

Flipped Classroom Research and Trends from Different Fields of Study

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Résumé de l'article

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Flipped Classroom Research and Trends from Different Fields of Study



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Abstract

This paper aims to analyse the trends and contents of flipped classroom research based on 20 articles that report on flipped learning classroom initiatives from 2013–2015. 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. The results of the analysis were interpreted using descriptive analysis, percentages, and frequencies. This analysis found that various fields were practiced in the flipped classroom approach, and some technology tools were used as the online platform for its practice. Analysis of the impacts showed that flipped classroom brought positive impacts toward students' learning activities such as achievement, motivation, engagement, and interaction. Several issues in this discussion become implications that can be taken into consideration for future research. Some challenges found in applying flipped classroom are needed to be addressed by future researchers, such as suitability of the flipped classroom for poor quality of video lectures and untrained instructor. This study also becomes an implication for government or policymakers to determine the flipped classroom as a contemporary model to be implemented in teaching-learning activities for higher education, even K-12 students.

Keywords: flipped classroom, Bloom's revised taxonomy, achievement, engagement, motivation, interaction, content analysis, research trends

Introduction

Technology in the twenty-first century puts instantaneous access to information, and the Internet can be handily accessed through numerous technology tools such as laptop, computer, and Smartphone

(Fu, 2013). Now more than ever, students spend much of their waking time on using some sort of technology tools; by using this technology, it is possible for them to interact with friends, instructors, and learning content everywhere, not only in the class but also outside the class through distance learning (Fisher, 2009). Also, many free learning materials have been provided on Web sites for learning activities. Richter and McPherson (2012) argued that in today's digital age, every student can access many free Internet learning resources such as online video lectures and they can watch these free contents everywhere and at their convenience. Even more, the use of the traditional learning approach which focuses on the instructor as the centre of knowledge is irrelevant in today's digital age (Wang & Heffernan, 2010). As a solution, traditional classroom activities such as lectures, labs, homework, and exams can be moved to the Web 2.0 technology and students can study everywhere outside the classroom (Staker & Horn, 2012). This positive impact of technology growth has influenced the development of instructional technology in education and replaced the use of the blackboard with online video lectures (Evans, 2011).

Halili, Razak, and Zainuddin (2014) mentioned that the use of Web 2.0 technology in education can build professional relationships through collaborating, coaching, and mentoring for social interactions in sharing ideas. In other words, by using various technological devices, the learners can study in different locations and times through collaborative distance learning. Therefore, living in a digital age demands the learners to work independently and collaboratively before coming to the classroom using various technology tools. New learning instructions that have emerged are now influencing education positively and producing students' independent learning. Indeed, technology in education is an ever-evolving process and demands the students and instructor always update the emerging technology in education. According to the Horizon Report which focuses on exploring and reporting emerging technology in education, the flipped classroom has been highlighted as an emerging technology for higher education which is very important to use at college level (Johnson, Adams Becker, Estrada, & Freeman, 2014). Therefore, by this reason the authors believe that it is very significant to examine the contents of current articles that report flipped learning classroom initiatives from the scholarly journals.

Related Literature Review and Theoretical Framework

In recent years, the flipped classroom has become one of emerging technologies in education and it can be a standard of teaching-learning practice to foster students' active learning in higher education (Hamdan, McKnight, McKnight, & Arfstrom, 2013). The flipped classroom is an approach to teaching and learning activities where students watch a video lesson outside the class through distance learning and have hands-on activities in the class. Halili and Zainuddin (2015) note that the flipped classroom or reverse classroom is an element of blended learning, integrating both face-to-face learning in the class through group discussion and distance learning outside the class by watching asynchronous video lessons and online collaboration. Blended learning is simply defined as the activity of teaching and learning which combined face-to-face physical activities with online learning (Heilesen, 2010; Lean, Moizer, & Newbery, 2014; Poon, 2014). Blended learning was practiced by mixed face-to-face and distance teaching and learning or the integration of both distance and face-to-face modalities to deliver instruction.

Flipped classroom is also known as a student-centred 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 & Bergmann, 2012). Hence, by applying the flipped classroom approach to teaching and learning activities, the instructor can move the traditional lecturer's talk to video and the students can listen to the lectures anywhere outside of class. 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 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, while the lecturer will use various technology media in their teaching practices (Zainuddin & Attaran, 2015).

The study of flipped classrooms was based on the theory of Bloom's revised taxonomy of cognitive domain. This taxonomy provides six levels of learning. The explanation is arranged from the lowest level to the highest level:

1. Remembering: in this stage, the students try to recognize and recall the information they receive; they also try to understand the basic concepts and principles of the content they have learned.
2. Understanding: the students try to demonstrate their understanding, interpret the information and summarize what they have learned.
3. Applying: the students practice what they have learned or apply knowledge to the actual situation.
4. Analyzing: the students use their critical thinking in solving the problem, debate with friends, compare the answer with peers, and produce a summary. The students obtain new knowledge and ideas after implementing critical thinking or a debate in group activities. In this level of learning, the students also produce creative thinking.
5. Evaluating: assessment or established peer-review knowledge, judge in relational terms; in this stage, students are evaluating the whole learning concepts and they could evaluate or make judgment on how far they successfully learned.
6. Creating: the students are able to design, construct and produce something new from what they have learned (Bloom, 1969).

In implementing flipped classroom, remembering and understanding as the lowest levels of cognitive domain are practiced outside the class hour (Krathwohl & Anderson, 2010). While in the classroom, the learners focused on higher forms of cognitive work, including applying, analyzing, evaluating, and creating. The following Figure 1 illustrates the level of students' learning in the flipped learning according to Bloom's revised taxonomy.

