revealed that the flipped classroom yielded positive learning outcomes on students' learning activities such as learning motivation and engagement, social interaction and self-directed learning skills. Meanwhile, the most significant challenges encountered by the instructor were the lack of students' motivation to watch pre-recorded video lectures or to study the contents outside of the class time.

Originality/value – The findings suggest that the flipped classroom concept might be effective in promoting twenty-first-century learning skills and developing the technology and information literacy competency based on national standards.

Keywords Research trend, Flipped classroom, Content analysis, Twenty-first-century learning skills, A systematic literature review

Paper type Research paper

Today's learners grow up immersed as digital natives and familiar with a wide range of digital devices. They also may have different learning styles, motivation and engagement approach to the learning process. Therefore, these actualities need contemporary

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pedagogical models and trends to accomplish students' twenty-first-century skills, needs and preferences. Flipped classroom is one of this trends aiming to promote students' learning performance, motivation, engagement, higher-order thinking skills and experiential learning (Çakıroğlu and Öztürk, 2017). Flipped classroom is also known as a student-centered approach to learning where the students are more active than the instructor in the classroom activity. In this case, the instructor acts as a facilitator to motivate, guide and give feedback on students' performance (Sams and Bergmann, 2013). The flipped classroom allows students to watch the video according to their preferred time and need, and they can study at their own pace; this type of activity also increases students' collaborative learning in distance education outside the class. Thus, by flipping the class, the students will not spend so much time listening to long lectures in the classroom but will have more time to solve problems individually or collaboratively through distance learning with peers. Applying the flipped classroom approach also contributes to better understanding of technology use in teaching and learning activities; students will use various technology media in learning activities independently, whereas the lecturer will use various technology media in their teaching practices (Kurt, 2017).

Purpose of the study

Despite the increased popularity of flipped classroom research, there is a lack of empirical evidence reported about the recent research and trend of the flipped classroom concept. Also, there is a lack of studies on reviewing various fields or sectors to increase user participation and engagement. Therefore, this study aims to review and analyze the trends and contents of flipped classroom research based on 48 studies published during 2017 and 2018. The analysis was based on the trend of methodological approaches adopted in research, the underlying theoretical models, technological platforms, the most frequent keywords used, countries of research, positive impacts and challenges.

Research questions

The employment of the flipped classroom approach is vastly becoming more and more prevalent in modern societies. However, despite the increased popularity of its research, there is a lack of empirical evidence that summarizes the positive impacts and challenges of flipped classroom implementation from various works. Besides, a few studies have also been performed to critically analyze this issue systematically. Therefore, based on these rationales, this study aims to rigorously review and analyze a number of selected publications from a wider research topic in a pedagogical context. The analysis of this study addresses the following research questions:

RQ1. What subjects of flipped classroom teaching practices have been widely researched in 2017 and 2018?

RQ2. What type of methodological approaches has been regularly used to study the flipped classroom?

RQ3. What kind of technological platforms has been used in flipped classroom research?

RQ4. What are the most commonly used keywords in flipped classroom research?

RQ5. Which country has mostly implemented and published the flipped classroom study in Web of Science (WoS) journal during the period of 2017 and 2018?

RQ6. What are the positive impacts of flipped classroom implementation?

RQ7. What are the challenges encountered in flipped classroom implementation?

Methodology

Research design

Recently, an inductive content analysis was used to analyze 48 refereed journal articles on flipped classroom research published in 2017 and 2018. Content analysis is a research technique usually applied in social science and humanities (McMillan, 2012). Creswell (2013) mentions that inductive content analysis is applied when the researcher needs to identify themes within written texts, artifacts, videos, pictures and recordings in a way that is similar to other qualitative coding strategies. As the study was inductive, there was no tested theory or a theoretical framework discussed in the literature review and methodology. Both quantitative and qualitative data analyses were used in this study, as Bozkurt *et al.* (2015) mentioned that content analysis is one of the research design methods that uses both qualitative and quantitative approaches to study empirical documentation with the purpose of grouping similar cases or data according to certain concepts and themes and then to organize and interpret the data systematically. In the content analysis, themes can be developed as an emergent model during the analysis and preset codes can also be implemented.

The rationale for using content analysis in this study is that this method is able to evaluate publishing piles, process of analysis and interpretation of articles including developing category, calculating frequencies and interpretation stages were carefully completed (Falkingham and Reeves, 1998). Another rationale is that the use of content analysis may link the data which are related to each other and analyze the themes that can be read by readers conveniently and efficiently; also, it may be used by researchers as a reference for potential future research (Bauer, 2000). The research of content analysis has been conducted by many researchers in the field of educational technology. For example, the content analysis was used as a methodology to investigate methodologies, area of studies, technology tools or online platforms, the most frequently keywords used and works cited references, impacts for students' learning and flipped classroom challenges. Bozkurt *et al.* (2015) also conducted a study to explore the current trends in the field of distance education research during the period of 2009–2013. They reviewed 861 articles from seven scholarly journals and examined the most frequently indicated keywords, chosen research areas, emphasized theoretical and conceptual backgrounds, employed research designs, used data collection instruments and data analysis techniques, focused variables, targeted population or participant groups, cited references and cited authors. Another content analysis was carried out by Özyurt and Özyurt (2015) to examine 69 articles regarding learning style-based individualized adaptive e-learning environments published from 2005 to 2014. The studies were categorized under the title of purpose, nature, method, participant characteristics, level, data collection tool, learner modeling, employed learning style, subject and findings.

Databases searched and samples

The present study investigated peer-reviewed scholarly articles published in 2017 and 2018. The journals were retrieved and analyzed using the following rationales:

- a specific focus on flipped classroom;
- containing various field of studies;
- all are original/empirical research (not study reports or literature review);
- refereed journals with Impact Factor, indexed by a prominent database, namely, Social Sciences Citation Index (SSCI)/WoS;

- the journals were accessed and found through electronic databases, namely, Science Direct, EBSCOhost Web, Emerald Insight, Wiley Online Library and Springer Link;
- searching with the following keywords: flipped classroom, flipped learning, flipping the class, inverted classroom and inverted learning;
- all articles accessed from January 12 to July 10, 2018;
- 188 articles were found in the Science Direct database, 838 articles in the EBSCOhost Web. 389 articles in the Wiley Online Library, 125 in the Emerald Insight and 418 articles in the Springer Link;
- some articles that had been found and selected earlier were not selected to avoid unnecessary repetition;
- all articles were then verified through the WoS database (InCites Journal Citation) to check the indexing journals;
- from the verification, papers that were not indexed by the SSCI (WoS) database were removed from this study;
- 48 articles were finally found to be indexed by the SSCI and considered as a sample used in this study;
- years of publications: 2017 (31 articles), and 2018 (17 articles); and
- 48 articles were selected and reviewed from 17 professional journals and published in the SSCI, namely, *Computers and Education, Journal Educational Technology and Society, British Journal of Educational Technology, Computers in Human Behavior, Educational Technology Research and Development, Higher Education, Journal of Computing in Higher Education, Journal of Science Education and Technology, Nurse Education Today, Foreign Language Annals, Teaching and Teacher Education, Disability and health journal, Journal of Computer Assisted Learning, International journal of nursing practice, Nurse education in practice, TESOL Quarterly* and *The Internet and Higher Education* (Table I).

Data collection procedure and analysis

The process of content analysis in this study is lengthy and may require the researcher to follow certain steps to get validation of the study. According to Kohlbacher (2006), content analysis refers to analyzing the material in a step-by-step process. In this study, the process of collecting the data is as follows: First, formulating the objectives of the study and reviewing and analyzing the trends and contents of flipped classroom research based on several criteria, namely, methodological approaches, fields of study, the purposes, platforms, keywords, countries of research, positive impacts and challenges. Second, reviewing the documents, the articles containing the above-mentioned keywords were downloaded and reviewed one-by-one. Among the repeated articles, only one article was included in the examination. All journals were verified through the WoS database. Third, data were obtained via content analysis and descriptively analyzed. The data were organized in frequencies and percentages. The studies were examined based on the research questions. Fourth, the authors discussed, concluded and suggested potential future research that could be carried out to contribute to the literature gaps of the flipped classroom.

Findings

This section would discuss the findings of study based on seven proposed research questions.

