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A Quasi-Experimental Study of the Effects of Flipped Learning on Engineering Students' Leisure Attitude and Connectedness

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The present study examined the effects of the flipped learning technique to engineering students' leisure attitude and social connectedness. A quasi-experimental design was used. Pre- and post-test were conducted with a total of 70 first-year students from one University in Dammam, Saudi Arabia, using a purposive sampling method. The students were divided into two groups (flipped and traditional). The questionnaires consisted of the revised version of the social connectedness and leisure attitude. The results of t-test revealed that students in flipped learning group scored higher leisure attitude and social connectedness levels than students in the traditional group. However, the result indicated that flipped learning technique is effective in enhancing connectedness and promoting positive leisure attitude for engineering students. Suggestions and recommendation on the flipped learning technique were provided.

Keywords: *Flipping Learning, Leisure Attitude, Engineering Education, university*

Introduction

In the 21st century, technology has transformed information access to a press of a key, using the Internet and several complementary tools of technology including a computer, laptop, smartphone, and tabs (Fu, 2013). It is thus natural than more than ever before, in the field of engineering education, students' technical and non-technical skills are required (Male, 2010; Changpueng & Wattanasin, 2018). This is because successful engineering students are those that comprehend engineering principles and practice, teamwork and effective communication in environments full of risk and uncertainty (Adamson & Darling-Hammond, 2012). In Saudi

Arabia, engineering students require technical and non-technical skills, calling for them to acquire competencies and skills to support their conceptual development and threshold action internal as well as external to their classrooms (Peter et al., 2017). Thus, in this regard, the traditional learning approach, instructor-centred, may no longer be applicable in the current world run by digital tools and technology (Wang & Heffernan, 2009). An effective alternative to the traditional approach is the flipped classroom pedagogical approach that replaces the outdated blackboard with online video lectures (Evans, 2011). Flipped learning has been garnering increased attention from researchers particularly, in the case of higher education engineering field (e.g., Su & Chen, 2018; Aqqal et al., 2017) application in teaching-learning practice to promote active learning among students (Hamdan et al., 2013). Prior studies indicated that active learning strategies frequently result in the students' engagement and learning accomplishments when compared to traditional approaches, such as lecturing, where the instructor is the centre of the approach (Zappe et al., 2009, p. 3).

However, despite the evidence provided by literature and practice (educators) of the effectiveness of flipped classroom approach and its positive effect on the connectedness and engagement of students (e.g., Jdaitawi, 2019; Su & Chen, 2018), some authors (e.g., Bergman & Sams, 2012), contended that flipped classroom success is linked to the attitudes of teachers, institutions and students, and the student's learning engagement. This is exemplified by Chen et al. (2014) study that indicated students to be hesitant to modify their study habits, as a result of which they refrain from participating in-class activities and from working in teams. Moreover, according to Yilmaz (2017), maintain motivation and attitude of students is significant and so is engaging them in in-class activities, as opposed to just being dependent on a singular model – the instructor has to use different approaches in the form of discussions, min-lectures and students' feedback and questioning (Ogden & Shambaugh, 2016). In this line of argument, flipped learning converges between interaction through problem-solving, discussion-cantered lessons and learning lessons in advance at the students' residence, which could involve individual classes and other activities that are focused on the learner (Yoon et al., 2017; Jensen et al., 2015).

Among the several benefits of flipped learning are; preparation prior to the class with the information and knowledge accessed, readiness for the application of learning, engagement in activities via active learning periods, application of knowledge and theory learned, heightened student's motivation due to their accountability to each other for their participation in activities (Mc Laughlin et al., 2014).

Higher education teaching tasks and activities generally stem from pedagogies and supported technologies aimed towards maximising the motivation of students, their engagement and enhanced learning attitudes (Jdaitawi, 2019; Su & Chen, 2018). The literature contains studies that compared between active learning in the flipped classrooms and traditional teaching

among students of engineering (Kerr, 2015; Toto & Nguyen, 2009; Kanelopoulos et al., 2017; Kim et al., 2014). Prior studies have also evidenced the role of flipped learning as an important determinant of attitude towards learning and connectedness of engineering students (e.g., Suwapaet, 2018; Jdaitawi, 2019).

