Students' Learning Styles and Preferences in a Gamification-enhanced Partially Flipped Classroom: A Q-Methodology Study

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(Submitted May 23, 2022; Revised September 3, 2022; Accepted October 1, 2022)

ABSTRACT: The aim of this Q-study was to identify and categorize learners' learning styles and preferences with regard to the incorporation of gamification-enhanced activities in a partially flipped gamified classroom during a Taiwan university eighteen week's Introduction to Marketing course. Q-methodology was used because it identifies assorted viewpoints subjectively and analyzes them statistically. Twenty-six students were surveyed and asked to rank thirty statements according to their perception of the teaching method used. A factor analysis and a correlation test were used to identify both the factors involved and the individuals with whom they were highly correlated. Three factors were identified: Factor A – Engaged Achiever, Factor B – Self-motived Explorer, and Factor C – Interactive Designer, each of which represented participants with similar perceptions. These multiple learning styles and perspectives present both challenges and opportunities in business education.

Keywords: Partially flipped classroom, Gamification, Badges, Q-methodology

1. Introduction

There is an increasing awareness in various educational institutions of the implementation of Flipped Classroom (FC) methods. FC refers to the practice of designing course materials, such as instructional videos, text-based materials, and online exercises outside class, while devoting time in class to a wide variety of interactive learning activities (DeLozier & Rhodes, 2016; Lo & Hew, 2020). Previous researchers have reported that the use of FC methods can promote students' academic performance, enhance their interaction, improve their attendance, and cultivate positive attitudes (Chen et al., 2014). Bhagat et al. (2016) point out that FC methods can also help low-achievers to improve because their teachers tend to pay more attention to them.

However, in contrast, Cabi (2018) observed that FC did not have a significant effect on academic enhancement. Some students also expressed concerns about having to do homework before classes (Chen et al., 2015). Liou et al. (2016) found that, as videos in FC were not interactive, other technologies needed to be incorporated in order to enhance learning. According to Sun and Wu (2016), while FCs result in better learning outcomes, there seems to be no significant "between-group" difference in teacher-student interactions. Consequently, other activities, such as integrated classroom polling systems, mobile game-based learning, or multimedia Learning Management Systems (LMSs) were needed to boost interactivity.

Despite the recent promotion of FCs by many educators and practitioners, Ye et al. (2018) found that appropriate teaching strategies were required, either before or during classroom activities, to help learners to organize their own studies and to augment higher-order cognition. The use of gamification in higher education as a means of engaging, retaining, and motivating students is advocated in much of the literature (Hew et al., 2016). However, there is little published data on the effect of gamification on FC activities. Nevertheless, as there is evidence that some learners skip out-of-class activities or pre-class video lectures, when gamification is not used, perhaps they would be more effectively engaged by its incorporation.

Recent FC developments have led to an interest in its partial use; hence, it is not necessary to apply it to entire courses. Selectively flipping the most difficult information makes the workload involved in developing flipped material less overwhelming for instructors because there is no need to flip the entire course, which gives them additional choices to modify the delivery of the course information based on its level of complexity (Strelan et al., 2020; Urquiza-Fuentes, 2020). To date, little is known of learners' subjective experiences and preferences in partially flipped classrooms in Taiwan and, since they have not been studied, the effectiveness of gamification remains to be seen. Consequently, because FC teaching is increasingly being used in higher education, it is essential for outcomes of the initial application of partial FCs to be investigated, particularly in terms of students' responses to out-of-class learning, in order to determine how to best incorporate them into the learning process.

How students learn, and especially their learning styles, based particularly on understanding individual learning preferences, has received considerable critical attention from researchers in numerous fields (Hassan et al., 2019). However, learning-style instruments cannot provide an in-depth understanding of learning skills as many of them are quantitatively-based. Consequently, Q-Methodology, which incorporates quantitative and qualitative methods, is used in this study to categorize students' opinion of a gamified, partially flipped classroom at a Taiwanese university. The study is structured as follows: (i) theoretical and empirical background, (ii) review of the relevant literature, (iii) description of the methodological approach, (iv) results, and (v) a conclusion, which includes a discussion of the results, a description of the limitations of the study, and some recommendations for further investigations in this field.