No.	Journals	No. of articles	Impact factors (JCR 2017)	Ranking	Quartile	Categories
1.	*Computers and Education*	10	4.538	4/238	*Q1*	Education and Educational Research
2.	*Journal Educational Technology and Society*	9	1.767	76/238	*Q2*	Education and Educational Research
2.	*British Journal of Educational Technology*	6	2.729	23/238	*Q1*	Education and Educational Research
4.	*Computers in Human Behavior*	4	3.536	16/135	*Q1*	Psychology, Multidisciplinary
				8/85	*Q1*	Psychology, Experimental
11.	*Educational Technology Research and Development*	3	1.728	80/238	*Q2*	Education and Educational Research
5.	*Higher Education*	2	1.937	56/238	*Q1*	Education and Educational Research
6.	*Journal of Computing in Higher Education*	2	1.517	100/238	*Q2*	Education and Educational Research
7.	*Journal of Science Education and Technology*	2	1.375	117/238	*Q2*	Education and Educational Research
8.	*Nurse Education Today*	2	2.067	10/115	*Q1*	Nursing
12.	*Foreign Language Annals*	2	0.802	187/238	*Q4*	Education and Educational Research
9.	*Teaching and Teacher Education*	1	2.473	31/238	*Q1*	Education and Educational Research
10.	*Disability and health journal*	1	1.863	35/79	*Q2*	Health Policy and Service
				60/156	*Q2*	Public, Environmental and Occupational Health
14.	*Journal of Computer Assisted Learning*	2	1.859	66/238	*Q2*	Education and Educational Research
				16/69	*Q1*	Rehabilitation
				93/181	*Q3*	Linguistics
13.	*International journal of nursing practice*	1	1.142	62/151	*Q3*	Nursing
15.	*Nurse education in practice*	1	1.313	47/115	*Q2*	Nursing
16.	*TESOL Quarterly*	1	2.256	42/238	*Q1*	Education and Educational Research
				10/181	*Q1*	Linguistics
17.	*The Internet and Higher Education*	1	5.847	2/238	*Q1*	Education and Educational Research
	Total	48 articles				

Note: Accessed from January 12 to July 10, 2018, and verified through the WoS database – InCites Journal Citation

Subjects of flipped classroom teaching practices
The first finding aims to answer and discuss *RQ1* "What subjects of flipped classroom teaching practices have been widely researched in 2017 and 2018?" Some studies show that various subjects have been implemented in a single flipped study, for instance, Lo *et al.* (2018),

examined four subjects in flipped class instruction, namely, mathematics, physics, Chinese language and information and communication technology (ICT). McNally *et al.* (2016) investigate health subject and include several topics including exercise science, physiotherapy, human services and social work, nursing, medical science, environmental health and dentistry. Sergis *et al.* (2018) applied three subjects in a single study, namely, math, ICT and humanities. Lai *et al.* (2018) interviewed three teachers in their study who had implemented flipped teaching with three different subjects, namely, Chinese language, international trade and programming language.

Based on the analysis, several subjects were categorized and ranked based on their frequency in the articles. As depicted in Table II, from 38 articles examined in this study, the majority of papers are from ICT and programming subject (Blau and Shamir-Inbal, 2017; Elmaadaway, 2017; Kostaris *et al.*, 2017; Lo *et al.*, 2018; Sergis *et al.*, 2018; Yilmaz, 2017; Yilmaz and Baydas, 2017) and computer-supported teaching (Çakıroğlu and Öztürk, 2017; Nel, 2017; Schwarzenberg *et al.*, 2017; Wang, 2017; Ye *et al.*, 2018).

It was shown that there are 14 articles that used flipped classroom instruction in the ICT and programming subject. For instance, technologies and learning systems (Blau and Shamir-Inbal (2017), electronic course design (Elmaadaway, 2017), computer-supported teaching, including educational games, open-access materials, 3D virtual worlds, social networks, online gamification systems, interactive whiteboard, mobile learning technologies, augmented reality (AR), e-books and gesture-based technologies (Yilmaz and Baydas, 2017), introduction to the internet and Web page development (Nel, 2017) and programming (Çakıroğlu and Öztürk, 2017; Schwarzenberg *et al.*, 2017; Wang, 2017).

The second majority is the language learning subject with 13 papers (Chuang *et al.*, 2016; Hsieh *et al.*, 2017; Kim *et al.*, 2017b). These studies were conducted for different purposes and the specific subject of language learning. For instance, the flipped classroom instruction was

No	Fields	No. of articles	References
1.	ICT and programming	14	Blau and Shamir-Inbal (2017), Çakıroğlu and Öztürk (2017), Cukurbasi and Kiyici (2018), Elmaadaway (2017), Kostaris *et al.* (2017), Lai *et al.* (2018), Lo *et al.* (2018), Nel (2017), Sergis *et al.* (2018), Yilmaz (2017), Yilmaz and Baydas (2017), Schwarzenberg *et al.* (2017), Wang (2017), Ye *et al.* (2018)
2.	Language Learning	13	Bakla (2018), Chuang *et al.* (2016), Hsieh *et al.* (2017), Kim *et al.* (2017b), Kurt (2017), Lai *et al.* (2018), Lee (2018), Lee and Wallace (2017), Lin and Hwang (2018), Lo *et al.* (2018), Long *et al.* (2017), Moranski and Henery (2017), Shyr and Chen (2017)
3.	Mathematics	10	Boevé *et al.* (2016), Araujo *et al.* (2017), Lee *et al.* (2016), Lo and Hew (2017), Lo *et al.* (2018), Mohamed and Lamia (2018), Tse *et al.* (2017), Zengin (2017), Sun *et al.* (2018), Sergis *et al.* (2018)
4.	Science	9	Chang and Hwang (2018), He *et al.* (2018), Long *et al.* (2017), Lo *et al.* (2018), Thai *et al.* (2017), Wang *et al.* (2018), Sletten (2017), Olakanmi (2016), Sun *et al.* (2016)
5.	Health: Medical, nursing, pharmacy and dental	6	El-Banna *et al.* (2017), Green and Schlairet (2017), Saunders *et al.* (2017), Kim *et al.* (2017a), Sheppard *et al.* (2017), McNally *et al.* (2016)
6.	Social Science: Business and education	3	Luo *et al.* (2018), Long *et al.* (2017), Ng (2018)

Table II.
The summary of flipped classroom studies in different subjects

used to explore individual characteristics, such as learner motivation, self-efficacy and epistemology beliefs, that might have an impact on learning outcomes in a flipped classroom, and the subject was applied English for vocational education (Chuang *et al.*, 2016). Kim *et al.* (2017b) investigated the cognitive effects of the flipped classroom approach in a content-based instructional context in Korean language classes. Other articles and subjects included, namely, English (Lee and Wallace, 2017; Long *et al.*, 2017; Shyr and Chen, 2017), Korean and English (Lee, 2018), Spanish (Moranski and Henery, 2017) and Chinese language (Lo *et al.*, 2018). The third majority was found in the mathematics subject with 10 papers (Boevé *et al.*, 2016; Araujo *et al.*, 2017; Lee *et al.*, 2016; Lo and Hew, 2017; Lo *et al.*, 2018). For instance, a study to present two cases of mathematics teachers who have flipped their instruction (Araujo *et al.*, 2017) investigated or two aspects of subject reading motivation using video-based flipped mathematics class were examined (Tse *et al.*, 2017).

The fourth majority was the science subject with nine papers and different topics (Long *et al.*, 2017; Lo *et al.*, 2018; Thai *et al.*, 2017; Wang *et al.*, 2018). These studies were conducted for different purposes and specific subjects, for instance, one study aimed at examining instructors' perceptions and experiences in using a flipped classroom model in instruction in an animal science course (Long *et al.*, 2017). Other particular subjects related to science were physics (Lo *et al.*, 2018; Sun *et al.*, 2016; Wang *et al.*, 2018), invertebrates (Thai *et al.*, 2017), biology (Sletten, 2017) and chemistry (He *et al.*, 2018; Olakanmi, 2016).

Furthermore, fifth, health subjects were found in six papers, including medical, nursing, pharmacy and dental fields. These studies were also conducted for different purposes and specific areas of health. For instance, Saunders *et al.* (2017) reported the outcomes of combining flipped and simulated learning to enhance nursing students' understanding of person-centered care, the professional nursing role and preparation for placement, and a study of Green and Schlairet (2017) used the flipped classroom to understand how students perceived their experiences in a nursing course. Moreover, Sheppard *et al.* (2017) conducted a study to develop and assess the efficacy of an educational intervention designed to introduce the topics of special education law and practices and working with parents of children with disabilities into an undergraduate medical education pediatrics course. Besides, there were several other subjects related to health subjects researched, such as pharmacology (El-Banna *et al.*, 2017), clinical practicum (Kim *et al.*, 2017a), exercise science, physiotherapy, human services and social work, nursing, medical science, environmental health and dentistry (McNally *et al.*, 2016).