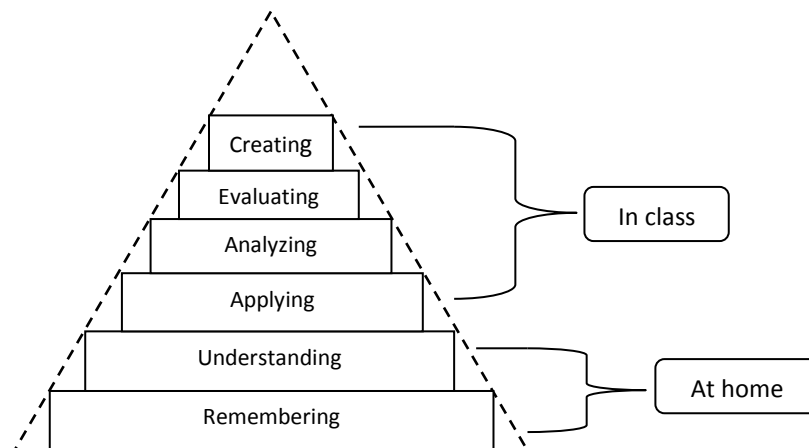


Figure 1. Bloom's revised taxonomy in the flipped classroom

With the flipped model, the lower levels are presented before class through recorded lectures and video. Readings, simulations, and other materials also provide this foundational support for learning so that in-class time can be spent working on higher levels of learning from application to evaluation. In flipped classrooms, students go from the lowest level (remembering) to achieve the highest level (creating). Lankford (2013) mentioned that the flipped classroom focuses on how to support the learners in achieving a higher level of the taxonomy domain. Additionally, Nederveld and Berge (2015) added that in flipped learning, classroom activity is spent on application and higher-level of learning rather than listening to lectures and other lower-level thinking tasks. As shown in Table 1, implementing flipped learning allows the students to spend more time supporting higher-level learning tasks such as a group discussion, while lower-level tasks such as knowledge and comprehension are completed independently outside the class.

Table 1

Comparison Between Traditional Classroom and Flipped Classroom in Achieving Higher Order Thinking of Bloom's Taxonomy

Level of learning	Traditional classroom tools	Flipped classroom tools
Remembering	Face-to-face lecture	Pre-recorded lecture, reading material, and watching video lectures independently
Understanding	Question and Answer	Reflection, peer-to-peer discussion and collaboration
Analyzing	Homework	Classroom activities such as a group discussion
Applying, Evaluating, Creating	Homework or nothing	Student projects, presentations, peer-evaluation and instructor-evaluation.

Purpose of the Study and Research Questions

The flipped classroom approach is commonly studied and used in various educational institutions worldwide. Therefore, we intend in this paper to provide more contribution on essential aspects to be considered when implementing the flipped classroom approach in educational settings. This review intends to identify the most frequently employed methodologies, area of studies, technology tools, most commonly keywords used and works the cited authors, impacts of students' learning, and challenges of flipping the class through a content analysis of the 20 most influential articles in 2013–2015. We also hoped that this study will encourage future researchers or policy makers to expand further their state-of-the-art and theoretical considerations, needed for undertaking their projects and derived publications in the flipped classroom approach.

Thus, the analysis of this study addresses the following research questions:

1. What methodologies have been frequently employed in flipped classroom research?
2. What areas of flipped classroom studies have been researched?
3. What technology tools or online platforms have been used for implementing the flipped classroom?
4. What are the most commonly used key words in flipped classroom research?
5. What are the most frequently work cited references in flipped classroom research?
6. What are the impacts of applying the flipped classroom on students' learning?
7. What are the challenges of applying the flipped classroom approach?

Methodology

Research Design

This study was conducted through content analysis to analyse 20 refereed journal articles on flipped classroom instruction published from years 2013 to 2015. Content analysis is a research technique usually applied in social science and the humanities (McMillan, 2000). Creswell (2012) notes that content analysis is a method which studies the content of written texts, artefacts, pictures, and recordings. 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 & 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, Bozkurt et al., (2015) 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. In this study, they 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. The findings of the study were interpreted using descriptive analysis (frequencies) and social network analysis. The findings and discussion in this study could become a basis for potential future research of the flipped classroom approach and the study in the area of distance education.

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. Data were analyzed by descriptive analysis including frequencies and percentages. The result showed that in terms of learning styles, more than half of the studies employed Felder-Silverman and Kolb learning styles.

Thus, 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 analysing the material in a step-by-step process. The steps to follow are the following: firstly, content analysis of the journal articles was conducted by formulating. Secondly, twenty influential or impact journal articles on the flipped classroom published in 2013, 2014 and 2015 were selected from various fields of study. Thirdly, categories the main point to be analysed, including methodologies, area of studies, technology tools, students' impact, most commonly key words used and work reference citations, impacts of students' learning, and challenges of flipping the class. The results of the analysis were interpreted using descriptive analysis, percentage, and frequencies to interpret the themes and obtain the most frequently employed categories in flipped class research. Fourthly, data were analysed and reported systematically beginning with the most frequently employed methodologies, area of studies, technology tools, most commonly keywords used and works the cited authors, interpretation of impacts of students' learning, and challenges of flipping the class. Then, the researcher concluded and suggested potential future research into the flipped classroom that could be carried out to contribute to the literature on flipped classroom approach.

Sample

The present study investigated 20 peer-reviewed scholarly articles published from 2013–2015. The 20 journals were retrieved and analyzed using the following rationales:

- A specific focus on flipped classroom research
- Refereed journals that were indexed by prominent databases (Social Sciences Citation Index (SSCI)/ Thomson Reuters and Scopus)
- A current publication in years 2013, 2014 and 2015
- Containing various field of studies

- The 20 journals were accessed and found through electronic databases such as ScienceDirect (<http://www.sciencedirect.com/>), SpringerLink (<http://www.springer.com/gp/>), and Taylor & Francis Online (<http://www.tandfonline.com/>).

Ten articles were selected and reviewed from professional journals and published in the Social Sciences Citation Index (SSCI), namely: *The International Review of Research in Open and Distributed Learning* (IRROD), *Educational Technology Research and Development* (ETR&D), *The Internet and Higher Education* (I&HE), *Computers & Education* (C&E), *Journal of Nursing Education* (JNE), *BMC Medical Education*, *Journal of Sociology* (JS), *Computer Assisted Language Learning* (CALL), and *Educational and Psychological Measurement* (EPM). The study also examined 10 articles selected from the Scopus® database: *Advances in physiology education* (APE), *American Journal of Pharmaceutical Education* (AJPE), *The Journal of Negro Education* (JNE), *International Journal of Mathematical Education in Science and Technology* (IJMEST), *International Review of Economics Education* (IREE), *TechTrends*, *PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies*, *Nurse Education in Practice* (NEP), *Journal of Political Science Education* (JPSE) and *Academic Medicine* (AM).

There were seven journals published in 2013, nine journals published in 2014 and four journals published in 2015 (see Appendix).

Findings and Discussion

In this study, 20 journals were examined during the three years of publication (2013–2015). The descriptive analysis in the form of percentage and frequency was used in analyzing the data. Discussion was carried out based on the percentages reported systematically beginning with the most frequently employed methodologies, area of studies, technology tools, most commonly keywords used and works the cited authors, impacts of students' learning, and challenges of flipping the class. From the articles reviewed, the research findings of this study are elaborated as follows.