2. Literature review

2.1. Use of gamified flipped classrooms in higher education

A gamified flipped higher education classroom operates in combination with game-based learning, which appears to be a promising method of instruction; however, gamification and game-based learning are not interchangeable, either in their definition or application. Game-based learning refers to the inclusion of games in learning activities to achieve instructional goals, whereas gamification refers to the inclusion of game elements or mechanics, such as "points." (numerical evidence of performance), "avatars" (visual representations of players' characters), "virtual goods" (online assets with perceived gaming value), "leaderboards" (direct comparison of expertise), or "badges" (visual representations of accomplishments) to enhance students' interest and motivation through competition in a non-game context (Buckley & Doyle, 2017; de-Marcos et al., 2016; Subhash & Cudney, 2018; Sun & Hsieh, 2018).

However, specific game elements, such as badges, have been found to undermine students' motivation instead of improving it (Facey-Shaw et al., 2020; Muilenburg & Berge, 2016). Furthermore, Buckley and Doyle (2017) stated that active, or global, learning style-orientated individuals had a positive perception of gamification, as did extraverts, whereas conscientious types were less motivated by it.

In summary, the primary aim of using gamified learning in an FC classroom is to integrate selected game-based elements with a view to increasing students' motivation, higher-level thinking, and self-efficacy.

2.2. Self-determination theory

The Self-determination Theory (SDT) is based on individuals' personality and motivation to indicate how they interact with and rely on society. Motivation can be either intrinsic or extrinsic. Intrinsic motivation is based on autonomy, competence, relatedness, self-determination, well-being, and engagement; it can refer to participating in educational activities that are enjoyable, interesting, appealing, and exciting. In contrast, extrinsic motivation drives individuals to constantly strive for rewards, avoid criticism or punishment, and have a diminished desire for autonomy. Hence, it lies on a continuum of identifiable behavioral regulations, such as external, introjected and integrated, which reflect the degree to which behavior creates a sense of self (Deci & Ryan, 1985, 2002).

The SDT contains two forms of motivation, namely, controlled and autonomous. The former involves behaving for external reasons, such as gaining rewards and avoiding punishment or guilty feelings, which creates a sense of obligation and stress. This kind of behavior is likely to be maintained for as long as rewards are on offer, but it will probably discontinue without external reinforcements. On the other hand, autonomous motivation drives self-determined behavior for intrinsic ends, such as through choice and interest; therefore, this kind of behavior will probably persist, even if a reward seems to be unlikely (Deci & Ryan, 2002; Hagger et al., 2014).

The SDT has recently been implemented in several gamification and FC studies in order to examine learning motivation, engagement, and performance (Kuo & Chuang, 2016; Tinati et al., 2017; Thai et al., 2017). It is important to note that the level of motivation affects the extent to which students will engage in, and persist with, certain behavior.

2.3. Learning styles

Several inventories have been made over the past thirty years, which suggest that learning styles have matured and been permeated with persuasive variables related to learning strategies that reflect their developers' diverse backgrounds. This has resulted in various theories, instruments, and empirical works based on different theories. For instance, Curry (1987) used an onion metaphor to categorize three layers of learning styles, (i) cognitive personality elements, (ii) information-processing, and (iii) instructional preferences, while Riding and Cheema (1991) used over thirty theoretical divisions they called "cognitive, or learning, styles." Neil Fleming's VARK model, which categorizes instructional preferences, classifies four kinds of learning preferences based on sensory pathways: (i) visual, (ii) aural, (iii) read/write, and (iv) kinesthetic (Aldosari et al., 2018). Students are classified into four dimensions in the Felder-Silverman learning-style model (FSLSM) based on the bipolar categories of sensory/intuitive, visual/verbal, active/reflective, and sequential/global: (1) Perception: how information is perceived (sensory-intuitive), (2) Input: how information is presented (visual-verbal), (3) Processing: how information is processed (active-reflective), and (4) Understanding: how information is understood (sequential-global) (Felder & Silverman, 1988). The Index of Learning Styles (ILS), developed by Felder and Soloman (1997) based on the FSLSM, is influenced by Jung's psychological types, the Myers-Briggs Type Indicator, and Kolb's learning processes. Hu et al. (2021) suggest that the FSLSM is a better model for a technology-enhanced learning environment since it includes essential cognitive learning theories and practices.