The last but not least were subjects related to humanities and social sciences. Three articles were found in these areas; the first paper aimed at examining instructors' perceptions and experiences in using a flipped classroom model in instruction in a business course (Long *et al.*, 2017); the second study was to compare the effects of three levels of student agency in an undergraduate flipped course, namely, theories of teaching and learning (Luo *et al.*, 2018); and the third study was to examine a good pedagogy for enhancing formative learning outcomes for a teacher education program (Ng, 2018). In addition to this finding, Figure 1 summarizes the percentage composition of research subject areas from 48 selected journal articles.

Methodological approaches

This analysis aims to answer *RQ2* "What type of methodological approaches has been regularly used to study the flipped classroom?" From the analysis, we found the majority of studies used a mixed-methods and quantitative approach, followed by qualitative, design-based research, and action research. In this study, we separate action research and design-based research into their approaches and stand-alone without depending on the qualitative

Figure 1.
The percentage of employing flipped classroom instruction in different subjects
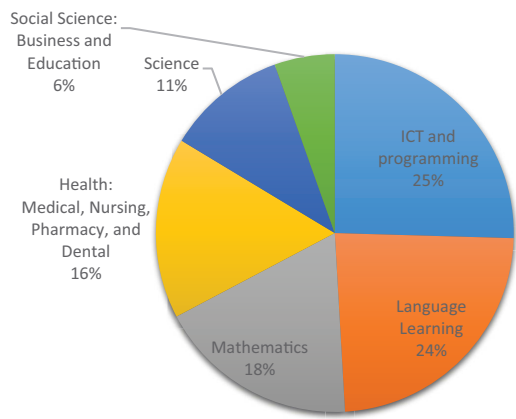
or quantitative research. Sigler (2009) asserted that action research is not about doing research on or about people or finding all available information on a topic looking for the correct answers. It involves people working to improve their skills, techniques and strategies. In its implementation, action research includes several stages that are composed of a circle of planning, action and fact-finding about the result of the action. Furthermore, design-based research viewed as an outgrowth of product development processes rather than scientific research, it attempts to solve current real-world problems by designing and enacting interventions as well as extending theories and refining design principles (Wang and Hannafin, 2005). Thus, it can be assumed that action research and design-based research are two different approaches apart from quantitative, qualitative or mixed-method approaches.

Meanwhile, Creswell (2013) mentions that action research can be applied through quantitative or qualitative data collection, and the mixed-methods approach is very often used. It is in coherence with the finding of this study that some action research used multiple data collection methods in its implementation. For instance, Kostaris *et al.* (2017) used assessment tests, observations and questionnaires in collecting the data. Likewise, Sergis *et al.* (2018) also implemented experimental tests, questionnaires, observations and interviews in their studies. Design-based research also used multiple data sources. The researchers need to integrate a variety of research methods and approaches from both qualitative and quantitative paradigms, depending on the stages of research. In this study, for instance, we found that several design-based research papers used multiple data collection methods such as questionnaires, interviews and observations (Lee *et al.*, 2016) and experimental tests, interviews, questionnaires and observations (Lo and Hew, 2017).

In terms of methodological approaches used across these studies, Table III summarizes 17 articles that used a mixed-methods approach, utilizing multiple data collection procedures. For instance, Sun *et al.* (2016) applied experimental tests, questionnaire surveys, observations and interviews in collecting the data. Furthermore, 14 articles were found that used a quantitative approach, with the majority of data collection procedures being students' learning assessment (tests) and questionnaire surveys. For instance, Thai *et al.* (2017) conducted a study to examine and compare the differential impact of students' learning performance in a flipped classroom setting, a blended learning, traditional learning and an e-learning setting, through a pre- and post-test. Then, eight studies were found that implemented a qualitative approach with various research designs such as case study,

No	Methods	No. of articles	References
1.	Mixed-methods research	17	Bakla (2018), Boevé et al. (2016), Chang and Hwang (2018), El-Banna et al. (2017), Hsieh et al. (2017), Kim et al. (2017b), Kurt (2017), Lai et al. (2018), Lin and Hwang (2018), Moranski and Henery (2017), Ng (2018), Olakanmi (2016), Sheppard et al. (2017), Sun et al. (2016), Wang et al. (2018), Ye et al. (2018), Zengin (2017)
2.	Quantitative research	14	Chuang et al. (2016), Elmaadaway (2017), He et al. (2018), Kim et al. (2017a), Luo et al. (2018), McNally et al. (2016), Schwarzenberg et al. (2017), Sletten (2017), Shyr and Chen (2017), Sun et al. (2018), Thai et al. (2017), Tse et al. (2017), Yilmaz and Baydas (2017), Yilmaz (2017)
3.	Qualitative research	8	Blau and Shamir-Inbal (2017), Çakıroğlu and Öztürk (2017), Cukurbasi and Kiyici (2018), Araujo et al. (2017), Green and Schlairet (2017), Long et al. (2017), Saunders et al. (2017), Lee (2018)
4.	Design-based research	5	Lee et al. (2016), Lo and Hew (2017), Lo et al. (2018), Mohamed and Lamia (2018), Wang (2017)
5.	Action research	4	Kostaris et al. (2017), Lee and Wallace (2017), Nel (2017), Sergis et al. (2018)

Table III.
The summary of
methodological
approaches

phenomenological research and grounded theory design. For instance, Long et al. (2017) conducted a case study to investigate instructors' experiences and perspectives on using the flipped classroom model in instruction. Structured interviews were used in collecting the data with eight faculty members.

The design-based research was used by five studies. Lee et al. (2016) used the ADDIE model (Analysis, Design, Development, Implementation and Evaluation) to guide the study and the data were collected through questionnaires, interviews and observations. Another example is a study by Lo and Hew (2017), which used Merrill's first principles as a framework of the study and the data were collected through multiple sources, including students' learning assessments, interviews, questionnaires and observations. Besides, Mohamed and Lamia (2018) used the intelligent tutoring systems and problem-based learning model in the flipped class design to improve students' learning motivation and students' centered learning. The last but not least was action research found in four studies; for instance, Nel (2017) used four stages of the data collection process based on McTaggart and Kemmis (1988), namely, plan, act, observe and reflect. In addition, Sergis et al. (2018) applied four step-wise phases in collecting the data, namely, the plan phase, the act phase, the observe phase and the reflect phase, based on Lewin's model.

In terms of research design, Table IV shows 14 papers that implemented experimental design, followed by survey design (four papers), case study (three papers), randomized clinical trial design (one paper), phenomenological study (one paper), exploratory study (one paper) and grounded theory design (one paper). The other studies did not explicitly mention the design approach used, instead stating multiple data collection methods used, such as tests or assessment, questionnaires, interviews, focus group discussions or observations. Furthermore, in terms of data collection methods, as depicted in Table V, most studies used questionnaire surveys (38 studies), followed by experimental tests or assessment (28 studies), interviews/focus groups (24 studies), observations (14 studies) and others (four studies), including learning management system (LMS) records/documents, documents analysis, videos, tasks, diaries and expert Delphi. Figure 2 summarizes the percentage composition of research methods, research design and data collection procedures from 48 selected journal articles.

No	Research design	No. of articles	References
1.	Experimental design	14	Lo and Hew (2017), Lo et al. (2018), Schwarzenberg et al. (2017), Thai et al. (2017), Shyr and Chen (2017), Luo et al. (2018), Hsieh et al. (2017), Kim et al. (2017b), Kostaris et al. (2017), Kurt (2017), Olakanmi (2016), Sergis et al. (2018), Sun et al. (2016), Zengin (2017)
2.	Survey design	4	He et al. (2018), McNally et al. (2016), Sletten (2017), Sun et al. (2018)
3.	Case study	3	Çakıroğlu and Öztürk (2017); Cukurbasi and Kiyici (2018), Long et al. (2017)
4.	Randomized clinical trial design	1	Kim et al. (2017a)
5.	Phenomenological study	1	Green and Schlairet (2017)
6.	Exploratory study	1	Saunders et al. (2017)
7.	Grounded theory design	1	Blau and Shamir-Inbal (2017)

Table IV.
The summary of research design

Technological platforms

This analysis attempts to answer *RQ3* "What kind of technological platforms has been used in flipped classroom research?" From 48 analyzed papers, we found that several studies used various learning platforms to record and share video lectures and contents or as an online platform for peer interaction outside of the classroom. For instance, Google Apps: Google Drive document, Google Drive spreadsheet, was used by Blau and Shamir-Inbal (2017) as a learning platform to allow students to create, edit, share and collaborate on documents, spreadsheets and presentations. The synchronous lessons were held via Zoom video conferencing that allows two-way communication during the lessons through watching (digital camera), speaking and listening (microphone and headphones) and sharing screens for presentation and teamwork. Besides, asynchronous discussions and individual assignments were carried out through a course forum assignment system on Moodle.