Research Methodologies Employed in Flipped Classroom Research

Various methodologies were employed in flipped classroom research from 20 journals examined. The first analysis explored the research question of what methodologies have been frequently employed in flipped classroom research. This analysis found that the most frequently used methodologies in flipped classroom research were the mixed-method approach (quantitative and qualitative), followed by the quantitative approach. This analysis began with the finding which used multiple instruments to collect rich information and identify effective flipped learning practices (e.g., Chen, Wang, & Chen, 2014; Roach, 2014; Kong, 2014; Davies, Dean, & Ball, 2013; Enfield, 2013; Galway, Corbett, Takaro, Tairyan, & Frank, 2014; Hung, 2015; Kim, Kim, Khera, & Getman, 2014; McGivney-Burelle & Xue, 2013; McLaughlin et al., 2013; Simpson & Richards, 2015; Talley & Scherer, 2013). The instruments used in collecting the data were mainly tests, questionnaires, documents, and interviews. For example, McLaughlin et al. (2013) used survey and open-ended text comments to collect data. Kim et al. (2014) also collected data from diverse sources including surveys, interviews, instructor reflections, and documents (e.g., meeting minutes, course syllabi, and student outcomes).

Another most frequently used method was quantitative approaches and most research testing the effectiveness of the flipped classroom studied and identified students' perceptions through survey.

The quantitative research of the flipped classroom has been conducted by numerous researchers (e.g., Baepler, Walker, & Driessen, 2014; Chen & Summers, 2015; Love, Hodge, Grandgenett, & Swift, 2014; McLaughlin et al., 2014; Missildine, Fountain, Summers, & Gosselin, 2013; Tune, Sturek, & Basile, 2013; Touchton, 2015; Warner, Koufteros, & Verghese, 2014). In collecting the data, Baepler et al. (2014) for example, used experimental research design to examine active learning between a flipped classroom and a traditional classroom; they used a post test-only non-equivalent groups design involving undergraduate students in three sections of a general chemistry course. In addition, Tune et al. (2013) used a survey to determine students' perspectives regarding the flipped classroom model at the end of the course. However, in this analysis, the authors did not find a qualitative approach employed such as using a single instrument interview, focus group discussion, or observation. The following two figures (Figures 2 and 3) show the percentage composition of research methods in flipped classroom research from 20 selected articles journal published in 2013, 2014 and 2015.

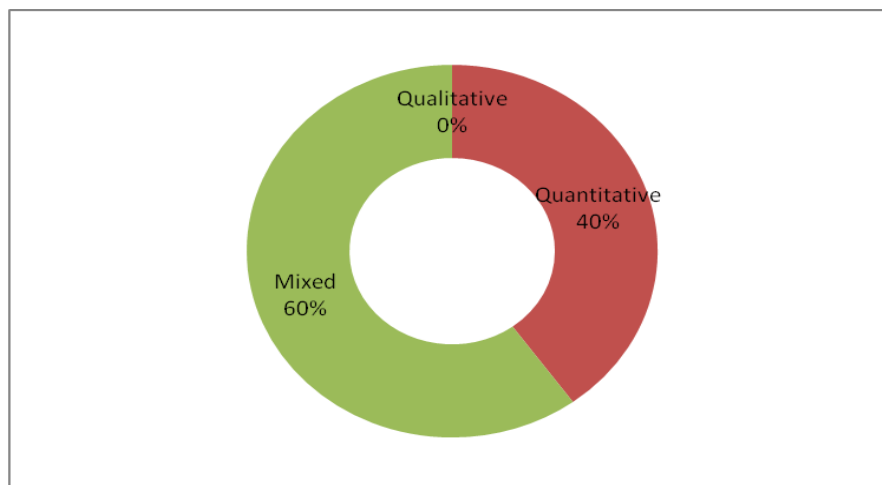


Figure 2. Percentage of research methods.

According to the methodology used in 2013, there were five journals that used mixed-method and three journals that employed quantitative methods. Likewise, in 2014, there were five journals that used the mixed-method approach and three journals that were designed by the quantitative approach. While in 2015, there were two journals published using quantitative methods and two journals that used the mixed-method approach. Figure 3 summarizes the frequency of research methods used in each year of publication.

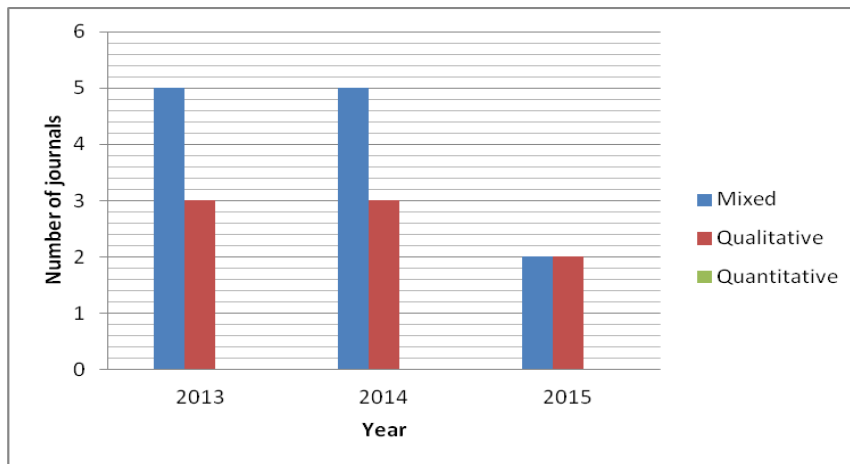


Figure 3. Frequency of research methods in each year.

In terms of participants or samples, all participants in this study were students from different levels of study. The majority of participants were undergraduate students or first year college students (e.g., McGivney-Burelle & Xue, 2013; Touchton, 2015; Talley & Scherer, 2013; Simpson & Richards, 2015; Enfield, 2013; Davies et al., 2013; Beapler et al., 2014; Kim et al., 2014; Hung, 2015; Roach, 2014; Mclaughlin et al., 2013). The second most participants were graduate students (e.g., Chen et al., 2014; Galway et al., 2014; Tune et al., 2013; Mclaughlin et al., 2013). The third were college students without detailed information whether undergraduate or graduate level (e.g. Warner et al., 2014; Love et al., 2014; Missildine et al., 2013). Then, only a study by Kong (2014) used students as participants without having specified from which level of education they were enrolled.