Wang et al. (2004) describe the student learning process as more complex in a web-based education environment than in a traditional classroom; as a result, a traditional learning-style typology may be inappropriate for a web-learning environment. They established a novel typology of web-based learning styles that included aggressive knowledge-seekers, active participants, silent cultivators, and heavy sleepers. In summary, although numerous models characterize preferred learning styles, it is imperative for instructors to recognize individual and group differences.

3. Methodology

3.1. Procedures

This study was conducted at a university in Hsinchu, Taiwan, during an eighteen-week Introduction to Marketing course. Prior to the research, a semester-long pilot test was also undertaken in the Human Resource Management course. The Introduction to Marketing course, which is an introduction to the basic principles and application of marketing practices, is a required component of a Department of Technology Management program. The course involved three one-hour classroom sessions each week. Twenty-six undergraduates whose major is Technology Management participated in the study. Their ages ranged from 19 to 20 years old, and they were evaluated based on sixteen written assignments and case studies, seven sessions of gamification-enhanced activities in a flipped classroom, and mid-term and final exams.

This course was based on a "partial-flip" approach, in which a flipped classroom format only accounted for a portion of the class time (7 times). Text-based lecture notes and pre-recorded multimedia micro-lectures were delivered via the school's Moodle e-learning system. Formal teams, each comprised of between two and four trainees, were assigned problem-solving and decision-making tasks, as well as being required to complete a peer review. A Moodle course management platform was designed to support the uploading of course resources and activities that included quizzes, assignments, and a digital badge display. The flipped classroom, based on Deci and Ryan's (1985, 2002) Self-Determination Theory, incorporated active learning strategies, while gamification-enhanced activities were designed to fulfill students' psychological needs of autonomy, relatedness, and competence (see Figure 1).