Furthermore, in terms of exploring students' learning behaviors in flipped class instruction, Boevé et al. (2016) used a course online diary; the students were invited to fill out an online diary of their study behavior on Mondays and Fridays through the Qualtrics platform (www.qualtrics.com). Besides, the Qualtrics platform was also used by Sheppard et al. (2017) to post the assessment online and an online discussion using Blackboard LMS. In recording course videos, multiple platforms were also used, for instance, Dev C++ Editor (Çakıroğlu and Öztürk, 2017) and EverCamTM (Chuang et al., 2016). To improve English as a Foreign Language students' English oral presentation, Lin and Hwang (2018) reported that the teacher selected educational videos related to the target language from TED, VoiceTube and YouTube and uploaded them to the Facebook wall. In another study conducted by Ye et al. (2018), gameplays were integrated into the flipped class implementation. Balance game (www.mobygames.com/game/ballance) was used for learning Newton's law of motion, and the Angry Birds game (www.angrybirds.com/games/) was used for students learning mechanical energy conservation.

Several other LMSs were also used for various purposes, for instance, Moodle – https://moodle.org (Kostaris et al., 2017), Edmodo – www.edmodo.com (Kurt, 2017), open-source platform OpenEDX – https://open.edx.org (Schwarzenberg et al., 2017), Desire2Learn – www.d2l.com/ (Sun et al., 2018), WebQuests and TED-Ed – https://ed.ted.com/ (Lee and Wallace, 2017), LINE apps – https://line.me/en-US/download (Hsieh et al., 2017),

No	Methods	No. of articles	References
1.	Questionnaires/ surveys (closed- and open-ended)	38	Bakla (2018), Boevé *et al.* (2016), Chuang *et al.* (2016), Araujo *et al.* (2017), El-Banna *et al.* (2017), Elmaadaway (2017), He *et al.* (2018), Hsieh *et al.* (2017), Kim *et al.* (2017a), Kim *et al.* (2017b), Kostaris *et al.* (2017), Lai *et al.* (2018), Lee *et al.* (2016), Lee and Wallace (2017), Lin and Hwang (2018), Lo and Hew (2017), Luo *et al.* (2018), McNally *et al.* (2016), Mohamed and Lamia (2018), Moranski and Henery (2017), Nel (2017), Olakanmi (2016), Schwarzenberg *et al.* (2017), Sheppard *et al.* (2017), Sletten (2017), Thai *et al.* (2017), Tse *et al.* (2017), Yilmaz and Baydas (2017), Yilmaz (2017 Chuang *et al.* (2016), Saunders *et al.* (2017), Sun *et al.* (2016, 2018), Shyr and Chen (2017), Wang (2017), Wang *et al.* (2018), Ye *et al.* (2018), Zengin (2017)
2.	Tests/assessments/ examination	28	Boevé *et al.* (2016), Chang and Hwang (2018), El-Banna *et al.* (2017), Elmaadaway (2017), He *et al.* (2018), Hsieh *et al.* (2017), Kim *et al.* (2017b), Kostaris *et al.* (2017), Kurt (2017), Lai *et al.* (2018), Lin and Hwang (2018), Lo and Hew (2017), Lo *et al.* (2018), Luo *et al.* (2018), Mohamed and Lamia (2018), Ng (2018), Olakanmi (2016), Sergis *et al.* (2018), Sheppard *et al.* (2017), Sun *et al.* (2016), Schwarzenberg *et al.* (2017), Thai *et al.* (2017), Chuang *et al.* (2016), Shyr and Chen (2017), Wang (2017), Wang *et al.* (2018), Ye *et al.* (2018), Zengin (2017)
3.	Interviews/ Focus groups	24	Bakla (2018), Blau and Shamir-Inbal (2017), Cukurbasi and Kiyici (2018), Chang and Hwang (2018), Chuang *et al.* (2016), Çakıroğlu and Öztürk (2017), El-Banna *et al.* (2017), Green and Schlairet (2017), Hsieh *et al.* (2017), Kim *et al.* (2017b), Kurt (2017), Lai *et al.* (2018), Lee *et al.* (2016), Lee (2018), Lo and Hew (2017), Lo *et al.* (2018), Long *et al.* (2017), Nel (2017), Ng (2018), Olakanmi (2016), Saunders *et al.* (2017), Sergis *et al.* (2018), Sun *et al.* (2016), Wang *et al.* (2018)
4.	Observations	14	Çakıroğlu and Öztürk (2017), Chuang *et al.* (2016), Cukurbasi and Kiyici (2018), Araujo *et al.* (2017), Kostaris *et al.* (2017), Lin and Hwang (2018), Lee and Wallace (2017), Lee *et al.* (2016), Lee (2018), Lo and Hew (2017), Olakanmi (2016), Sergis *et al.* (2018), Sun *et al.* (2016), Ye *et al.* (2018)
5.	Others (coding scheme, LMS records, documents, diaries, tasks and videos and expert Delphi)	6	Boevé *et al.* (2016), Blau and Shamir-Inbal (2017), Araujo *et al.* (2017), Wang *et al.* (2018)

Table V.
The summary of data
collections
employment

HotPotatoes – https://hotpot.uvic.ca/, Softchalk – http://softchalk.com/, Moodle (Bakla, 2018), LEGO applications (www.lego.com) and AR (Chang and Hwang, 2018). However, for those who had a limited internet access at home, a study by Olakanmi (2016) provided an alternative platform to share video lectures for students using flash drives and DVDs; thus, the students could still watch the videos on their TV or PC without the internet.

Keywords
Besides title and abstract, keywords play a crucial role in journal publication and would have a great impact on user searches or basic information on the internet search engine (Day and Gastel, 2017). The researcher needs to choose appropriate keywords for their journal articles for indexing purposes; well-chosen keywords would help more rapidly identify the manuscript, increase the number of people reading it and likely lead to more citations.
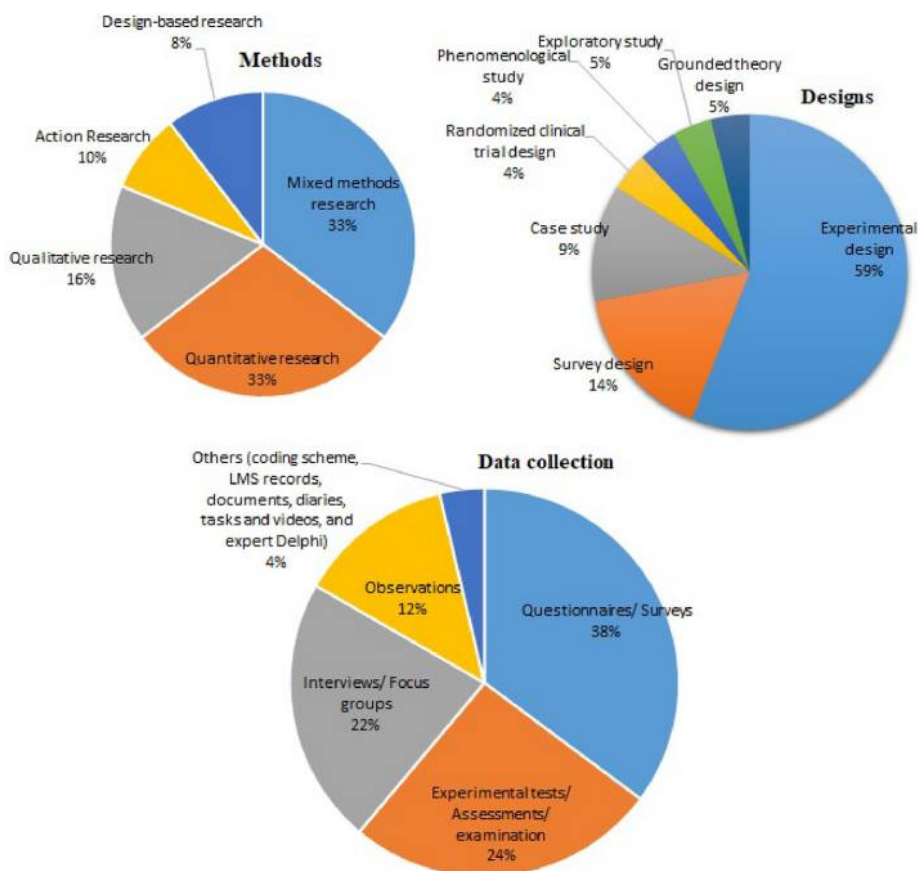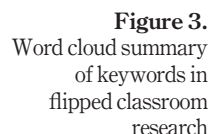
Figure 2.
The summary of the percentage composition of research methods, research design and data collection procedures from 48 selected articles

Otherwise, readers would not be able to find or cite their articles without using relevant keywords. Besides, these keywords would also represent the content of the manuscript. Therefore, this section would answer *RQ4* "What are the most commonly used keywords in flipped classroom research?" Through the analysis of keywords in this study, the readers would know the most commonly used keywords in 48 selected flipped classroom article journals that reflected the research paper topic and provide a great recommendation for their further studies.