Furthermore, in terms of data collection (instruments), Figure 4 shows that the most instruments used in the flipped classroom research was survey (28%), followed by testing course (28%), interview (14%), observation (7%), existing test score (5%), document analysis (5%), and analysis of logs system (2%).

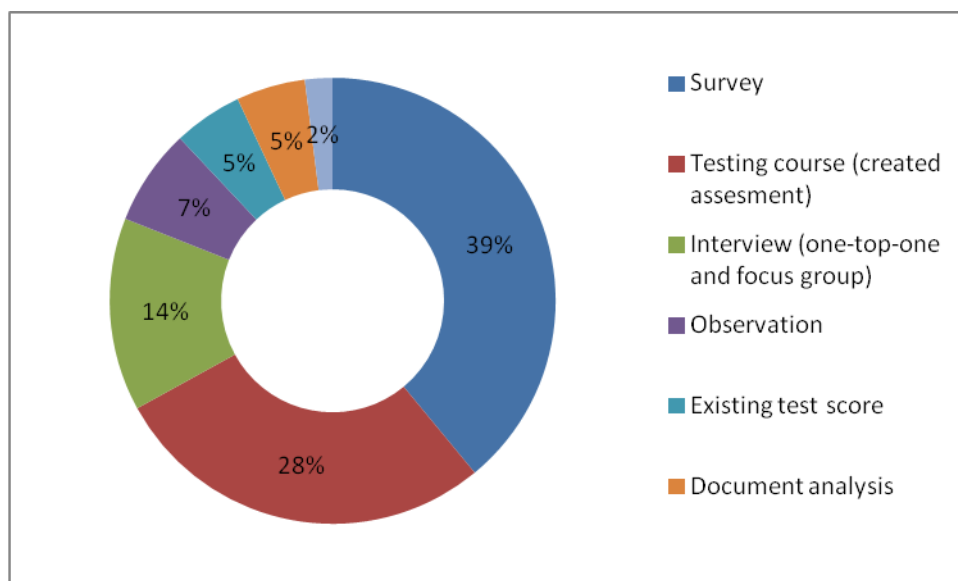


Figure 4. Data collection (instruments).

Area of Studies in the Flipped Classroom

Besides the different methodologies used in flipped classroom research, there were many areas of study where the flipped classroom had been implemented during the three years. The analysis of this explored the research question “What areas of flipped classroom studies have been researched?” This study reported that the flipped classroom had been implemented in various areas of study. Morgan (2014) mentioned that many instructors from different fields of study in the United States of America (USA) tried to conduct experiments study in using the flipped classroom approach. Sams and Bergmann (2012) also showed that flipped classroom instruction is not only applied in chemistry and math classes, but also in all areas of study.

Various studies in flipped classroom in 2013, 2014 and 2015 showed different fields of studies, including science and social courses, such as information systems (Davies et al., 2013), chemistry (Baeppler et al., 2014), algebra (Love et al., 2014), economics (Roach, 2014), engineering, sociology and humanities (Kim et al., 2014), integrated humanities (Kong, 2014), physiology (Talley & Scherer, 2013), statistics (Touhcton, 2015), public health (Simpson & Richards, 2015), calculus (McGivney-Burelle & Xue, 2013), science, technology, engineering, or mathematics (STEM; McLaughlin et al., 2014), business (Warner et al., 2014), and English language (Hung, 2015).

Technology Tools or Online Platforms Used in the Flipped Classroom

Diverse technology tools or online platforms have also been used in flipped classroom research. Hence, this section will answer the research question three “What technology tools or online platforms have been used for implementing the flipped classroom?” In applying the flipped classroom approach, there are various technology tools such as Wikis and Blogs can be employed to interact virtually outside the class and used to work collaboratively to solve problems or exchange ideas. These tools allow the users to share text, pictures, and videos with other users during distance learning (Pempek, Yermolayeva, & Calvert, 2009). This study shows that various technology tools or online platforms have been used by students to access online video or contents before coming to class. The students also used these platform tools to study through online collaboration outside the class. Staker and Horn (2012) mentioned that the activity of teaching and learning is not only limited to behind the classroom wall, but can also take place outside the class. Therefore, by using various technology media or online platforms, students can study virtually, watch learning subjects for free all the time and interact with students and instructors outside of the class.

Here, we share some examples of different online platforms used in the flipped classroom practice. Love et al. (2014) reported that the screencasts were developed specifically in a flipped linear algebra course and the instructor created the presentations using the LaTeX beamer package. Roach (2014) used a Blog as online platform to share the video lectures; students had to access and watch one video per week that was available on a Blog. Hung (2015) used a WebQuest to establish students’ active learning in and English language class. Missildine et al. (2013) reported that 16 master’s-prepared faculty members taught two courses via interactive television on three campuses. While Kim et al. (2014) reported that students in a flipped classroom watched video lectures on YouTube and collaborated on Google Docs and Google Hangout. Table 2 summarizes various technological tools or online platforms have been employed in flipped classroom research.

Table 2

Technological Tools or Online Platforms in Flipped Classroom Research (2013–2015)

Source: (author, year)	Technology tools or Online Platforms
Davies et al. (2013)	MyITLab videos and software simulation
McLaughlin et al. (2013)	Echo360 Classroom Capture (Echo360 Inc., Dulles, VA), the Sakai Website, Integrated Learning Accelerator Modules (ILAM).
Talley and Scherer (2013)	Recorded tools, webcam, laptop, tablet device, or mobile phone. Blackboard® Journal page.
Love et al. (2014)	Online screencasts and LaTeX beamer package.
Roach (2014)	Blog, online software (http:// ed.ted.com), video sources adopted from: Khan Academy, Freakonomics; NPR: Planet Money; PBS: Idea Channel; Wall Street Journal: Opinion Journal.
Kim et al. (2014)	YouTube video, Blackboard LMS , Google Docs, and, Dropbox, Google Hangout.
Baepler et al. (2014)	A video message board, microphones, large-screen monitors, whiteboards, and wireless.
Kong (2014)	A tablet PC, Online pre-lesson learning and a Web-based word processor (Google Docs).
Missildine et al. (2013)	Interactive television.
Enfield (2013)	Course Website (http://www.jacobenfield.com/allThingsWeb)
Galway et al. (2014)	Course Website (http://www.NextGenU.org)
Hung (2015)	WebQuest
McGivney-Burelle and Xue (2013)	The TI-89 graphing calculator and WeBWork (an online homework system), Maple Worksheets, mathlets, videos, clickers, and e-textbooks.