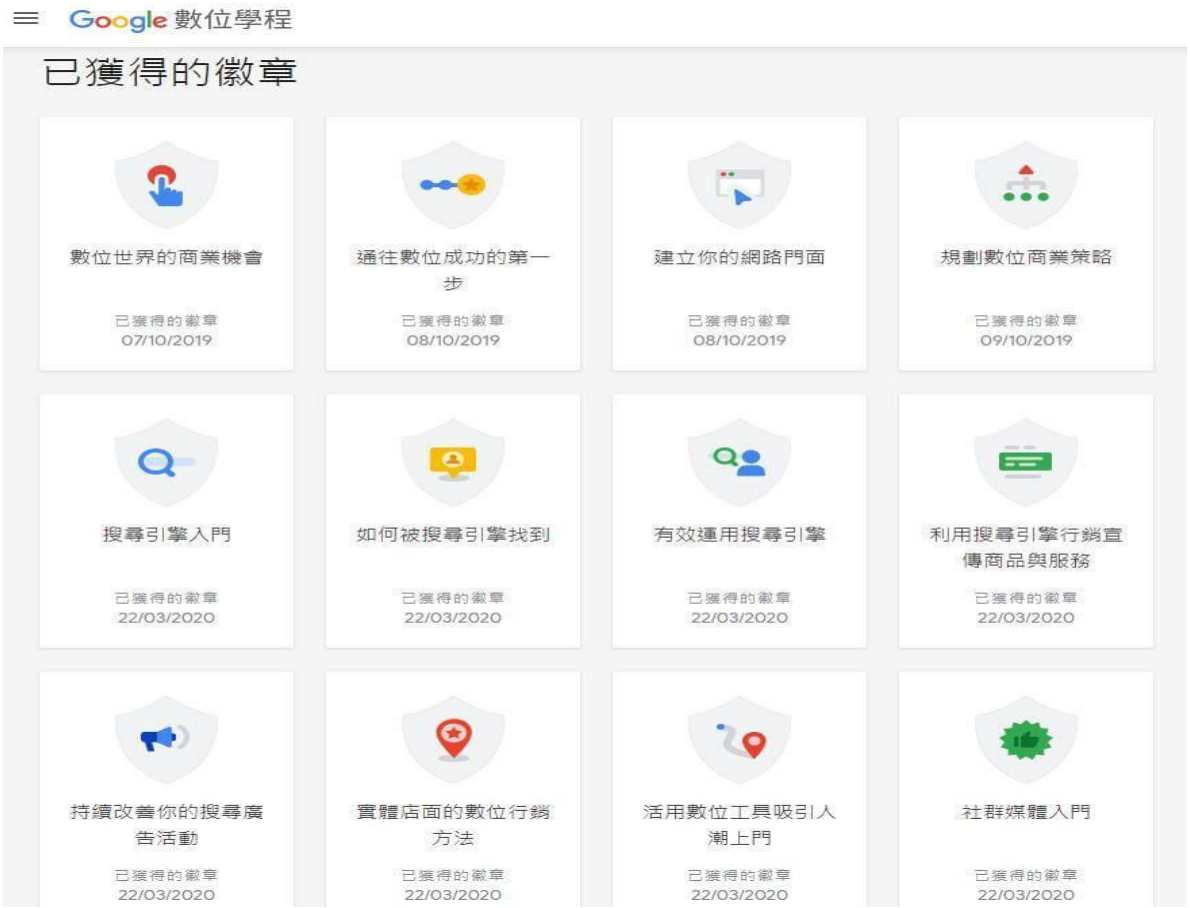
It is important to note that Hew et al. (2016) and Denden et al. (2021) have validated the efficiency of the proposed SDT based gamification design. Four types of badges were used, (i) autonomy-based, such as "early-bird," (ii) relatedness-based, such as "reply warrior," (iii) competence-based, and (iv) text-based, where the instructor wrote personal comments on "magic stone" badges based on individuals' performance.

There were two levels of competence-based badges: (i) apprentice, and (ii) knowledge expert (see Figure 1). Students who logged into Moodle e-Learning to access the course materials before class received an autonomy-based badge. Those who participated in discussion forums received a relatedness-based badge, and those who completed flipped activities, such as self-directed quizzes, received a competence-based badge.

Figure 1. Badges earned in class

Students who completed all twenty-six modules earned twenty-six badges (see Figure 2), and were also awarded Google's Fundamentals of Digital Marketing certificate via self-directed learning.