From 48 articles analyzed, seven articles published in the *British Journal of Educational Technology* (Chuang *et al.*, 2016; Elmaadaway, 2017; Luo *et al.*, 2018; Nel, 2017; Sun *et al.*, 2016; Tse *et al.*, 2017) and one article from *TESOL Quarterly* (Lee and Wallace, 2017) did not report "Keywords". Therefore, this section summarizes keywords from 48 selected articles and found a total of 191 keywords. The most appearances were as follows: "Flipped classroom/s" (25), "Flipped learning" (five), "Self-regulated learning" (five), "Teaching/learning strategies" (five), "Active learning" (four), "Improving classroom teaching" (four), "Inverted classroom/class" (four), "Pedagogical issues" (four), "Blended learning" (two), "Flipped classroom model" (two), "Higher education" (two), "Improving classroom teaching" (two), "Learning performance" (two) and "Pedagogy" (two). In summary, a total of 191

keywords from the analysis are displayed in Figure 3 with word clouds. Besides, Figure 4 shows the eight high-frequency keywords and their hit frequencies:

Two keywords, "Self-regulated learning" and "Active learning", mostly appeared in numerous articles. It can be implied that most flipped classroom research focuses a discussion or issue on students' ability to independently monitor, adapt and evaluate their learning. Self-regulated learning skills discussed in many studies refer to students' independent activities outside of class time such as watching pre-class video lectures autonomously and taking notes and questions to further in-class discussion. Besides, students' active learning discussed in several studies may refer to teaching strategies that engage students as active participants in their learning, particularly during the in-class time activities, such as a group discussion, give-and-take conversations, presentation, question or another group study session.

Productive countries in flipped classroom research publication
This analysis attempts to answer *RQ5* "Which country has mostly implemented and published the flipped classroom study in WoS journal during the period of 2017 and 2018?" From the analysis, we found that the majority of the studies was carried out in Taiwan (11), followed by the USA (nine), Turkey (seven), South Korea (five) and Hong Kong (four). We believe that this report can be valuable information for the readers to understand the current status of global scientific productivity in flipped classroom studies. In other words, it will inform the scholars about the quality and level of scientific research of countries regarding flipped classroom implementation. Figure 5 summarizes the proportion of countries that implemented flipped classroom instruction in the teaching–learning process.

Figure 3.
Word cloud summary
of keywords in
flipped classroom
research

Positive impacts of flipped classroom implementation

Despite the newest instruction and emerging pedagogy in twenty-first-century learning, there is a growing body of literature that discusses the countless positive impacts of the flipped classroom research. This analysis attempts to answer *RQ6* "What are the positive impacts of a flipped classroom implementation?" Three major impacts were found and discussed, namely, motivation and engagement, self-efficacy and social interaction.

In terms of learning motivation, a study by Thai *et al.* (2017) reveals that the flipped classroom model has positively resulted in students' intrinsic motivation and self-efficacy learning skills. These positive impacts are subsequently followed by students' positive learning achievement. Students' self-determined motivation in the flipped classroom implementation was discovered in many articles analyzed in this study (Marchalot *et al.*, 2018; Sergis *et al.*, 2018; Thai *et al.*, 2017). There are numerous reasons that flipped class instruction successfully promoted students' learning motivation; for instance, Chuang *et al.* (2016) reported that pre-content courses (the online video course) outside of the class and quiz strategy before in-class have successfully enhanced students' learning motivation. In line with this, another study also published that students become more motivated to come to class prepared so that they could actively participate in classroom activities (Nel, 2017). A study by Lo and Hew (2017) also reported that the employment of the first principles of instruction in the flipped classroom has successfully promoted students' motivation and engagement in solving the problem.

Besides, students' engagement was also produced in the flipped classroom learning. Engagement is commonly defined as the visible outcome of motivation where students are actively involved throughout the learning activities (Coffman, 2013). It has been claimed that the employment of technology and digital tools in flipped class instruction has supported and enhanced active individual and collaborative learning (Blau and Shamir-Inbal, 2017), and students' engagement was shown by their confident talking in class during a group discussion (Araujo *et al.*, 2017). A study conducted by Elmaadaway (2017) published that participants in the experimental group were more active and engaged compared with those in the control group. Students exhibited greater behavioral and emotional engagement. Students were able to study course content at home first, thereby preparing themselves to participate in relevant class activities, pose questions and engage in problem-solving with peers. Students' pre-learning activities became the main reason students engaged both in class and outside of the classroom (Green and Schlairet, 2017).

The employment of flipped-class instruction also grants the potential to foster an innovative learning environment beneficial to knowledge delivery by instructors and
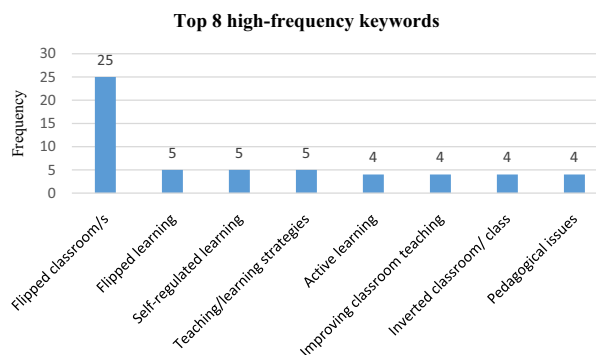

Top 8 high-frequency keywords

Figure 4.
The eight high-frequency keywords and their hit frequencies

profound engagement in learning English among learners (Hsieh *et al.*, 2017), the confidence of the students in performing core nursing skills was likely to increase after they engaged in the clinical practicum in both study groups flip and non-flip (Kim *et al.*, 2017a) and most students seemed to enjoy learning English in a flipped learning environment and more engaged in the learning process (Lee and Wallace, 2017). Besides, some studies also reported that the impact of students' engagement favorably empowers students' critical thinking and problem-solving skills (Green and Schlairet, 2017; Sun *et al.*, 2018; Wang, 2017).

Other studies also reveal the positive impact of flipped classroom instruction, namely, students' self-efficacy. The value of technology and digital tools in the flipped classroom has enhanced self-regulated strategies in in-class and out-of-class settings, particularly students' ability of independent learning skills before the lessons (Blau and Shamir-Inbal, 2017). In nursing education, Green and Schlairet (2017) reported that the flipped class model of instruction produces a self-directed and autonomous learning environment, beginning with narrated lectures and pre-readings that students consumed prior to class at a time and place of their choosing. Students were responsible for self-preparation outside of class and expected to come to class ready to apply the information. Students' ability to study at their own pace before they participate in real-world practicums was also reported by Kim *et al.* (2017a). This study summarizes that the flipped learning environment has been gaining traction as an effective method in clinical practicums because it has the potential to transform nursing education and practicums by placing a greater focus on learner's self-directed learning.

Besides, all participants in the English language teaching program appreciated watching the lectures at any time they wanted and being able to decide on their own pacing (Kurt, 2017). The integration of OpenCourseWare (OCW) and a flipped classroom also more effectively enhanced students' self-regulation of help-seeking than that of OCW and distance learning (Sun *et al.*, 2016). In terms of technology use, the flipped classroom model of instruction also enhanced students' computer and internet self-efficacy (Yilmaz, 2017). Still in terms of students' self-efficacy, the results of the study reported by Ng (2018) showed that students in the flipped classroom were able to apply their self-learned knowledge to editing images both collaboratively and individually.