Keywords Indicated

Besides title and abstract, keywords play a crucial role in journal publication and they have a great impact on user searches or basic information on the Internet search engine (Day & Gastel, 2012). The researcher needs to choose appropriate keywords for their journal articles for indexing purposes, well-chosen keywords enable their articles to be more rapidly identified and cited by others. Otherwise, readers would not be able to find or cite their articles without using relevant keywords.

Through this analysis, the readers would know the most commonly used keywords in 20 flipped classroom article journals which reflected the research paper topic. In this study, the researchers found a total of 81 keywords from the analysis of 20 selected articles. This analysis investigated the research question four, which it is “What are the most commonly used key words in the flipped classroom research?”

From 81 keywords identified in 20 journals, seven keywords most frequently appeared in several articles and flipped classroom was used as the main keyword, followed by active learning, blended learning, flipped learning, technology integration, pedagogical issues and e-learning. Figure 5 summarizes the most commonly used keywords in flipped classroom research.

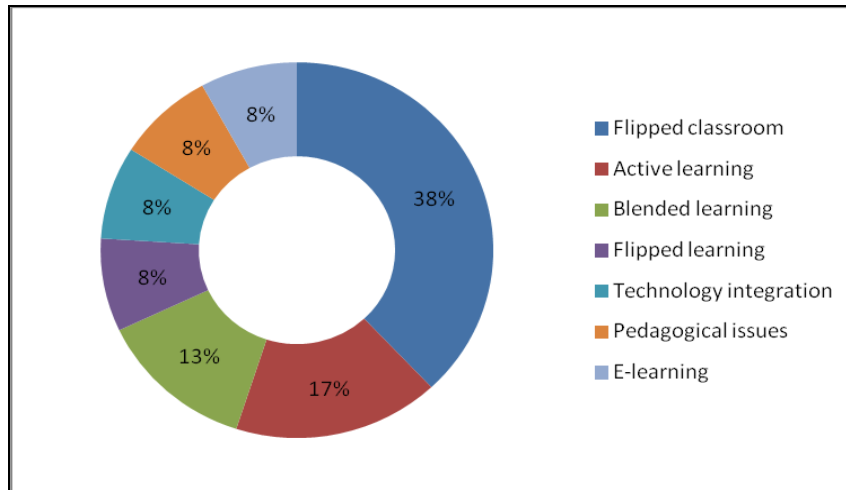


Figure 5. The most commonly used keywords in the flipped learning research publication.

The Most Frequently Cited References

Flipped classroom is an instructional strategy in education and becomes one of the most studied in recent years. Therefore, through this analysis, we found the most cited reference by researchers regarding the flipped classroom study. This part will analyze the trends of citation in the flipped classroom research and it will explore the research question “What are the most frequently cited references in the flipped classroom research?”

The researchers found a total of 605 references from 20 selected articles of flipped classrooms and the most highly cited reference was Bergmann and Sams (2012) from a book entitled “Flip Your Classroom, Reach Every Student in Every Class Every Day”, a total of citation was eight times. From this result, we assume that high citation was influenced by their roles and contribution of the pioneers of the flipped class movement after successfully flipping their class. According to Halili and Zainuddin (2015), Jonathan Bergman and Aaron Sams are high school chemistry teachers in Colorado, United States and they began implementing the flipped classroom in 2007 by video-recording learning materials and sharing them with students to be learned at home.

Likewise, the article by Lage, Platt and Treglia (2000) was also cited eight times in 20 flipped classroom articles, their article has been published seven years before the flipped classroom model was popularized by Bergman and Sams in 2007. Lage, Platt, and Treglia in a paper entitled “Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment” discussed their research on flipped classrooms at the college level which focused on two college economics courses. However,

according to a Google scholar (<https://scholar.google.com/>) report in April 2016, Bergmann and Sams' book (2012) has more citations with 864 times compared to Lage et al. (2000) with the citation of 797 times. The following Table 3 summarizes the trends of references that have been cited at least 5 times.

Table 3

The References List of Most Cited Studies

Rank	Frequency	References
1	8	Bergmann, J., & Sams, A. (2012). <i>Flip your classroom: Reach every student in every class every day</i> . Washington, DC: Internal Society for Technology in Education.
1	8	Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. <i>The Journal of Economic Education</i> , 31(1), 30-43.
2	5	Deslauriers, L., Schelew, E., & Wieman, C. (2011). Improved learning in a large-enrollment physics class. <i>Science</i> , 332(6031), 862-864.
2	5	Berrett, D. (2012). How 'flipping' the classroom can improve the traditional lecture. <i>The Chronicle of Higher Education</i> , 12, 1-14.
2	5	Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. <i>Learning Environments Research</i> , 15(2), 171-193.
2	5	Baker, J. W. (2000). The "classroom flip": Using web course management tools to become the guide by the side. <i>11th International Conference on College Teaching and Learning</i> , (pp. 9-17). Jacksonville, Florida, United States.

Impacts on Students' Learning

In addition, several studies showed that the flipped classroom had positive impacts on teaching and learning practice. The analysis of this explored the research question "What are the impacts of applying the flipped classroom for students' learning?" In this study, the researchers found a number of positive impacts in flipped learning practice: students' achievement, students' motivation, students' engagement, and students' interaction.

Students' achievement. Achievement tests can provide an accurate snapshot of how well students are performing on various subjects. The structure of innovative learning environment and pedagogical strategy is the most pivotal factor that will increase student achievement in learning

activities (Huang & Chiu, 2015). Therefore, the main goal of the emergence of the flipped classroom in education is to enhance student learning and achievement by focusing class time activities on student understanding and hands-on activities rather than on lecture. Some researchers have implemented the flipped classroom model to examine students' achievement in learning various subjects. The following reports showed that the flipped classroom model has effectively supported students' learning achievements with several motives.

Previous studies reported that students in flipped classrooms could obtain similar high examination scores when the class was flipped and that they could prepare for the subject before coming to class (Galway et al., 2014). Davies et al. (2013) conducted a study to explore how the use of technology in the flipped classroom might be utilized to effectively promote students' achievement. The findings showed that using technology was effective and scalable in a flipped classroom, and students' post-test scores in a flipped classroom improved compared to their pre-test scores. In term of pre-test and post-test comparison achievement, other studies also reported in which students statistically improved their learning and mastering of the subject in a post-test. In other words, the students have shown that they can understand the learning content and obtain a high score in the test or exam (Enfield, 2013; Kong, 2014; Talley & Scherer, 2013).

