



## RESEARCH ARTICLE

### TECHNOLOGICAL DIVERSITY IN FLIPPED CLASSROOMS: EXPERIENCES AND OBSTACLES

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#### ABSTRACT

This paper focuses on the ability of lecturers in Saudi universities to employ technological diversity in flipped classrooms and the barriers that prevent them from using this technology. A quantitative method was used in this study, with a questionnaire as the data collection instrument. The study sample consisted of 270 Saudi university lecturers. The results showed that the lecturers did not have sufficient experience of employing technological diversity to deliver content to students before their lectures. Problems of infrastructure and internet service, and a lack of incentives, posed obstacles to their use of technological diversity. Interestingly, the findings confirmed that the high cost of the various technological tools used in the flipped classrooms, the lack of experience of the lecturers, the difficulty of managing flipped classrooms through various technologies, and the time required for this were not significant as obstacles preventing lecturers from using technological diversity in their flipped classrooms.

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## INTRODUCTION

In our current era, with the technological revolution and integration of technology into educational environments, pedagogical communities have started to embrace the new instructional approaches through which teacher-based learning has been transformed to student-based learning. One of these approaches is the flipped classroom, which has emerged as a new approach to increasing the effectiveness of learning through students' positive participation and through making more efficient use of class time in collaborative activities among students and their teachers (Bergmann & Sams, 2012). The flipped classroom can play a significant role in enhancing collaborative learning and problem-based learning because students can view online videos which include the lesson content, allowing class time to be used in discussions and working on solving problems rather than on the presentation of content (Bergmann, Overmyer, & Wilie, 2012; Foertsch *et al.*, 2002; Fulton, 2012; Hughes, 2012; Zappe *et al.*, 2009). One of the misconceptions about the flipped classroom is the belief that it includes the mere assigning of reading outside of the class and having discussions in the class. Substantiating this claim, Everson *et al.* (2013) declared that: "There is no escaping the fact that we now live in a world where people have opportunities to connect, communicate, and collaborate in ways that were once inconceivable" (p.69).

The presence of the internet and social media has given individuals the opportunity to participate in online activities and to collaborate with others. As a result, research into the flipped classroom nowadays should not be limited to simply doing away with assigning reading outside the class but, rather, it should look at the extent to which teachers have the ability to employ interactive and collaborative activities, and use various technological tools and online platforms in their implementation of the flipped classroom, as suggested by Al-Harbi and Alshumaimeri (2016). The term 'flipped classroom' is very dynamic and is one of the hot topics in higher education (Honeycutt & Garrett, 2014). Many studies have investigated the flipped classroom in higher education, as noted in studies carried out periodically, the majority of which have focused completely on students. For example, the studies of Baepler *et al.* (2014), McLaughlin *et al.* (2014), and Enfield (2013) all focused on the impact of the flipped classroom on student achievement. Also, Kim *et al.* (2014), McGivney-Burelle and Xue (2013), and Galway *et al.* (2014) focused on the impact of flipped classroom on student motivation. In addition, Chen *et al.* (2014), and Missildine *et al.* (2013) focused on student engagement and satisfaction about the use of the flipped classroom.

**Theoretical Framework:** In traditional classrooms, the students usually listen to a lecture which is sometimes followed by a short discussion. The teacher is the axis of the educational process, which focuses on filling the students with information through memorization. Then, outside the

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classroom, the students are responsible for solving problems and applying knowledge that was acquired in class, though there exist many difficulties and challenges that may hinder them from reaching suitable solutions. The flipped classroom, however, can play a significant part in increasing the positive role of the learner during the educational process. Therefore, it represents a truly student-centered learning environment that merges different learning activities and strategies during class time, and this, in turn, allows learners to spend time during class on problem-solving, critiquing and synthesizing with their peers and with their instructor (Honeycutt & Garrett, 2014). The flipped classroom typically provides learners access to a pre-class online video that includes information about the topic to be studied so that learners are prepared to participate during class time in more interactive and higher-order activities such as debates, problem-solving, creating, and synthesizing (Bergmann, Overmyer, & Wilie, 2012; Foertsch *et al.*, 2002; Zappe *et al.*, 2009). In addition, in the flipped classroom model, instructors are responsible for preparing students for class by applying appropriate teaching strategies, and students are responsible for their own readiness to contribute to discussions and solving problems during class time. This means that the flipped classroom demands more of both learners and instructors, and the roles and responsibilities of instructors and learners are proactive (Berrett, 2012; Zhang, Wang, & Zhang, 2012).