Numerous studies have also reported positive impacts on students' collaboration and interaction with peers and instructors (Araujo *et al.*, 2017; Green and Schlairet, 2017; Olakanmi, 2016; Sun *et al.*, 2018; Sheppard *et al.*, 2017; Wang, 2017). A study of Sheppard *et al.* (2017) reveals that special children with disabilities are more engaged in mastering the
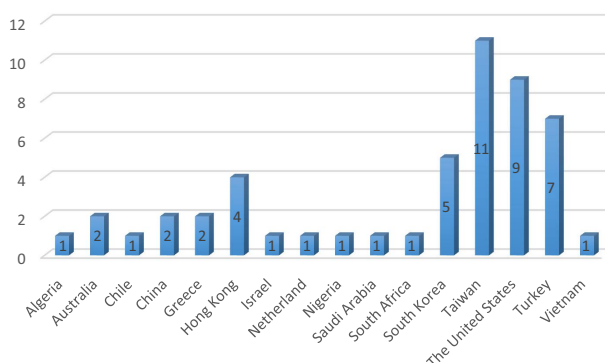

Figure 5.
The proportion of countries that published flipped classroom studies in WoS journals during the period of 2017–2018

content and learning through experiential learning activities and have a great opportunity to interact with their parents in pre-class activities (e.g. doing tasks). Technology in the flipped classroom also plays a very crucial role in promoting students' outside-of-class interaction. Blau and Shamir-Inbal (2017) reported the value of technology and digital tools in supporting and enhancing active individual and collaborative learning (teamwork) in the flipped classroom. Results also indicated a positive relationship between learners as published by Araujo *et al.* (2017) that the flipped classroom increases collaboration among students, student-to-student talk increased as compared to their prior non-flipped teaching.

Flipped class instruction helped a student gain confidence in communicating with peers in English, as a student in one study reported, "I can listen to my own recording and take my partner's recording for reference. I can practice as much as I want" (Hsieh *et al.*, 2017). Besides having the opportunity to interact with peers, students were also able to interact with a teacher during the learning processes in the classroom or after the class time, even personal consultancy (Olakanmi, 2016). Everyone has equal right to speak, ask and share information, as reported by Lee (2018) that flipped class instruction has transformed the way of learning into a more equal and democratic classroom.

All positive themes, such as learning motivation, self-directed learning skills and social interaction, are related to and influence each other; for instance, through teacher–student interactions, the learners would learn better about the process of self-awareness and the quality of learning outcomes become positive and improved (Sun *et al.*, 2016). The results of this study also show that the better the students' self-directed learning skills are, the higher the satisfaction and motivation of students from the class conducted according to the flipped classroom model of instruction is. In terms of self-efficacy and learning achievement, another study also reveals that students' self-efficacy in learning math was significantly positively related with academic achievement in both pre- and in-class learning environments (Sun *et al.*, 2018). Flipped learning also promotes interactions between students and teachers, better academic achievement by individualized learning and greater flexibility and efficiency via self-paced learning in a clinical practicum in nursing education (Kim *et al.*, 2017a). Besides, introducing self-reflection and self-assessment activities in the flipped classroom helps entice behavior engagement in online study and social interaction, which in turn promote engagement in problem-solving activities (Wang, 2017).

Challenges of implementing flipped classrooms

This analysis attempts to answer *RQ7* "What are the challenges encountered in a flipped classroom implementation?" This analysis reports that not all flipped classroom implementations resulted in positive learning outcomes. Numerous published studies assert that flipped class instruction has no significant effects on students' learning as compared to conventional instruction (Boevé *et al.*, 2016; Çakıroğlu and Öztürk, 2017; Clark, 2015; El-Banna *et al.*, 2017; Keengwe *et al.*, 2014; Long *et al.*, 2017; Tse *et al.*, 2017). A study by Sun *et al.* (2016) reported that there was no significant between-group (flipped learning and distance learning) difference in terms of students' self-regulated learning skills. A study by El-Banna *et al.* (2017) also shows that there was no statistically significant difference between the flipped class and non-flipped class in terms of students' examination scores. At the same time, during a focus group discussion, students also acknowledged that they were more satisfied with the conventional class over flipped classroom instruction. Besides, Clark (2015) found no statistical difference in measures of central tendency on test scores of students who studied algebra using a flipped class model over a seven-week period when compared to those who did not. Furthermore, a study of Boevé *et al.* (2016) reveals that students' learning behavior in flipped class instruction does not look very different as

compared to students in a non-flipped class, whereas Çakıroğlu and Öztürk (2017) report that students encountered difficulties in understanding the pre-course content at home. In terms of learning motivation, Tse *et al.* (2017) report that the flipped class instruction in reading subject does not positively contribute to motivating students' learning, as compared to a regular course.

Moreover, Blau and Shamir-Inbal (2017) noticed that changing the instruction without good preparation can cause confusion and stress among students and teachers. Particularly some teachers who have been very comfortable with their traditional instruction as the information holder may struggle to transform their classes into students' independent learning instruction (Blau and Presser, 2013). At the same time, some students who have been very comfortable with the conventional instruction may not engage with enthusiasm to study autonomously, especially outside of class hours. In addition to the technical and instructional management work involved in flipped class implementation, the literature recommends that students must be well-trained to study effectively in the flipped classroom model (Herreid and Schiller, 2013; Pearson, 2012). Some students are not ready to learn independently outside of the class without guidance from the instructor, as the content normally presented in the class through lectures would instead be distributed as homework for students' mastery before attending class (Sams and Bergmann, 2013).

Furthermore, just instructing students to watch a video or read a book outside the class is a recipe for failure in the flipped classroom. A study reported that students were reluctant to watch assigned videos outside of the class due to the lack of instruction from their instructors (Brunsell and Horejsi, 2013). The lack of students' motivation to watch pre-recorded video lectures has become a challenge in the flipped class instruction. To address this issue, Brunsell and Horejsi (2013) conducted an experimental flipped class study by giving a video quiz as a means to motivate and challenge students for watching the videos at home. Meanwhile, this strategy did not successfully motivate students to become interested to watch the pre-class video lectures. Therefore, Araujo *et al.* (2017) suggest that the use of a new strategy is much required in the flipped classroom practice to increase students' watching of videos or content mastery before class. Table VI summarizes a sample of challenges faced in the flipped classroom implementation.

Concluding discussion and recommendations

This study has summarized 48 selected empirical studies of the flipped classroom published during 2017 and 2018. Seven domains have been reviewed and reported, including research methods, subjects, technological platforms, the most frequently used keywords, countries of research, positive impacts and challenges. In terms of the subject investigated, ICT and programming-related subjects have dominated the study, followed by language learning, mathematics, science, health (medical, nursing, pharmacy and dental) and humanities/social sciences (business and theories of teaching and learning). This summary can be a potential gap for further research to study and implement the flipped classroom model of instruction in other subjects, which are poorly investigated and published in WoS journals, particularly in the field of humanities and social science, such as arts, politics and religious studies. For methodological employment, mixed-methods approaches have dominated the studies, followed by quantitative research and qualitative research. However, design-based research and action research approaches still lack publications, and therefore, further study is highly recommended to apply these research designs in the flipped classroom studies.

Furthermore, different technological platforms have been implemented during instruction, for instance, the use of Zoom video conferencing to establish two-way

Challenges of flipped classroom practice	References
Students' study behavior in the flipped course did not appear to be very different from that of students in a regular course	Boevé *et al.* (2016)
The students encountered difficulties in understanding the pre-course contents at home	Çakıroğlu and Öztürk (2017)
The participants felt that the primary challenge of using the flipped classroom model was students' potential lack of preparation prior to class	Long *et al.* (2017)
Lack of a significant difference in self-regulation between flipped class and non-flipped class	Sun *et al.* (2016)
Students in the flipped classes reported significantly lower motivation for subject reading, including reading curiosity, reading importance and reading compliance	Tse *et al.* (2017)
There were negative views on the flipped classroom, particularly when the students first came across this instruction	Cukurbasi and Kiyici (2018)

Table VI.
The summary of challenges in flipped classroom research

synchronous communication among students outside of the classroom. Moodle LMS has also been applied to asynchronous discussions and individual assignments outside of class time (Blau and Shamir-Inbal, 2017). Flipped classroom instruction is also potentially implemented in the area where the internet access is limited. An alternative platform of flash drives and DVDs can be used to share video lectures for students' learning outside of the class time, thus the students could still watch the videos on their TV or PC without the internet connection (Olakanmi, 2016). Further studies are highly recommended to implement various technological platforms in the flipped classroom study to support today's net-generation students who ubiquitously use various technological tools and social media platforms in their daily lives. Based on the analysis of keywords, "Flipped classroom" was the most frequently used in most studies, followed by "Self-regulated learning" and "Active learning". It can be implied that numerous flipped classroom research in this analysis focus on students' independent learning skills, active learning and engagement. In class activities, students independently complete problems while the instructor acts as a guide in case anyone needs assistance (Sun *et al.*, 2016). The flipped classroom also allows autonomous students' learning to take place outside of classrooms (Green and Schlairet, 2017). Before class, students watch the video in their own time and can make notes on it at their own pace. Besides, students also report a more positive learning experience, higher engagement and self-confidence in the flipped classroom discussion (Blau and Shamir-Inbal, 2017; Elmaadaway, 2017). Besides, students' emotional and behavioral engagement reported by Elmaadaway (2017) was in coherence with a theory of Reeve (2012) that in behavioral engagement, students' learning is by involvement in the academic activities and mostly related to some behavioral characteristics, such as students' class attendance, attention, persistence, effort and contribution to learning activities, and emotional engagement is related to students' emotional involvement in the learning environment and mostly related to students' psychological well-being such as happiness, enjoyment, interest, enthusiasm, eagerness, excitement, better mood, optimism and relaxation.