Figure 2. Badges from Google Certification



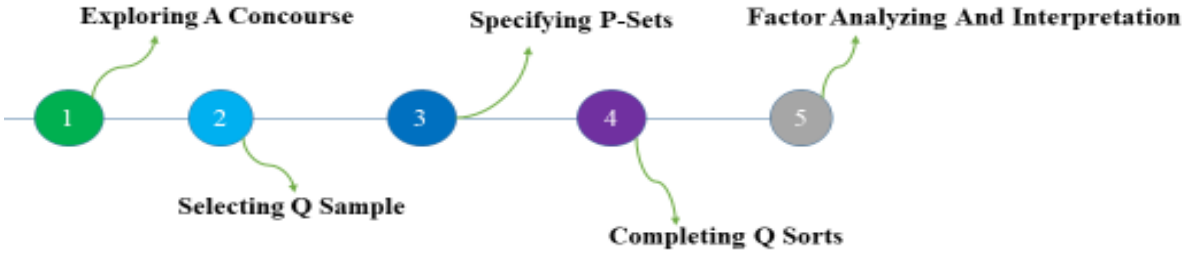
3.2. Measuring subjectivity

Q-methodology was chosen as the research tool to distinguish the students' learning styles and acquire a deeper understanding of their perception and how they learn. Q-methodology is a distinctive set of psychometric and operational principles which, when combined with statistical applications of correlational and factor-analytic techniques, provide researchers with a systematic and rigorously quantitative procedure for investigating the subjective components of human behavior; however, it does not identify causes or generalize demographic variables in a large population (Brown, 1993). A small sample was used for this study, and since Q-methodology effectively explains the main participants' perspectives, their number was deemed to be unimportant. Research subjects in Q-methodology are often chosen due to theoretical or pragmatic considerations (i.e., by convenience sampling or particular relevance to the topic). According to Stephenson (1935), Q methodology was designed to give a small number of individuals a large number of tests, test items, or responses, in contrast to the majority of quantitative research, which gives a large number of participants a small number of tests. As a result, the value of Q-methodology lies in discovering the opinions and understanding of groups of participants; therefore, while most studies are effective with forty to sixty participants, some require far fewer. (Valaitis et al., 2007; Watts & Stenner, 2012). According to Webler et al. (2009), numerous Q-studies have between 12 and 20 participants, who are usually chosen intentionally, purposefully or strategically. Although a small sample size is not an issue in Q-methodology, the participants must be familiar with the topic and have a distinctive opinion of it (Chng et al., 2022; Watts & Stenner, 2012).

3.3. Data collection

Q-methodology has five stages: (i) exploring a list of items defining the topic's perspectives (the concourse), (ii) selecting the Q-sample (Q-statements or Q-sets) by refining those items to provide a well-rounded research perspective of the topic, (iii) specifying a P-set (participants), which is non-random and comprised of relevant individuals, (iv) completing the Q-sort, where each participant is identified as a sorter who orders Q-statements and administers the Q-sort, and (v) a factor analysis and interpretation (see Figure 3). The correlation between the sorts, the factor analysis, and the factor score, is calculated during stage (v). The factors related to the groups of participants can be interpreted when the Q-factor analysis is complete (Brown 1993), McKeown and Thomas (2013), Chen et al. (2015) for a further theoretical explanation.

Figure 3. Stages of Q-methodology



After completing the course, the twenty-six students took part in a Q-study, beginning with semi-structured interviews to respond to the research question, "Tell me about your learning experience. How did you learn that?" A representative sample of thirty statements from the interviews containing key ideas was used to develop the research instrument (i.e., Q-set) (see Figure 4). The process of creating the Q-set consists of gathering distinctive assertions, thoughts, or concepts related to the subject, preferably up to saturation point. The sampling may involve a literature review, preliminary data collection (e.g., interviews), or searching for other publicly-available resources. Photographs and other images may also be used. Opinion statements can be gathered from any primary or secondary source where the issue of interest is discussed. The collected statements are then reduced and refined (e.g., by grouping similar ideas together) to produce a manageable Q-set.

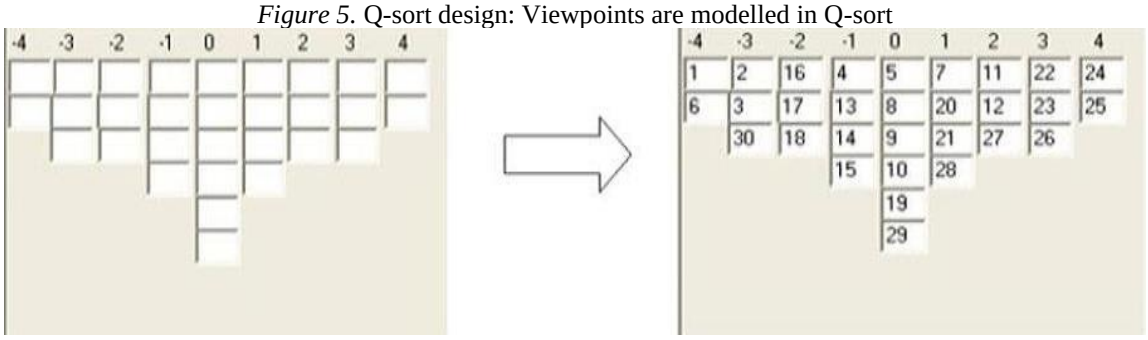
Fisher's variance design is the most formal way to ensure the comprehensiveness of the Q-sample, with equal numbers of statements chosen from each cell of a theoretically informed two-dimensional matrix. Some Q methodologists advocate a more liberated, creative approach that is focused on understanding and representing the statement population as a whole (Brown, 1993). Different from the present study, Hall et al. (2013) adapted the existing instrument of Soloman-Felder ILS as the Q-statement of a Q-method study in an introductory geographic information systems course. Fisher's variance design was not used to structure the Q-sample in the present study because it was not designed to select statements to meet a predetermined quota. Instead, the final Q-set of statements was chosen through a content analysis that characterized aspects of technology, content, and