**The Theoretical foundation to support the use of the flipped classroom:** Several theories support the use of the flipped classroom. For example, the theory of Bloom's revised taxonomy of the cognitive domain is one of the conditions-based theories. This taxonomy consists of six levels of learning, ranging from recalling simple facts to creating new ideas when solving problems. The taxonomy is structured as follows:

- ) **Remembering:** In this level, the students try to recall information and retrieve previously learned material, as well as try to understand the basic elements of the content.
- ) **Understanding (comprehension):** The students in this level try to construct meaning from what they have learned through interpreting, classifying, summarizing, or explaining learned content.
- ) **Applying:** The students try to practice acquired knowledge in the real world.
- ) **Analyzing:** The students try to break materials or concepts into parts by determining some relations that relate the parts with each other. This occurs through collaborative work and debates with peers in order to generate critical thinking.
- ) **Evaluating:** The students make judgments on how far they have successfully learned, based on criteria and standards.
- ) **Creating:** Students are required to put parts together in a new pattern and create and produce new forms from their acquired knowledge (Richey, Klein, & Tracey, 2011; Zainuddin & Halili, 2016).

According to Krathwohl and Anderson (2010), the lowest two levels of Bloom's revised taxonomy of the cognitive domain (those of remembering and understanding) are practiced

outside of class when applying the flipped classroom model in the education process. The higher levels of Bloom's revised taxonomy (applying, analyzing, evaluating and creating) are constructed by students themselves inside the classroom through collaborative activities and debates with peers and their teacher (Nederveld & Berge, 2015). Constructivist theory focuses on the intellectual processes by which students form new knowledge through combining previous experiences with new ideas. One of the principles of constructivist theory is that: "Learning results from an exploration of multiple perspectives" (Richey, Klein, & Tracey, 2011, p. 130) and this, in turn, leads to a focus on collaborative learning environments that "allow learners to share and collaboratively reflect" (Hay & Barab, 2001, p.283). The flipped classroom can play a significant role in creating collaborative learning through the various activities, discussions and reflections that are carried out inside the classroom. In addition, problem-based learning (PBL) could be implemented in the flipped classroom, thus creating student-centered learning. According to Hoffman and Ritchie (1997), PBL is an educational strategy centered on the student which provides resources and guidance to allow learners to think and solve problems through realistic contexts. In a study carried out by Tsai, Shen and Lu (2015), they sought to determine the effects of problem-based learning with the flipped classroom (FPBL) on the development of students' learning performance. This study was applied to three groups: the first was taught by problem-based learning with flipped classroom (FPBL); the second used problem-based learning (PBL) but not in a flipped classroom; and the third was taught by traditional methods. This study found that the learning performance of students who were taught by FPBL was significantly higher than that in the two other groups. This is indicative of the role of the flipped classroom in creating a successful interactive learning environment through applying student-centered learning methods.

**The role of the flipped classroom in improving instruction and learning:** The use of innovative methods of instruction has an important role in helping students learn and develop their learning skills (Tsai, Lee, & Shen, 2013). Therefore, it is not surprising that improved instruction and learning have resulted through the use of the flipped classroom. The flipped classroom can have a significant role in increasing the interaction and engagement of peers and teacher, as well as in shifting the responsibility for learning to students, thereby changing their role from mere passive listener to active learner. Doyle *et al.* (2013) concluded that different innovative methods (including flipping the classroom) were desirable and preferred by faculty and students because they reinforce essential clinical skills in real life situations and increase student engagement. Perhaps what best reinforces the role of the flipped classroom in higher education is a study carried out by Zhang, Ma and Liu (2014). This study used a number of research methods, such as questionnaire, literature review, interview, and action research, which were applied to two classes in Southwest University. The control group was taught by traditional methods whereas the experimental group was taught on the flipped classroom model. The findings of the study showed that the flipped classroom played a significant role in changing students' attitudes towards learning, as well as in improving students' performance and decreasing teachers' total workload. Thus, this study showed that the use of the flipped classroom was beneficial for students in higher

education. This may be due to the ability of higher education students to take responsibility for applying the flipped classroom correctly. Moreover, Pierce & Fox (2012) applied the flipped classroom model to a renal pharmacotherapy topic module. In this study, the students were prepared with video podcasts of lectures prior to coming to class and then, in the classroom, students discussed patient cases. The study found that the students who attended a flipped classroom in a pharmacy-integrated therapeutics course performed significantly higher on the final examination than students who depended on instructor-dominated traditional lectures. Although there can be great benefits in employing the flipped classroom in higher education, there are some challenges that can hinder the adoption of models such as this. These challenges have been found to arise from reasons such as lack of student motivation to adapt to this type of learning (Aboraya&Alket, 2016; Greener, 2015). A number of these challenges may nonetheless be overcome through employing diverse technologies and online platforms through the use of mobile devices (Barber, 2015). As a result, my study is significant in exploring in depth some other factors that prevent or limit the adoption of the flipped classroom in the educational process, through studying the extent to which the faculty members in Saudi universities can employ technological diversity in the flipped classroom.