This study has also summarized a number of positive impacts of the flipped classroom implementation. Three major themes emerged based on the review of 48 empirical articles, namely, students' learning motivation and/or engagement, self-directed learning skills and social interaction. This finding was consistent with a self-determination theory (SDT) perspective regarding the behavior of individuals in learning performances (Deci and Ryan, 2002). We found that autonomy satisfaction

positively affected students' learning experiences. Students have opportunities to be autonomous, which in turn drives them to positive academic performance. In line with the SDT, this study confirmed that the flipped classroom approach is performed to encourage students to be active and engaged during in-class time activities and also gives them the freedom to learn at their own pace outside class hours. Consequently, these activities may facilitate student needs for autonomy, relatedness and competence, and it is likely to promote intrinsic motivation and a deeper engagement in the learning process.

Although numerous studies reveal positive impacts on the flipped classroom implementation, some published studies also assert that flipped class instruction has no significant effects on students' learning as compared to conventional instruction. For instance, a study by El-Banna *et al.* (2017) shows that there was no statistically significant difference between the flipped class and non-flipped class in terms of students' examination scores. Thus, this portrays that there is a room for improvement in the future of flipped classroom research. Besides, the most significant challenges encountered by the instructor are the students' lack of motivation to study the contents outside of the class or to watch pre-recorded video lectures (Brunsell and Horejsi, 2013). Thus, based on this case, it can be implied that the incorporation of a new strategy is much needed in the flipped classroom practice to increase students' participation in class. A novel extension of the current flipped classroom model is required by integrating another innovative strategy and its implementation such as AR, as conducted by Chang and Hwang (2018), or game-based learning, as conducted by Ye *et al.* (2018). Besides, a gamification concept as a contemporary model of instruction may also be integrated into the flipped classroom studies to enhance learning.

References

Araujo, Z.D., Otten, S. and Birisci, S. (2017), "Mathematics teachers motivations for, conceptions of, and experiences with flipped instruction", *Teaching and Teacher Education*, Vol. 62, pp. 60-70.

Bakla, A. (2018), "Learner-generated materials in a flipped pronunciation class: a sequential explanatory mixed-methods study", *Computers and Education*, Vol. 125, pp. 14-38.

Bauer, M. (2000), "Classical content analysis: a review", *Qualitative Researching with Text, Image and Sound*, Sage, New York, NY, pp. 32-151.

Blau, I. and Presser, O. (2013), "e-Leadership of school principals: increasing school effectiveness by a school data management system", *British Journal of Educational Technology*, Vol. 44 No. 6, pp. 1000-1011.

Blau, I. and Shamir-Inbal, T. (2017), "Re-designed flipped learning model in an academic course: the role of co-creation and co-regulation", *Computers and Education*, Vol. 115, pp. 69-81.

Boevé, A.J., Meijer, R.R., Bosker, R.J., Vugteveen, J., Hoekstra, R. and Albers, C.J. (2016), "Implementing the flipped classroom: an exploration of study behaviour and student performance", *Higher Education*, Vol. 74 No. 6, pp. 1015-1032.

Bozkurt, A., Akgun-Ozbek, E., Yilmazel, S., Erdogdu, E., Ucar, H., Guler, E. and Sezgin, S. (2015), "Trends in distance education research: a content analysis of journals 2009-2013", *The International Review of Research in Open and Distributed Learning*, Vol. 16 No. 1, available at: http://doi.org/10.19173/irrodl.v16i1.1953

Brunsell, E. and Horejsi, M. (2013), "Science 2.0: a flipped classroom in action", *The Science Teacher*, Vol. 80 No. 2, p. 8.

Çakıroğlu, Ü. and Öztürk, M. (2017), "Flipped classroom with problem based activities: exploring self-regulated learning in a programming language course", *Journal of Educational Technology and Society*, Vol. 20 No. 1, pp. 337-349.

ITSE

Chang, S. and Hwang, G. (2018), "Impacts of an augmented reality-based flipped learning guiding approach on students' scientific project performance and perceptions", *Computers and Education*, Vol. 125, pp. 226-239.

Chuang, H.H., Weng, C.Y. and Chen, C.H. (2016), "Which students benefit most from a flipped classroom approach to language learning?", *British Journal of Educational Technology*, Vol. 49 No. 1, pp. 56-68.

Clark, K. (2015), "The effects of the flipped model of instruction on student engagement and performance in the secondary mathematics classroom", *The Journal of Educators Online*, Vol. 12 No. 1, available at: http://doi.org/10.9743/jeo.2015.1.5

Coffman, T. (2013), *Using Inquiry in the Classroom: Developing Creative Thinkers and Information Literate Students*, Rowman and Littlefield Education, Lanham.

Creswell, J.W. (2013), *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, SAGE Publications, Thousand Oaks.

Cukurbasi, B. and Kiyici, M. (2018), "High school students' views on the PBL activities supported via flipped classroom and LEGO practices", *Journal of Educational Technology and Society*, Vol. 21 No. 2, pp. 46-61.

Day, R.A. and Gastel, B. (2017), *How to Write and Publish a Scientific Paper*, Cambridge University Press, Cambridge.

Deci, E.L. and Ryan, R.M. (2002), *Handbook of Self-Determination Research*, University of Rochester Press, Rochester, New York, NY.

El-Banna, M.M., Whitlow, M. and Mcnelis, A.M. (2017), "Flipping around the classroom: accelerated Bachelor of Science in Nursing students satisfaction and achievement", *Nurse Education Today*, Vol. 56, pp. 41-46.

Elmaadaway, M.A. (2017), "The effects of a flipped classroom approach on class engagement and skill performance in a blackboard course", *British Journal of Educational Technology*, Vol. 49 No. 3, pp. 479-491.

Falkingham, L.T. and Reeves, R. (1998), "Context analysis—a technique for analysing research in a field, applied to literature on the management of R&D at the section level", *Scientometrics*, Vol. 42 No. 2, pp. 97-120.

Green, R.D. and Schlairet, M.C. (2017), "Moving toward heutagogical learning: illuminating undergraduate nursing students experiences in a flipped classroom", *Nurse Education Today*, Vol. 49, pp. 122-128.

He, W., Holton, A.J. and Farkas, G. (2018), "Impact of partially flipped instruction on immediate and subsequent course performance in a large undergraduate Chemistry course", *Computers and Education*, Vol. 125, pp. 120-131.

Herreid, C.F. and Schiller, N.A. (2013), "Case studies and the flipped classroom", *Journal of College Science Teaching*, Vol. 42 No. 5, pp. 62-66.

Hsieh, J.S., Huang, Y. and Wu, W.V. (2017), "Technological acceptance of LINE in flipped EFL oral training", *Computers in Human Behavior*, Vol. 70, pp. 178-190.

Keengwe, J., Onchwari, G. and Oigara, J.N. (2014), *Promoting Active Learning through the Flipped Classroom Model*, Information Science Reference, An imprint of IGI Global, Hershey, PA.

Kim, H.S., Kim, M.Y., Cho, M.K. and Jang, S.J. (2017a), "Effectiveness of applying flipped learning to clinical nursing practicums for nursing students in Korea: a randomized controlled trial", *International Journal of Nursing Practice*, Vol. 23 No. 5, available at: http://doi.org/10.1111/ijn.12574

Kim, J., Park, H., Jang, M. and Nam, H. (2017b), "Exploring flipped classroom effects on second language learners' cognitive processing", *Foreign Language Annals*, Vol. 50 No. 2, pp. 260-284.

Kohlbacher, F. (2006), "The use of qualitative content analysis in case study research", *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, Vol. 7 No. 1, pp. 1-30.

Kostaris, C., Sergis, S., Sampson, D.G., Giannakos, M.Í. and Pelliccione, L. (2017), "Investigating the potential of the flipped classroom model in K-12 ICT teaching and learning: an action research study", *Journal of Educational Technology and Society*, Vol. 20 No. 1, p. 261.