the teacher and participants. Each participant was given a questionnaire in which they were asked to share their thoughts about this novel pedagogy. They were asked to rank thirty statements into nine categories, ranging from Most Disagreeable (-4) to Most Agreeable (+4) (see Figure 5), providing their opinions in Q-sorts on the answer sheet, without bias and with equal treatment for disagreements and agreements (Watts & Stenner, 2012).

Figure 4. Examples of statement

Item	Statement
1	I am passionate about progressing towards Google certification.
2	I gained valuable expertise via this approach.
3	I am very happy to know that I obtained the rare "Magic Stone Badge" since it is very scarce and hard to get.
4	I appreciate this way of teaching because I can collect many badges.
5	It is important for me to get more than 20 badges in the Moodle system.

Figure 5. Q-sort design: Viewpoints are modelled in Q-sort



3.4. Data analysis

Data and Q-sorts were entered into the PQMethod (version 2.11) statistical software program, which resulted in different piles of statement numbers. The statements were examined, and various methods of factor rotation and statistical procedures were used to preserve the factor reliability. Correlation, a centroid factor analysis, and judgmental (hand) rotation were used to identify the significant factors in this partial FC context (Watts & Stenner, 2012).

Researchers have shown that the correlation values for test-retest reliability are usually .80 or higher when the same people are given the same instrument (Q-sample) on two separate occasions. Q-methodology has produced similar findings when the same set of statements is used with different person samples, and different Q-samples drawn from the same concourse yield similar results. Since the respondents' Q-sorts are neither right nor wrong, but constructed by their rank-ordering of self-referent items, validity in line with quantitative research tenets is not a concern in Q-studies (Valenta & Wigger, 1997).

4. Results

To address the research aim, the findings revealed (i) a 3-factor structure – Factors A, B, and C being three types of learning styles (see Table 1), and (ii) because factor scores were used to represent the characteristics of each cluster, the clusters were defined by the uniqueness of statements that were combined to define each factor's distinctiveness (Table 1), with the first factor describing an engaged achiever (EA – Factor A), the second describing a self-motivated explorer (SME – Factor B), and the third describing an interactive designer (ID – Factor C). These three factors were named by comparing and contrasting the three sets of distinguishing statements, which helped to define and explain the uniqueness of each factor (see Table 2). Those arranged in the most important (+4 and +3) and least important -4 and -3) columns were distinguishing items, while each factor was labeled with a name so that it could be seen in the distinguishing items rankings. The complete pattern of the statements helped to identify the discriminated clusters of learners. The analysis of the Q-sorts revealed three distinctive factors. Twenty-three (88.5%) of the participants' Q-sorts were divided into these factors and three were found to be statistically insignificant. Twelve (52.17%) participants' Q-sorts were Factor A, six (26.09%) were Factor B, and five (21.74%) were Factor C (see Table 1).

Table 1. Factor structure of student group (*)

ID	Factor A	Factor B	Factor C
1	.83		
2	.84		
6	.50		
7	.60		
8	.56		
9	.52		
11	.77		
13	.60		
14	.74		
15	.63		
16	.79		
26	.74		
3		.84	
5		.65	
12		.51	
18		.70	
21		.80	
24		.45	
10			.70
17			.42
19			.65
20			.44
22			.48

Note. *Only significant loadings shown ($p < .01$).