Furthermore, applying flipped classroom model is more effective compared to traditional classroom in term of students' achievement. Beapler et al. (2014) released the results of their research showing that students' outcomes in a flipped classroom were significantly better than those in a conventional classroom or control class, and students' perceptions of the learning environment were also improved. Hung (2015) in her study reported that the structured and semi-structured flip lessons were more effective instructional designs than the non-flip lessons (flip > semi-flip, flip > non-flip, $p < .05$) in teaching the English language. In the same manner, McGivney-Burelle and Xue (2013) also noticed that flipping pedagogy in calculus was effective and worth the significant investment of faculty time and effort compared to traditional class.

Formative assessment was also one of the reasons that students improved their learning achievements. The instructor always gave feedback to facilitate students' improvement. Kim et al. (2014) noted that through formative assessment in the flipped classroom, the instructor could evaluate students' improvement in their learning activities while the students could understand what needed to be done to overcome their deficiencies in learning. Additionally, according to report by McGivney-Burelle and Xue (2013), students' ability to pause and re-watch the videos at any time may affect students' effective learning; they also enable students to take notes from the videos at their own pace. The following Table 4 summarizes students' effective learning achievements in flipped classroom research.

Table 4

Students' Achievement

Author(s) and year	Impacts
Davies et al. (2013)	Achievement of most students was significantly improved compared to the traditional class.
Tune et al. (2013)	By having a quiz and class meeting, students'

	performance was improved especially in the exam.
Missildine et al. (2013)	Flipped classroom can improve students' performance.
Enfield (2013)	Effective in helping students learn the content of learning.
Talley and Scherer (2013)	Improved students' average course grades when compared to a previous semester without flipping.
McGivney-Burelle and Xue (2013)	Flipping pedagogy in calculus was effective and worth the significant investment of faculty time and effort compared to traditional class.
Baepler et al. (2014)	Experimental class with a flipped classroom was more effective and improved students' learning compared to a conventional or control class.
Kim et al. (2014)	Students felt the formative assessment through which they could improve their weaknesses in mastering the content very helpful.
Galway et al. (2014)	Students achieved similar high examination scores.
McLaughlin et al. (2014)	The flipped classroom has improved students' exam performance.
Hung (2015)	The structured and semi-structured flip lessons were more effective instructional designs than the non-flip lessons.

Student's motivation. Besides students' achievement or effective learning, students' motivation also played a significant role in implementing the flipped classroom. Motivation is an inner power that pushes humans to take an action or move toward a goal (Harmon-Jones, Harmon-Jones, & Price, 2013). Students' motivation is defined as a spirit, initiative, and willingness of students to attend and learn material (Cole, Field, & Harris, 2004). In education, motivation is acknowledged as one of the most crucial elements which support students' performance and achievement.

According to self-determination theory, students' motivation is distinguished into two main types: intrinsic and extrinsic motivation (Abeysekera & Dawson, 2015). Intrinsic motivation refers to those actions that individuals engage in as they are inherently interesting, fun, exciting, and enjoyable, while extrinsic motivation refers to individuals engaging in actions because they lead to reward or to avoid punishment (Deci & Ryan, 2002; Ryan & Deci, 2000). Likewise, this analysis showed that the flipped classroom has promoted students' empowerment, development, and ability to learn independently or at their own pace (McLaughlin et al., 2013; Galway et al., 2014).

Even more, the flipped classroom's success relies upon students undertaking substantial out-of-class work—and being motivated to do so independently (Kim et al., 2014). Many studies showed that the impact of applying the flipped classroom was to increase students' motivation in relation to learning activities. For example, Davies et al. (2013) mentioned that students were able to learn based on simulated learning and that they were motivated to learn at their own pace; they also noted that the students wished to recommend the flipped classroom to their other friends.

The flipped classroom also increases self-perceived knowledge or self-efficacy in independent learning (Galway et al., 2014; Enfield, 2013). McLaughlin et al. (2014) mentioned that the strategy of the flipped learning approach will foster students' motivation in further learning. Their study indicated that the ILAM LMS (Integrated Learning Accelerator Modules) allowed students to learn at their own pace outside the class. In terms of in independent learning, McGivney-Burelle and Xue (2013) also noted that students are able to work at their own pace in class. Therefore, it can be implied that learning environments created by the flipped classroom approach are likely to satisfy students' needs for competence, autonomy, and relatedness and, thus, entice greater levels of intrinsic motivation. The following Table 5 summarizes students' motivation in flipped classroom research.

Table 5

Students' Motivation

Author(s)	Impacts
Davies et al. (2013)	Students were able to learn based on simulated learning, they were motivated to learn at their own pace, and recommended flipped learning to other friends.
Enfield (2013)	The flipped classroom can improve students' self-efficacy in independent learning.
Kim et al. (2014)	Students undertake substantial out-of-class work—and are motivated to do so independently.
Galway et al. (2014)	Increase in self-perceived knowledge.
McLaughlin et al. (2014)	The strategy of flipped learning approach will foster students' motivation in further learning.
McGivney-Burelle and Xue (2013)	Students are able to work at their own pace in class.

Students' engagement. The next positive impact is enhancing students' engagement. All researchers probably agree that the aim of flipped learning is to establish students' engagement with active learning. Students' engagement refers to students' active learning or students' desire to actively participate in routine class activity such as submitting homework, listening to the topic, working on what the instructor asks them to do, and actively attending the class (Yang & Cheng, 2014). Likewise, Zepke, Leach and Butler (2009) mentioned that students' engagement resulted from students' motivation. The term students' engagement is frequently used for students' active learning or students' desire to actively participate in routine class activity such as submitting homework, listening to the topic, working on what the instructor asks to do, and actively attending the class (Delialioglu, 2012).

Several studies showed that students had engaged in the flipped classroom. Kim et al. (2014) reported that students were able to prepare for in-class activities by watching and exploring on-line learning materials (e.g., online video lectures) before coming to class. Students felt confident when learning in

the class because they had already prepared the lesson before coming to class. Talley and Scherer (2013) also reported that students could confidently produce a summary of the biological process in their own words by implementing the flipped classroom and they could be active in the class. Other researchers also mentioned students' confidence—by interacting with asynchronous video lectures outside the class, they could be more confident and prepared when participating in discussions in the class (Kim et al., 2014).