Kurt, G. (2017), "Implementing the flipped classroom in teacher education: evidence from Turkey", *Journal of Educational Technology and Society*, Vol. 20 No. 1, p. 211.

Lai, H., Hsiao, Y. and Hsieh, P. (2018), "The role of motivation, ability, and opportunity in university teachers' continuance use intention for flipped teaching", *Computers and Education*, Vol. 124, pp. 37-50.

Lee, M. (2018), "Flipped classroom as an alternative future class model? Implications of South Korea's social experiment", *Educational Technology Research and Development*, Vol. 66 No. 3, pp. 837-857.

Lee, G. and Wallace, A. (2017), "Flipped learning in the English as a foreign language classroom: outcomes and perceptions", *TESOL Quarterly*, Vol. 52 No. 1, pp. 62-84.

Lee, J., Lim, C. and Kim, H. (2016), "Development of an instructional design model for flipped learning in higher education", *Educational Technology Research and Development*, Vol. 65 No. 2, pp. 427-453.

Lin, C.J. and Hwang, G.J. (2018), "A learning analytics approach to investigating factors affecting EFL students' oral performance in a flipped classroom", *Journal of Educational Technology and Society*, Vol. 21 No. 2, pp. 205-219.

Lo, C.K. and Hew, K.F. (2017), "Using 'first principles of instruction' to design secondary school mathematics flipped classroom: the findings of two exploratory studies", *Journal of Educational Technology and Society*, Vol. 20 No. 1, pp. 222-236.

Lo, C.K., Lie, C.W. and Hew, K.F. (2018), "Applying 'first principles of instruction' as a design theory of the flipped classroom: findings from a collective study of four secondary school subjects", *Computers and Education*, Vol. 118, pp. 150-165.

Long, T., Cummins, J. and Waugh, M. (2017), "Use of the flipped classroom instructional model in higher education: instructors' perspectives", *Journal of Computing in Higher Education*, Vol. 29 No. 2, pp. 179-200.

Luo, H., Yang, T., Xue, J. and Zuo, M. (2018), "Impact of student agency on learning performance and learning experience in a flipped classroom", *British Journal of Educational Technology*, available at: http://doi.org/10.1111/bjet.12604

McMillan, J.H. (2012), *Educational Research: Fundamentals for the Consumer*, Pearson, Boston.

McNally, B., Chipperfield, J., Dorsett, P., Fabbro, L.D., Frommolt, V., Goetz, S. and Lewohl, J. (2016), "Flipped classroom experiences: student preferences and flip strategy in a higher education context", *Higher Education*, Vol. 73 No. 2, pp. 281-298.

McTaggart, R. and Kemmis, S. (Eds) (1988), *The Action Research Planner*, Deakin University, Victoria.

Marchalot, A., Dureuil, B., Veber, B., Fellahi, J.L., Hanouz, J.L., Dupont, H. and Lorne, E. (2018), "Effectiveness of a blended learning course and flipped classroom in first year anaesthesia training", *Anaesthesia Critical Care and Pain Medicine*, Vol. 37 No. 5, pp. 411-415.

Mohamed, H. and Lamia, M. (2018), "Implementing flipped classroom that used an intelligent tutoring system into learning process", *Computers and Education*, Vol. 124, pp. 62-76.

Moranski, K. and Henery, A. (2017), "Helping learners to orient to the inverted or flipped language classroom: mediation via informational video", *Foreign Language Annals*, Vol. 50 No. 2, pp. 285-305.

Nel, L. (2017), "Students as collaborators in creating meaningful learning experiences in technology-enhanced classrooms: an engaged scholarship approach", *British Journal of Educational Technology*, Vol. 48 No. 5, pp. 1131-1142.

Ng, E.M. (2018), "Integrating self-regulation principles with flipped classroom pedagogy for first year university students", *Computers and Education*, Vol. 126, pp. 65-74.

Olakanmi, E.E. (2016), "The effects of a flipped classroom model of instruction on students' performance and attitudes towards chemistry", *Journal of Science Education and Technology*, Vol. 26 No. 1, pp. 127-137.

Özyurt, Ö. and Özyurt, H. (2015), "Learning style based individualized adaptive e-learning environments: content analysis of the articles published from 2005 to 2014", *Computers in Human Behavior*, Vol. 52, pp. 349-358.

Pearson, G. (2012), "Biology teacher's flipped classroom: a simple thing, but it's so powerful", *Education Canada*, Vol. 52 No. 5.

Reeve, J. (2012), "A self-determination theory perspective on student engagement", *Handbook of Research on Student Engagement*, Springer, New York, NY, pp. 149-172.

Sams, A. and Bergmann, J. (2013), "Flip your students learning", *Educational Leadership*, Vol. 70, pp. 16-20.

Saunders, A., Green, R. and Cross, M. (2017), "Making the most of person-centred education by integrating flipped and simulated teaching: an exploratory study", *Nurse Education in Practice*, Vol. 27, pp. 71-77.

Schwarzenberg, P., Navon, J., Nussbaum, M., Pérez-Sanagustín, M. and Caballero, D. (2017), "Learning experience assessment of flipped courses", *Journal of Computing in Higher Education*, Vol. 30 No. 2, pp. 237-258.

Sergis, S., Sampson, D.G. and Pelliccione, L. (2018), "Investigating the impact of flipped classroom on students learning experiences: a self-determination theory approach", *Computers in Human Behavior*, Vol. 78, pp. 368-378.

Sheppard, M.E., Vitalone-Raccaro, N., Kaari, J.M. and Ajumobi, T.T. (2017), "Using a flipped classroom and the perspective of families to teach medical students about children with disabilities and special education", *Disability and Health Journal*, Vol. 10 No. 4, pp. 552-558.

Shyr, W. and Chen, C. (2017), "Designing a technology-enhanced flipped learning system to facilitate students self-regulation and performance", *Journal of Computer Assisted Learning*, Vol. 34 No. 1, pp. 53-62.

Sigler, E. (2009), "Action research in public schools: is it research? Should it be reviewed?", *Journal of Empirical Research on Human Research Ethics*, Vol. 4 No. 2, pp. 17-25.

Sletten, S.R. (2017), "Investigating flipped learning: student self-regulated learning, perceptions, and achievement in an introductory biology course", *Journal of Science Education and Technology*, Vol. 26 No. 3, pp. 347-358.

Sun, J.C., Wu, Y. and Lee, W. (2016), "The effect of the flipped classroom approach to OpenCourseWare instruction on students' self-regulation", *British Journal of Educational Technology*, Vol. 48 No. 3, pp. 713-729.

Sun, Z., Xie, K. and Anderman, L.H. (2018), "The role of self-regulated learning in students success in flipped undergraduate math courses", *The Internet and Higher Education*, Vol. 36, pp. 41-53.

Thai, N.T., Wever, B.D. and Valcke, M. (2017), "The impact of a flipped classroom design on learning performance in higher education: looking for the best 'blend' of lectures and guiding questions with feedback", *Computers and Education*, Vol. 107, pp. 113-126.

Tse, W.S., Choi, L.Y.A. and Tang, W.S. (2017), "Effects of video-based flipped class instruction on subject reading motivation", *British Journal of Educational Technology*, available at: http://doi.org/10.1111/bjet.12569

Wang, F.H. (2017), "An exploration of online behaviour engagement and achievement in flipped classroom supported by learning management system", *Computers and Education*, Vol. 114, pp. 79-91.

Wang, F. and Hannafin, M.J. (2005), "Design-based research and technology-enhanced learning environments", *Educational Technology Research and Development*, Vol. 53 No. 4, pp. 5-23.

Wang, J., Jou, M., Lv, Y. and Huang, C. (2018), "An investigation on teaching performances of model-based flipping classroom for physics supported by modern teaching technologies", *Computers in Human Behavior*, Vol. 84, pp. 36-48.

Ye, S.H., Hsiao, T.-Y. and Sun, C.T. (2018), "Using commercial video games in flipped classrooms to support physical concept construction", *Journal of Computer Assisted Learning*, Vol. 34 No. 5, pp. 602-614.

Yilmaz, R. (2017), "Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classroom", *Computers in Human Behavior*, Vol. 70, pp. 251-260.

Yilmaz, R.M. and Baydas, O. (2017), "An examination of undergraduates' metacognitive strategies in pre-class asynchronous activity in a flipped classroom", *Educational Technology Research and Development*, Vol. 65 No. 6, pp. 1547-1567.

Zengin, Y. (2017), "Investigating the use of the Khan Academy and mathematics software with a flipped classroom approach in mathematics teaching", *Journal of Educational Technology and Society*, Vol. 20 No. 2, pp. 89-100.

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