In the same line of study, Kerr (2015) revealed that flipped classroom implementation for the instruction of engineering courses generated optimum performance and higher confidence among students. Moreover, in Suwapaet's (2018) study, the authors revealed that flipped learning group outperformed their traditional group peers in engineering courses, and they displayed higher levels of satisfaction. Also, different authors examined the flipped learning approach in the university environment (Su & Boucher, 2013) and public health (Simpson & Richards, 2015). Still, only a few have focused on higher education (Chung & Lee, 2018) and what few there is concentrated on the effectiveness of the approach on the performance of students (e.g., Suwapaet, 2018; Choi et al., 2015). In relation to this, leisure attitude and the connectedness of students were largely ignored (Jdaitawi, 2019).

Based on the above arguments, the present study focuses on flipped learning in terms of connectedness and leisure attitude as the primary factors affecting the learning outcomes of engineering students. It is argued that if engineering students are provided opportunities to be involved in flipped learning activities, their leisure attitudes will be more pleasant and they will be more engaged in deep thinking and discussion, as a result of which the classes will be effectively planned out and conducted. Furthermore, Kerr (2015), Mason, Shuman and Cook (2013) and Bishop and Verleger (2013) highlighted the lack of studies on the significant factors required in designing an effective flipped learning approach and the way the factors contribute to the learning of engineering students. To compound the need further, engineering students need to be adept at solving actual real-life problems in a team, which is where the flipped classroom comes into play. This calls for understanding the best approach that could promote students' leisure attitude and connectedness in the learning environment. To this end, the study develops and proposes an innovative flipped instructional design that includes a flipped learning approach in engineering track classes. The study's main objective is to determine the flipped learning effects on engineering students' learning attitudes and connectedness.

Literature Review

Flipped Learning

In the realm of learning, flipped learning approach has been garnering increasing attention from global institutions, researchers and practice. Jamaludin and Osman (2014) described flipped learning as the restructuring of the classroom environment and activities in the home. They added that classroom activities in the flipped learning approach are conducted outside of the classroom, for the students to use in learning strategies (problem-solving and discussion, with

the help of the lecturer). The flipped classroom refers to an inverted classroom, where lecture material delivered in class is delivered online to the students before class ensues to increase the knowledge practice and application period. Flipped learning has also been described in the literature as an alternative to in-class learning with collaborative, practical activities, requiring students to review course materials at their leisure (Chen et al., 2014; Lai & Hwang, 2016). Literature evidences different benefits that flipped learning model can offer to teach and learn different disciplines (Jdaitawi, 2019; Aycicek & Yelken, 2018; Yousefzadeh & Salimi, 2015; Vliet et al., 2015) – notwithstanding this fact. Only a few studies have focused on examining the relationship between leisure attitude and connectedness of students in the flipped learning approach, particularly in the higher education setting of Saudi Arabia.

Leisure Attitude

Leisure attitude represents a complex concept as clear from the attempts of scholars and researchers to define it along with its significance to adolescent development (e.g., Freire & Teixeira, 2018; Caldwell & Witt, 2011; Jdaitawi et al., 2020). Definitions of the concept abound, but a universal definition remains elusive. To begin with, Munson and Savickas (1998) described leisure attitudes as attitudes projected towards activities like sports, games, arts and hobbies, music, socialising, reading, thinking and contemplating. In other words, leisure attitude encompasses cognitive, affective and behavioural elements and comprises the knowledge and belief, perceptions and behaviour of individual towards leisure (Texeira & Freire, 2013, p. 57). More specifically, the cognitive element consists of general knowledge and beliefs regarding the leisure concept, the related characteristics and the relationship to the life quality of the individual. An effective element consists of the feeling towards leisure, the degree to which the individual perceives leisure activities and experiences (positive/negative), and behavioural element consists of the past, present and future actions related to leisure activities and experiences (Rageb & Beard, 1982, p. 158). According to leisure studies, leisure attitudes form the core of the understanding of leisure experience and participation in it and the time scheduled activities (Freire & Teixeira, 2018). Furthermore, the significance of leisure is linked to the associations of the societal members, work productivity, health and life quality as a whole. More importantly, in the field of education, one of the features of students that influence their learning process is their attitudes towards the lesson (Altinok, 2004). In relation to this, attitude represents perceptions, knowledge, beliefs, feelings and patterns of behaviour regarding the leisure, and based on several studies (Akgul & Ertuzun, 2015; Teixeira & Freire, 2013; Lioyd & Auld, 2002; Kim et al., 1997; Choi & Yoo, 2017), leisure attitudes attributes encompass leisure resources, personal characteristics and aspects of social-psychology such as motivation, interest and arousal.