**Diversity of technology and the flipped Classroom:** The diversity of technological tools and online platforms has played a significant part in expanding pedagogical approaches because flipped classrooms are not confined to specific technological tools. Numerous tools and online platforms have been employed in the flipped classroom, such as Blackboard LMS, Google Docs, Wikis and blogs, which have assisted in creating an interactive learning environment through sharing videos, texts, pictures and ideas among students (Zainuddin &Halili, 2016). Other new methods have been used for employing educational platforms with the flipped classroom. For example, Ferri, a professor at Georgia Tech's School of Electrical and Computer Engineering, developed two MOOCs in conjunction with her class. She posted MOOC videos to the general public and to on-campus students. The on-campus students watched the videos and then reported to class to conduct various activities (Raths, 2015). Further, Wallace (2014) suggested that Edmodo, in conjunction with videos generated by teachers themselves, could be an online platform through which to implement the flipped classroom. This was confirmed by a study carried out by Al-Harbi and Alshumaimeri (2016) in which the flipped classroom approach was applied through uploading videos on to the Edmodo site. The learners in their experimental group could learn through watching these videos, adding comments on the video in addition to posting questions and exchanging views and ideas with each other. The findings of the study showed positive attitudes towards using the flipped classroom strategy.

**Purpose of the study:** Many traditional classrooms ignore the role of students in the instructional process, meaning that the role of the student does not exceed that of mere listener to the lecture delivered by the teacher. In recent years, the integration of technology in education has played a significant role in transforming the teacher-based learning environment to a student-based learning environment. Many approaches have been applied in education and many studies have demonstrated

the positive roles of these approaches. The flipped classroom is one of these approaches that has led to increased collaborative learning, as well as creating a learning environment which focuses on problem-based learning, so it has gained great popularity and attention in recent years (Brooks, 2014). Most studies which have examined the flipped classroom have focused on its impact on the students, but the present study differs from previous ones in that it focuses on the teachers. It investigates the ability of lecturers in Saudi universities to employ technological diversity as a flipped classroom tool, through seeking answers to the following questions:

1. What are the lecturers' experiences in Saudi universities with employing technological diversity as a flipped classroom tool?
2. What are the obstacles that hinder the lecturers in Saudi universities from using technological diversity as a flipped classroom tool?

## METHODOLOGY

A quantitative method was used in this study as a data collection tool in order to explore the whole picture of the lecturers' experiences in Saudi universities with employing technological diversity as a flipped classroom tool and the obstacles hindering them.

**Sample of Study:** Lecturers in Saudi universities constituted the population of this study, and the number of participants in the sample was approximately 270.

**Questionnaire design and its validity and reliability:** The questionnaire used in this study consisted of three parts. The first part asked for the name of the participant (optional) and whether they had used flipped classrooms in their teaching. The second part focused on the lecturers' experiences in Saudi universities with employing technological diversity as a flipped classroom tool. It consisted of seven items, and a five-level Likert-scale was used: 5) always, 4) often, 3) sometimes, 2) rarely, and 1) never. The third part focused on the obstacles that hindered the lecturers from using technological diversity as a flipped classroom tool. It was composed of seven items and used a five-level Likert-scale: 5) strongly agree, 4) agree, 3) neutral, 2) disagree, and 1) strongly disagree. The validity of the questionnaire was ascertained through sending it to experts in the field and revised based on their feedback, ensuring that the questions would measure what they were supposed to measure. As for reliability, Tavakol and Dennick (2011) stated that: "High quality tests are important to evaluate the reliability of data supplied in an examination or a research study" (p. 54). A pilot study was therefore used to test the reliability of the questionnaire. This pilot study was carried out with 10 participants, and Cronbach's alpha was used to measure the reliability. When Cronbach's alpha is 0.80 or greater, it is preferred (Cortina, 1993), and the reliability of the questionnaire measures were found to be greater than 0.80 (see Table 1), confirming the reliability of the measures.