Students can enhance their engagement in classroom activity, participate in discussions, exchange ideas, and solve problems with their peers (McLaughlin et al., 2013). The use of the flipped classroom also promotes students' empowerment, development, engagement, and critical thinking. The study conducted by Chen et al. (2014) reported that students were satisfied with the class meeting, their attendance of the class was improved, and they had opportunities for active learning rather than listening to long lectures. He also mentioned that the number of students who came to class in the flipped classroom (in 2013) was 110, which was better than the previous year (in 2012) when the class was not flipped and the number of students was 88. Hung (2015) reported that the students engage the learning environment and engaged in the learning process. McLaughlin et al. (2014) also reported that students participated and engaged in discussions in class, and they were confident in their ability to apply the knowledge. Additionally, McGivney-Burelle and Xue (2013) also noted that students enjoyed having the instructor available in class to help them while they worked on problems.

From all findings, it showed that the flipped classroom has been successfully practiced to better engage students in learning various subjects. In contrast, the class without flipping or traditional class tends to produce disengaged learning environment because this conventional learning model has some problems. For example, teaching and learning activities only focus on text books and lectures, and students tend to be disengaged in active learning because they have a lack of time to express their abilities or performances in class. Traditional learning tends to produce a low level of student engagement, and students often pay less attention to the subjects they learn (Carini, Kuh, & Klein, 2006). Nguyen (2010) also noted that traditional class activities also focus on textbooks and lecture talks; students tend to be disengaged in their learning activity. Hence, students who are disengaged in learning will show some negative habits such as boredom, restlessness, and disruptive behavior (Freeman et al., 2007). The following Table 6 summarizes students' engagement in flipped classroom research.

Table 6

Students' Engagement

Authors and year	Impacts
McLaughlin et al. (2013)	Students can enhance their engagement in classroom activity, participate in discussions, exchange ideas, and solve problems with peers.

Chen et al. (2014)	Students were satisfied with the class activities, their attendance improved, and they had more opportunities for active learning.
Talley and Scherer (2013)	Students can confidently produce a summary of the biological process in their own words.
Missildine et al. (2013)	Students have engaged in active learning.
Kim et al. (2014)	By interacting with asynchronous video lectures outside the class, students were more confident and prepared while discussing in the class.
McLaughlin et al. (2014)	Students participated and engaged in discussions in class and improved high level of confident to apply their knowledge.
Hung (2015)	Students engage the learning environment and engaged in the learning process.

Students' interaction. Students' interaction is the other positive impact in a flipped classroom environment either in the classroom or in distance learning. Students' interaction refers to students' communication with all the elements in the learning environment including the instructor, students, and content (Woo & Reeves, 2007). It proves that students' social interaction in technology learning environment is more effective than that in traditional classroom without using technology; students in traditional classroom only interact physically in the classroom but not outside class hours (Wang, 2013). It can be assumed that students' social interactions will increase when technology media is integrated in teaching-learning activities. Technology use will indeed help students interact easily with all communities both inside and outside the class.

According to Moore (1989), three fundamental interactions should be established for successful teaching-learning with technology-based learning: student-content interaction, student-teacher interaction and student-student interaction. Hillman, Willis, and Gunawardena (1994) suggested student-interface interaction or interaction with technology tools as the fourth interaction to complete Moore's concept. All these interactions are very significant elements to apply in the flipped classroom approach in which technology is used as media to relearn and interact outside the classroom. Roach (2014) reported in his research that the students responded positively about flipping the classroom because the instruction helped them to collaborate with each other to solve problems. The flipped classroom enabled students to build a learning community and exchange ideas to solve problems (Kim et al., 2014). Another reported that it could build the dialogue inside the class or virtually through distance learning outside the class hours (McLaughlin et al., 2013).

Love et al. (2014) compared the effectiveness of two teaching methods (a traditional lecture and a flipped style) in a sophomore-level linear algebra course at a mid-sized metropolitan university. The findings showed that the students had a positive perception of the flipped classroom according to their experience of studying for one semester. It was mentioned that students had more opportunities to

interact with one another and this helped them learn from other students. Missildine et al. (2013) reported that the blending of new technology and the traditional classroom had established students' interactive learning, particularly outside the class through LMS. Another study mentioned that students can enrich the dialogue with their friends both inside and outside the class because the activity of teaching-learning in a flipped classroom is not just limited to behind the classroom wall (McLaughlin et al., 2013). Also, Hung (2015) reported that 75 students (64%) in flipped learning class increased their interactions with the instructor and classmates. The following Table 7 summarizes students' interaction in flipped classroom research.

Table 7

Students' Interaction

Authors	Impacts
Love et al. (2014)	Students had more opportunities to collaborate with each other.
Roach (2014)	The instruction helped them to work together in a group interactively to solve problems.
Missildine et al. (2013)	The blending of new technology and the traditional classroom has established interactive learning.
Kim et al. (2014)	Flipped classroom enables students to build a learning community and exchange ideas to solve problems.
McLaughlin et al. (2013)	Students can enrich the dialogue with their friends both inside and outside the class because the activity of teaching-learning in a flipped classroom is not only limited to behind the classroom wall.
Chen et al. (2014)	Flipped learning has increased students' interactions and enhanced interactions between all parties.
Hung (2015)	Participants in flipped learning approach were enhanced interaction with the instructor and classmates.

Challenges in the flipped classroom approach. On the other hand, Kim et al. (2014) reported that there was no evidence that flipped learning had improved students' grades. They mentioned that there were some limitations and required future research into areas such as achievement scores, technology, and how pedagogy must be integrated. Chen et al., (2014) also reported that many students had difficulty adapting to the flipped classroom because of the new approach. Most of the part-time students also mentioned that the course was very heavy and they did not have time to watch the video lesson outside the class. Besides challenging students, instructors

also faced some problems in practicing flipped learning, as more time would be spent on designing good content to ensure students were motivated to watch the lecture before coming to class. Milman (2012) noted that poor quality of video usually became a common problem in flipped classroom practice. Enfield (2013) also stressed that if the content and design of a video lecture is unattractive, the students will find it tedious to watch outside the class.

Discussion, Conclusion, and Future Implications

This study aims to analyse the trends and contents of flipped classroom research based on 20 articles that report on flipped learning classroom initiatives in 2013–2015. It was found that research into the flipped classroom employed different 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. The flipped classroom also benefited students academically and motivationally, the students could study at their own paces and feel confident during interactive learning activities in the class. In other words, this learning instruction has contributed to students' learning achievement, motivation, engagement, and interaction.