Social Connectedness

The implementation of a flipped classroom with the help of interactive technologies in the education field (e.g., Blackboard), facilitates linkage among students, enhances their thinking skills and supports their social connectedness. Connectedness refers to the individual's ability to be comfortable and confident in the face of family and friends (Lee & Robbins, 1995). In such an approach, students are provided with the course content before the class begins to be more informed and participative in class (Strayer, 2012). It also brings about positive classroom activities through students' engagement while helping in satisfying their psychological and social needs, in promoting class enjoyment, and in showing empathy to peers. Moreover, the approach promotes the interaction among students, peers, their thought expressions, self-sense and interaction, which in turn leads to a learning environment that is stable and connected, boosting positive education perceptions (Atkins et al., 2014). According to Helgevold and Moen (2015), flipped classroom emphasises increasing classroom interaction, involving the interaction of students with the activities of learning. Nevertheless, studies that compared between abilities and skills of students in flipped and traditional courses revealed inconsistent findings (e.g., Wilson, 2013; Mc Laughlin et al., 2013; Kwon & Woo, 2018; Ok, Erdogan et al., 2017).

Effect of Flipped Learning Strategy on Leisure Attitude and Students' Connectedness

Active learning strategies approach adopted by students generally result in higher engagement and learning achievements relative to the instructor-centred traditional approach (e.g., lecturing) (Zappe et al., 2009, p. 3). In relation to this, constructive learning theory views knowledge as something personal and context-bound, involving the interaction of students with others in the process of learning (Vygotsky, 1978; Ausubel, 1963). The theory prepares students for active and self-directed learning in educational institutions (Wheelahan, 2010). In this line of study, Lave (2009) revealed that in the constructive program, integrative knowledge learning, skills and attitude is promoted through the authentic learning contexts usage. The learning environment needs to boost learning activities of learners through the facilitation of collaboration and flexible, personalised and inclusive surroundings to accommodate dynamic changes (Marca & Longo, 2017). In the current times, technology is part of every life aspect, whether personal or professional, and it improves learning and outcomes in the field of education (Yousefzadeh & Salimi, 2015). In other words, the flipped learning approach has a key role as a determinant of learning outcomes (Jdaitawi, 2019). Successful flipped learning is associated with the attitudes and learning engagement of students (Bergmann & Sams, 2012), during which the student's motivation and attitudes towards learning is maintained by involving students in-class activities to make sure that the flipped learning efficiency is established (Yilmaz, 2017).

More importantly, the flipped classroom is all about increasing classroom interaction by promoting students' interaction with learning activities (Helgevold & Moen, 2015). Flipped classroom approach establishes positive classroom interaction through students' engagement, while at the same time satisfying their psychological and social needs, enabling them to enjoy their classes and promoting their empathetic nature. It promotes the interaction of students with peers, thought expressions, self-sense and interaction, and a learning environment that is stable and that facilitates positive education perceptions (Atkins et al., 2014). Despite the advantages of flipped classroom approach, only a few studies have examined its effects on learning outcomes (e.g., self-regulation, students' attitudes, students' engagement and their connectedness level (Jdaitawi, 2019; Ok et al., 2017). In comparison to traditional learning approach, flipped learning strategies offer better positive outcome effects as evidenced by Chao et al. (2015), Chen et al. (2014), and Yilmaz (2017), their learning attitudes as demonstrated by Chao et al. (2015) and Lin and Chen (2016), as well as their engagement and connectedness as revealed in Saulnier (2015) and Jdaitawi's (2019) studies.

More specifically, in Chao et al. 's (2015) study, the author focused on the effects of flipped learning approach on computer-aided design in light of learning attitude and achievement and found the approach to enhance the attitudes of students towards learning and it enhanced their learning achievement. Both instructors and students were convinced that flipped learning positively impacted learning satisfaction and effectiveness in Lin and Chen's (2016) study, while Saulnier (2015) reported that using flipped learning in system analysis and design enhances the focus of students in the class, their engagement and their learning outcomes. Meanwhile, using flipped learning was evidenced by Jdaitawi (2019) to maximise students' self-regulation and social connectedness in class,

Nevertheless, although evidence of flipped classroom approach on learning outcomes have been established by Maloy (2014), Chao et al. (2015), Chen et al., (2014), Yilmaz (2017) and Jdaitawi (2019), studies dedicated to the topic and its impact on leisure attitudes and connectedness are still few and far between. Literature reviews showed that no study had been done on the effect of the flipped classroom on leisure attitude and connectedness among students, with only a few addressing such gap in the literature. Therefore, in the present study, the author mainly attempts to minimise the literature gap by investigating the effects of the flipped classroom approach on the leisure attitude and connectedness of engineering students.