## RESULTS

**Lecturers' experiences in Saudi universities about employing technological diversity as a flipped classroom tool:** Although a large percentage of the participants (68.5%,

n=185) in this study confirmed that they had used flipped classrooms strategies in their teaching, the results showed that the lecturers in Saudi universities did not have sufficient experience of employing technological diversity to deliver content to their students before the lecture. Only 38.9% (n=105) of participants had experience of asking their students to submit assignments and conducting activities by using technological diversity before the beginning of the lecture. Thus, the technology may have been used merely as a tool through which tasks and assignments were submitted and not as an educational strategy to provide academic content to the students before the start of the lecture. What confirms this is that technological applications such as WhatsApp, Telegram, Blackboard, YouTube tutorials, and discussion forums through Blackboard were not used extensively as tools for delivering content in flipped classrooms (see Table 2).

technological diversity as tools for flipped classrooms in Saudi universities. On the other hand, 48.2% (n=130) of participants asserted that the high cost of the various technological tools used in the flipped classrooms was not an obstacle to the lecturers' use of technological diversity in flipped classrooms. This may be due to the technological spread in the present day and that the majority of students, if not all, owned devices such as smartphones, laptops, etc. Moreover, the lack of experience of the lecturers, the difficulty of managing flipped classrooms through the various technologies, and the time required for this were not prominent as obstacles preventing lecturers from using technological diversity in the flipped classrooms. Nevertheless, proportions of the participants that cannot be underestimated stated that these obstacles did hinder them from using diverse technologies in their flipped classrooms (see Table 3).

**Table 1. Reliability of the Questionnaire**

Variables	N of Items	Cronbach's Alpha ( )
The faculty members' experiences in Saudi universities about employing technological diversity as a flipped classroom tool	7	0.83
Obstacles that hinder faculty members in Saudi universities from using technological diversity as a flipped classroom tool	7	0.81

**Table 2. Participants' experiences with technological diversity as a flipped classroom tool**

Q	Items	Percentages and numbers of participants' responses				
		Always	Often	Sometimes	Rarely	Never
1	I use a number of educational videos with my students to provide them with content before the lecture begins.	9.3% N=25	22.2% N=60	37.0% N=100	14.8% N=40	16.7% N=45
2	I ask my students to submit assignments and activities by using technology before the lecture begins.	5.6% N=15	33.3% N=90	37.0% N=100	9.3% N=25	14.8% N=40
3	I ask my students to view YouTube tutorials related to the lesson before the lecture begins.	11.1% N=30	18.5% N=50	31.5% N=85	24.1% N=65	14.8% N=40
4	I form specific groups of students by using technology applications (WhatsApp, Telegram, Blackboard...) to discuss the content of the lesson before the lecture begins.	14.8% N=40	13.0% N=35	20.4% N=55	22.2% N=60	29.6% N=80
5	I ask students to add any content related to the topic of the lecture to the discussion forums on the Blackboard before the lecture begins.	7.4% N=20	18.5% N=50	29.6% N=80	22.2% N=60	22.2% N=60
6	I direct my students to enter discussion forums on social media to discuss the content of scientific subjects before the lecture begins.	7.4% N=20	13.0% N=35	38.9% N=105	16.7% N=45	24.1% N=65
7	I use a number of social applications (WhatsApp, Telegram, Snapchat ..... ) as a resource for exchanging knowledge with my students before the lecture begins.	14.8% N=40	22.2% N=60	31.5% N=85	14.8% N=40	16.7% N=45

**Table 3. Obstacles hindering use of technological diversity as a flipped classroom tool**

Q	Items	Percentages and numbers of participants' responses				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	I do not have enough experience to employ a number of technologies as a flipped classroom tool.	5.5% N=15	31.5% N=85	14.8% N=40	31.5% N=85	16.7% N=45
2	I have difficulty managing and implementing flipped classrooms by using technology diversity.	3.7% N=10	29.6% N=80	20.4% N=55	35.2% N=95	11.1% N=30
3	I do not have enough time to employ technological diversity in order to deliver the content to students before the lecture begins.	3.7% N=10	29.6% N=80	24.1% N=65	35.2% N=95	7.4% N=20
4	Students do not have sufficient capacity to use appropriate technology to implement flipped classrooms.	13% N=35	35.2% N=95	11.1% N=30	25.9% N=70	14.8% N=40
5	Lack of incentives offered to me prevents me from using technological diversity in flipped classrooms.	27.8% N=75	27.8% N=75	20.4% N=55	14.8% N=40	9.3% N=25
6	The high cost of the various technological tools used in the flipped classrooms is considered one of the obstacles to implementing the flipped classroom by using one of the technological tools.	5.5% N=15	25.9% N=70	20.4% N=55	38.9% N=105	9.3% N=25
7	Many technological applications that can be used to implement flipped classrooms require a fast internet connection, which some students lack.	35.2% N=95	44.4% N=120	13.0% N=35	7.4% N=20	0% N=0