The findings of this study are also in coherence with the theory of Bloom's revised taxonomy for cognitive domain (Bloom, 1969). This means that this study has a great implication on students' learning where they were able to do the lower levels of cognitive work (gaining knowledge and comprehension) at home or outside of class, and focus on the higher forms of cognitive work (application, analysis, synthesis, or evaluation) in class by hands-on activities or practice. This model contrasts from the traditional model in which the students practiced the lowest level of remembering and understanding in the classroom by listening to instructor's talk, while other levels were practiced outside the class such as doing homework or nothing.

Several issues in this discussion become implications that can be taken into consideration for future research. Some challenges found in applying the flipped classroom are needed to be addressed by future researchers, such as suitability of the flipped classroom for poor quality of video lectures and untrained instructors. Therefore, this study should be continued and developed in future research to fill in the literature on the flipped classroom approach. In terms of online video lectures, flipped learning videos must encourage students to interact as well as watch. In designing online video, it may include several elements such as animation, cartoon, and music to attract students' attention to watch it.

Although the video and online platforms are important tools in the flipped classroom practice, the instructor may not ignore other significant factors which influence students' successful learning such as students' interaction, motivation, and engagement. It may also look more specifically on a variety of pedagogical strategies and designs such as specific flipped learning strategy and learner types or learning styles. We believe that the instructor's teaching strategy such as the flipped classroom is always integrated and synchronized with students' learning styles. Therefore, the instructor may develop various strategies in flipping the class by adjusting with students' learning styles without ignoring any content or syllabus. We also believe that all domains of students' learning styles can be applied in the flipped classroom practice, which leads to active, effective learning and students' higher order thinking.

In the same manner, future studies may not only focus on outside class activities, but also in-class activities. The in-class activities are doubly important for students' hands-on activities, group discussion, or inquiry based learning in order to construct their critical and creative thinking. Additionally, we need studies examining the flipped learning processes in informal and non-formal learning environments as well as for part-time students who have limited time to prepare the contents outside the class. Hence, future flipped learning is not only practiced in higher education or college level, but also for K–12 environments. We believe that if the flipped classroom is practiced correctly and thoughtfully, it will be an excellent instructional model which can promote students higher forms of cognitive domains which is incoherence with the theory of Bloom's revised taxonomy for cognitive domain.

We also recommend that future flipped classroom studies may use a variety of research designs such as experimental research, case study, ethnography, and indeed design and developmental research (DDR) or design based research (DBR). The systematic study of DDR research will produce a variety of models, techniques, and modules of flipped classroom practices. Even more, future studies of flipped classrooms may apply for not only science studies, but also social studies such as foreign language classes, physical education, English, history, drama classes, and humanities. A number of different online platforms or learning management systems (LMSs) may be used in applying the future flipped classroom approach; those tools can be used to share the content (video lectures) and establish interaction among students and between students and instructor outside the class. Web 3.0 also can be integrated in the future flipped classroom and it will have potential and useful to produce a new model of flipped classroom.

In summary, this study has clearly demonstrated that the application of flipped learning has altered the culture of students' learning from a lecturer-centered to student-centered, with more class activities belonging to students. This research has implications for students' learning activities; the students learned through hands-on and project-based learning activities. With limited time dedicated to the lectures, students have more occasions to practice the contents with peers. The results of this study have contributed to better understanding of technology use in teaching-learning activities. For government or policymakers, they should determine the flipped classroom as a contemporary model to be implemented in teaching-learning activities for higher education and even K–12 students. Finally, perhaps the findings and discussion of this study will contribute to deeper understanding of future research in the flipped classroom area.

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Appendix

Table A1

Lists of Flipped Classroom Articles Selected and Reviewed from Professional Journals

Author(s) and year	Journal	Article title
Davies et al. (2013)	<i>Educational Technology Research and Development (ETR&D)</i>	Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course.
Tune et al. (2013)	<i>Advances in physiology education (APE)</i>	Flipped classroom model improves graduate student performance in cardiovascular, respiratory, and renal physiology.
McLaughlin et al. (2013)	<i>American journal of pharmaceutical education (AJPE)</i>	Pharmacy student engagement, performance, and perception in a flipped satellite classroom.
Talley et al. (2013)	<i>The Journal of Negro Education (JNE)</i>	The enhanced flipped classroom: Increasing academic performance with student-recorded lectures and practice testing in a "flipped" STEM course.
Missildine et al. (2013)	<i>Journal of Nursing Education (JNE)</i>	Flipping the classroom to improve student performance and satisfaction.
Enfield (2013)	<i>TechTrends</i>	Looking at the impact of the flipped classroom model of instruction on undergraduate multimedia students at CSUN.
McGivney- Burelle and Xue (2013)	<i>PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies</i>	Flipping calculus.
Love (2014)	<i>International Journal of Mathematical Education in Science and Technology (IJMEST)</i>	Student learning and perceptions in a flipped linear algebra course.
Roach (2014)	<i>International Review of Economics Education (IREE)</i>	Student perceptions toward flipped learning: New methods to increase interaction and active learning in economics.
Kim et al. (2014)	<i>The Internet and Higher Education (I&HE)</i>	The experience of three flipped classrooms in an urban university: an exploration of design principles.
Baepler et al. (2014)	<i>Computers & Education (C&E)</i>	It's not about seat time: Blending, flipping, and efficiency in active learning classrooms.
Kong	<i>Computers & Education (C&E)</i>	Developing information

(2014)		literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy.
Galway et al. (2014)	<i>BMC medical education</i>	A novel integration of online and flipped classroom instructional models in public health higher education
Chen (2014)	<i>Computers & Education (C&E)</i>	Is FLIP enough? Or should we use the FLIPPED model instead?
Warner et al. (2014)	<i>Educational and Psychological Measurement (EPM)</i>	Learning computerese: The role of second language learning aptitude in technology acceptance.
McLaughlin et al. (2014)	<i>Academic Medicine (AM)</i>	The flipped classroom: a course redesign to foster learning and engagement in a health professions school.
Chen and Summers, (2015)	<i>The International Review of Research in Open and Distributed Learning (IRROD)</i>	Developing, using, and interacting in the flipped learning movement: Gaps among subject areas.
Hung (2015)	<i>Computer Assisted Language Learning (CALL)</i>	Flipping the classroom for English language learners to foster active learning.
Touchton (2015)	<i>Journal of Political Science Education (JPSE)</i>	Flipping the classroom and student performance in advanced statistics: Evidence from a quasi-experiment.
Simpson and Richards, (2015)	<i>Nurse Education in Practice (NEP)</i>	Flipping the classroom to teach population health: Increasing the relevance.