Methods

Design

In this study, a pre- and post-test design was developed, using a learning management system, the Blackboard, within which the teaching materials, videos and reading text concerning the

engineering course were uploaded. The students were divided into experimental groups (flipped learning approach) and control group (traditional learning approach).

Sample

The study sample consisted of first-year 70 engineering track students from Imam Abdulrahman Bin Faisal University. The subject is a communication course, entailing learning the fundamental skills of communication in engineering track classes. The study participants' ages varied from 18-19 years, and the students were in their second semester.

Procedure and Instructional Design

Both experimental and control groups were provided with four weeks of flipped and traditional classroom approach respectively and were given a pre-test before the study, and a post-test following the four weeks of exposure to the approaches. Flipped classroom students were presented procedures and roles in each session to save session time, and the instruction units were limited to four topics with each session spanning two hours of the communication course. The course topics were uploaded on the Blackboard before the class periods. Meanwhile, the control group students were taught through the lecturing approach.

Instruments

This study used two instrument types (pre-test and post-test of leisure attitude and connectedness), from which the required data was collected. The student's connectedness instrument was interpreted using Lee and Robbin's (1998) scale to determine the interpersonal closeness level between the students and his social network, and the difficulty level in closeness maintenance. The scale was suitable because of its applicability across different languages and settings, and as such, students were requested to respond to 20 items measured on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). In this regard, higher scores indicated higher connectedness. The scale showed high internal reliability as evidenced by the high alpha coefficient (0.85) and high validity, as shown in Table 1.

Moving on to measure attitude variable, the scale was adopted from Raghed and Beard (1982), with 18 items developed, measuring three dimensions (general knowledge and beliefs concerning leisure, beliefs concerning leisure relation with health, happiness and work, and other concepts relating to quality and characteristic traits. The items were measured on a 5-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree). The instrument's validity and reliability were first established using the following ways; first, they were translated from English to Arabic, by two Arab referees teaching English and Psychology at the University. Second, five referees' experts in education and educational psychology fields

further evaluated the instruments. The scales reliability values were further confirmed through high internal reliability, represented by an alpha coefficient of 0.68.

Table 1: Cronbach's alpha value of the study variables

	Items	Alpha Value
Leisure Attitude	18	.68
Connectedness	20	.85

Result

The study conducted the first assumption to determine data normality and outlier, using descriptive statistical analysis, after which data were analysed to determine the differences in leisure attitude and connectedness of engineering track students in the pre-test data. No significant differences were found between the two groups in terms of the two variables (i.e., social connectedness, t = .071, sig. 943, and leisure attitude, t = 1.456, sig. 150) as shown in Table 2.

Table 2: T-test differences results between groups on leisure attitude and connectedness pre-test

	Mean / SD	t-value	Sig.2-tailed
Leisure Attitude			
Flipped Group	3.62 / .414	.071	.943
Control Group	3.48 / .395		
Connectedness			
Flipped Group	3.50 / .639	1.456	.150
Control Group	3.49 / .527		

Two t-tests were then carried out to determine the effects of the differences of flipped learning approach on the leisure attitude and connectedness of the students in the post-test. Based on the students' groups (experimental and control) difference in post-test leisure attitude was determined using independent sample t-test, and the differences are presented in Table 3. It is evident from the table that t-test analysis results showed significant differences in terms of the level of leisure attitude among the experimental and control group (t = -6.960 (.000; $p < 0.05$). Other analysis results are also provided in Table 3. From the table, the mean and standard deviation for the flipped learning approach group is (M = 4.258, SD = .276), which is better than that of the control group (M = 3.596; SD = .474). Moving on to differences in post-test of connectedness level of the students in both groups, an independent sample t-test was conducted to compare the groups' mean scores. The differences in connectedness level of the students, according to the group, are presented in Table 3. T-test analysis indicates significant differences in the level of student's connectedness in the two groups (t = -6.411 (.000; $p < 0.05$).

Furthermore, the mean and standard deviation of the flipped learning group when it comes to connectedness level (M = 4.287, SD = .399) is better compared to that of the control group (M = 3.717; SD = .345).