**Obstacles hindering lecturers from using technological diversity as a flipped classroom tool:** Although many applications of technological diversity can be loaded on to smart devices for students, these only work with adequate internet service. The findings showed that the problems of infrastructure and such as the internet service posed obstacles to the use of technological diversity in flipped classrooms. In addition, the lack of incentives had a role in not using

**DISCUSSION AND IMPLICATIONS**

The data collected from lecturers' responses about their experiences of employing technological diversity in flipped classrooms, revealed that the majority of lecturers (n=165) did not have sufficient experience with employing technological diversity to deliver content to students before the lecture, while a sizable minority of lecturers (n=105) had asked their students to submit assignments and activities using technological

diversity rather than employing it as an educational strategy to provide content to the students before the start of the lecture. This could be a result of their lack of pedagogical knowledge about teaching strategies employing technological diversity in flipped classrooms to deliver content to students. In this regard, Alblaihead (2016) pointed out that pedagogical knowledge plays an essential role in shaping teachers' professionalism. Also, since teachers' pedagogical knowledge is a major influence on students' learning, the teachers' lack of pedagogical knowledge would be harmful to students' learning (Keller, Neumann, & Fischer, 2017). Therefore, it can be argued that, in order to achieve effective use of technological diversity in flipped classrooms, professional development needs to be given more attention by policy makers in the Ministry of Education in order to "encourage and facilitate teachers to reflect on their learning and practices" (Mansour *et al.*, 2014, p.970). In the Saudi context, a number of studies (e.g. Alkhowaiter, 2016; Alsufyani, 2019; Alzaher, 2002) have recommended that the lack of professional development of university teachers needs to be addressed in order to improve their practice and performance. The obstacles faced by lecturers mostly focus on technological issues. 79.6% of participants mentioned that many technological applications require high speed internet, and this may not be available for many students. Many countries of the world may suffer from the issue of poor internet service. For example, Li *et al.* (2017) indicated that although China has had rapid development of the internet in recent years, the coverage was weak and expensive in some non-economically advantaged areas. It is clear that Saudi universities should provide computer labs and libraries with high-speed internet service; this would assist faculty in employing a variety of technologies in education. In addition, it would help to provide an appropriate learning environment to enhance students' experience on the campus and allow them to benefit from electronic services and the internet in their education. Moreover, 55.6 % of participants asserted that the lack of incentives provided by their universities was a reason preventing them from using technological diversity as a flipped classroom tool. It is recommended that universities should provide material and moral incentives to lecturers and students to encourage them to employ technological diversity for educational purposes. For example, a prize could be given to the lecturer who best employs multiple types of technology in flipped classes. In return, there should be a prize for the student who interacts most positively with the content delivered using various technologies before the lecture. Additionally, 48.2 % of participants disagreed that the high cost of technology was an impediment to employing technological diversity as a flipped classroom tool. This may be because students today possess many electronic devices, *let alone* the technological skills students have at this time. Livas *et al.* (2019) asserted that: "The pervasiveness of digital devices in almost every facet of student and faculty life leads to the integration of technology in teaching and learning practices of contemporary educational institutions" (p. 489). Also, 48.2% of participants stated that students did not have sufficient capacity to use various technologies as flipped classroom tools, but this may be due to lecturers' lack of knowledge about implementing a flipped classroom strategy. Lecturers should initially use simple inverted classroom strategies, for example providing students with reading content or a video clip that is read or watched before attending a lecture, and then use more effective strategies such as discussions or simulations.

## Conclusion

Traditional education is no longer viable at the present time. In light of technological developments and the adoption of a number of diverse technologies in the field of education, the student has become a more active element in learning through student-centered learning environments. Saudi universities are striving diligently to keep up with technological developments and the employment of modern trends in the educational process through the gradual merging of interactive learning strategies, such as the flipped classroom. The flipped classroom plays an important role in enhancing the positive role of the learner during the educational process by providing the students with content before the lecture by the use of technology and exploiting class time in debates, problem-solving, creating, synthesizing and applying knowledge to new situations. This study has confirmed that lecturers in Saudi universities do not have sufficient experience in employing technological diversity. Although the participants in this study emphasized their use of the flipped classroom strategy, they did not have the ability to implement it properly through discussion groups that would increase the active involvement of students during learning. Many obstacles prevented lecturers using technological diversity as flipped classroom tools, such as lack of incentives and technical issues.

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