4.1. Factor A: Engaged achiever

The Q-sorts of twelve participants: 6 males and 6 females, were significantly loaded, as evidenced by strong positive and negative statements (Table 2). familiarization with the performance evaluation and the badging mechanism pre-course was important (Statement 6), as were positive feelings about achieving badges and Google certification through self-directed learning. Teacher-student interactions were also enhanced (Statements 4, 5, 23, 25) and there was strong disagreement with Statement 14, "I personally prefer to work alone to complete the tasks although this course requires group discussion and collaboration." The mean scores of the mid-term and final exams for the EAs were 91.09 (*SD* = 8.006) and 86.82 (*SD* = 6.794), respectively.

4.2. Factor B: Self-motivated explorer

The Q-Sorts of six participants: 5 males and 1 female, were significantly loaded, as evidenced by distinguishing items rankings (Table 2). SMEs, like EAs, indicated the importance of achieving badges and progressing toward Google certification independently (Statements 5, 25). Interestingly, neither EAs nor SMEs expressed a wish to design and issue badges to peers. Both groups indicated that not seeing any students tended to dominate the class discussions. They disagreed that team members usually compete with each other (Statements 9, 11, 21). The SMEs strongly stated that they read pre- course materials and answered fundamental and advanced pre-class questions (Statements 26, 27, 30). The SMEs' mid-term and final exam mean scores were 86 (*SD* = 9.933) and 81.29 (*SD* = 6.291), respectively.

4.3. Factor C: Interactive designer

The Q-sorts of five students: 3 males and 2 females, were significantly loaded, as evidenced by their strong positive and negative statements (Table 2). They strongly agreed that they had gained considerable knowledge and were delighted to learn at their own pace (Statements 2, 22). They also believed that the teaching method increases teacher-student interaction (Statement 23). Interestingly, this group wished they could have designed customized badges for their classmates (Statement 21). They described some students as dominating the panel discussions, allowing fewer opportunities for others to participate. They did not feel that team members competed with each other (Statements 9, 10, 11) (Table 2). Unlike the SMEs they described themselves as being unprepared for class by not completing the pre-class questions. They were the only participants who did not have

a positive experience with the leaderboard because the accumulated points/badges were displayed publicly (Statements 26, 7). The IDs' mean scores of the mid-term and final exams were 69.2 (*SD* = 10.895) and 71 (*SD* = 7.211), respectively.

Table 2. Statement scores by factor/opinion types

Factor statements		A	B	C
	Factor A: Engaged achiever			
6	I get to know the performance evaluation mechanism and points/badges percentages in each activity before classes.	4		
25	I appreciate gaining extra Google certification via self-directed learning.	4		
4	I appreciate this way of teaching because I can collect many badges.	3		
5	It is important for me to get more than 20 badges in the Moodle system.	3		
23	This approach enhances my interaction with my instructor.	3		
9	Team members usually compete with each other when they join the group discussion.	-4		
10	I sometimes disagree with other group members in a group discussion.	-4		
11	Some members have a dominant voice during panel discussions so that others have fewer opportunities to speak.	-3		
14	I prefer to work alone to complete tasks although this course requires group discussion and collaboration.	-3		
21	I wish I could design my own personalized badge in class and distribute it to my classmates.	-3		
	Factor B: Self-Motivated explorer			
5	It is important for me to get more than 20 badges in the Moodle system.		4	
30	I usually download and read course materials on the Moodle system before class.		4	
25	I appreciate gaining extra Google certification via self-directed learning.		3	
26	I usually answer not only basic questions, but also advanced questions of the pre-class quiz listed on the MOODLE system.		3	
27	I usually answer the basic questions on the Moodle system before classes.		3	
9	Team members usually compete with each other in group discussions.		-4	
10	I sometimes disagree with other group members in a group discussion.		-4	
11	Some members have dominant voices during panel discussions so others have fewer opportunities to speak.		-3	
19	I like the appearance (form, color, style) of the badges		-3	
21	I wish I could design my own personalized badge in class and distribute it to my classmates.		-3	
	Factor C: Interactive designer			
2	I gained valuable expertise via this approach.			4
23	This teaching method increases my interaction with my instructors.			4
11	Some members have dominant voices during panel discussions so others have fewer opportunities to speak.			3
21	I wish I could design my own personalized badge in class and distribute it to my classmates.			3
22	This course is taught via pre-class previews and classroom discussions. I am pleased to learn at my own pace.			3
7	I had a positive experience with the leaderboard since everyone can see the accumulated points/badges publicly. It is important for me to use the leaderboard to interpret my rank relative to that of others.			-4
9	Team members usually compete with each other when they join group discussions.			-4
3	I am very happy to know that I obtained the rare "Magic Stone Badge" since it is very scarce and hard to get.			-3
10	I sometimes disagree with other group members in group discussions.			-3
26	I usually answer not only the basic questions, but also the advanced questions of the pre-class quiz listed on the MOODLE system.			-3