Table 3: T-test differences results between groups on leisure attitude and connectedness post-test

	Mean / SD	t-value	Sig.2-tailed
Leisure Attitude			
Flipped Group	4.25 / .276	-6.960	.000
Control Group	3.59 / .474		
Connectedness			
Flipped Group	4.28 / .399	-6.411	.000
Control Group	3.71 / .345		

Discussion

The primary objective of this study is to examine the flipped learning approach effects on the engineering track students' leisure attitude and connectedness, with the help of a quantitative study method, with data gathered and analysed with the help of instruments. Literature generally supports the flipped learning approach effects on the leisure attitude and connectedness of students. However, studies of these topics are still few and far between, particularly in the education field in Saudi Arabia. Based on the study results obtained, significant differences were found between leisure attitude and connectedness of students in the post-test, which means flipped classroom approach implementation, may be effective in enhancing the students' leisure attitude and connectedness. Flipped learning assists the students to promote learning motivation and participation and interaction in-class activities in an enjoyable learning method. The results are consistent with those reported by Karadag and Keskin (2014) who reported that flipped learning method facilitates a positive learning experience, ups the enjoyment scale, and is effective, productive and advantageous to students.

Moreover, the positive outcome may also be related to the student's increased interest in the curriculum owing brought about by the new learning method and design, which is more student-centred. In addition, the heightened interaction of students plays a significant role in enhancing their positive attitude as they are provided with prior knowledge concerning the curriculum prior to the class, leading to their positive participation notwithstanding their level of learning. This finding is consistent with those by Hsu et al. (2016) and Foldnes (2016). According to Hsu et al. (2016), students' recipient of flipped learning had a positive attitude towards the approach, while Chung and Lee (2018) reported that the motivation and attitude of recipients of flipped learning were enhanced. In the same study, Karadag and Keskin (2017) revealed that flipped learning has a positive influence on the attitude of students.

Moving on to social connectedness, based on the results, flipped classroom students showed higher social connectedness scores in comparison to traditional approach recipient students. Such differences may be related to the learning mode, wherein the flipped classroom mode, students are provided with the opportunity to collaborate with their peers and to engage in activities, and they receive performance feedback. They are also allowed to have discussions on new topics and concepts before class to improve their collaboration skills, their engagement in class and their effective learning in teams.

Prior literature in the same line, such as Kwon and Woo (2018) and Foldnes (2016) also revealed similar results, and so did Roehl et al. (2013). They found the flipped learning approach students to be more aware of the learning process and their communication and connection development with others compared to traditional learning approach students. Also, the flipped classroom approach was evidenced to enhance the engagement and learning of students in comparison to the traditional classroom approach. Therefore, the flipped classroom model can contribute value to the promotion of students' leisure attitude and connectedness and their learning activities participation.

Conclusion and Recommendations

In this research, a course design incorporating a flipped learning method into an engineering track course was developed and presented, to determine the effect of the approach on the connectedness and leisure attitude of students. According to the obtained results, there is a positive effect of flipped learning on the connectedness and leisure attitude of engineering track students. Moreover, this study has several implications for the student's learning in general and flipped classroom in particular. Literature concerning flipped classroom still lacks in studies, with no evident strategies and patterns for its implementation effectiveness. Thus, the study contributes to literature concerning the effects of the flipped classroom on leisure attitude and connectedness of students. Second, the findings showed that the flipped classroom approach facilitates effective assistance to students' academic experience, with the model furnishing an overview of the classroom learning process and determining the changes faced by students throughout the process. Third, the findings are consistent with the findings evidencing the teachers working towards enhancing social connectedness of students in flipped classrooms by making them the focus of the approach, enhancing their involvement and interpersonal relationships, supporting their networks – all of which positively contribute to their learning process.

However, despite the above implications and contributions, this study has some limitations that have to be taken into consideration by future authors. The first limitation is related to the study sample, which comprised of students from the engineering track at Imam Abdulrahman Bin Faisal University, Saudi Arabia. This limitation in the sample may influence the

generalisability of findings and as such, future studies can include students from other universities and colleges. The second limitation relates to the self-report measures used to gather data. Towards this end, future studies may adopt a qualitative method instead of to obtain in-depth students' perceptions of the learning approaches. The third limitation is the short study period using a cross-sectional approach, where data was gathered at one point in time. In this regard, future studies can conduct a longitudinal and experimental study instead to extensively cover the responses of the sample concerning the influence of flipped classroom learning and the related factors. Although the use of flipped learning approach is still in its infancy in the Saudi higher education context, the study provides insights into its potential extensive implementation in higher education institutions.

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