Note. Item rankings: -4 = most unimportant in this sample; 0 = ambivalent; +4 = most important in this sample

4.4. Consensus statements

While those with all three learning styles had opposing views on many issues, there was agreement on a few (Table 3). Consensus statements – those not distinguishing any factor pairs in the three groups – appear in Statements 2, 9, 10, 22, 23, 25.

Table 3. Consensus statements between Factor A, B, and C

Statements	Factors	A	B	C
2	I gained valuable expertise via this approach.	2	1	4
9	Team members usually compete with each other when they join group discussions.	-4	-4	-4
10	I sometimes disagree with other members in group discussions.	-4	-4	-3
22	This course is taught via pre-class previews and classroom discussions. I am glad I can learn at my own pace.	1	1	3
23	This teaching method increases my interaction with my instructor.	3	1	4
25	I appreciate gaining extra Google certification via self-directed learning.	4	3	1

4.5. Learning outcomes

A one-way analysis of variance (ANOVA) was used to determine if there were any significant differences between the students' mid-term and final exam scores and learning outcomes (final exam scores – mid-term scores) in terms of different factors. The results, which are shown in Table 4, indicate a significant difference between the mid-term and final exam scores of students in terms of different factors, but not a significant level of different learning effectiveness. F-values of 9.734 and 9.501 for mid-term and final exam scores respectively, with *p*-values of .001 and .001 for each factor, reached a significant difference level.

Table 4. Multiple comparisons of learning results for Factors A (EAs), B(SMEs), and C(IDs)

Learning results	Group	Number of students	Mean	*SD*	*F-value*	Post hoc comparison
Results of Mid-term Exam	EAs	12	91.09	8.006	9.734^{***}	1 > 3, 2 > 3
	SMEs	6	86.00	9.933		
	IDs	5	69.20	10.895		
Results of Final Exam	EAs	12	86.82	6.794	9.501^{***}	1 > 3
	SMEs	6	81.29	6.291		
	IDs	5	71.00	7.211		
Learning Effectiveness (Midterm vs. Final exam)	EAs	12	-4.27	3.580	2.914	
	SMEs	6	-4.71	5.090		
	IDs	5	1.80	7.791		

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

A follow-up Scheffe's test was also conducted and the results indicated that the mid-term exam scores of both EAs and SMEs were significantly higher than those of IDs. The final exam scores of EAs were significantly higher than those of IDs. In terms of learning effectiveness, the means of the final exam scores of EAs and SMEs were less than those of their mid-term scores. The means of the final exam scores of IDs were higher than their mid-term scores. The F-value of learning effectiveness was 2.914, and the p-value was 0.077, which did not reach the significant difference level.

5. Discussion and conclusion

5.1. Discussion

5.1.1. Construct whole or partial FC experiences

Previous researchers found that not all students agreed that the FC improved their learning due to cultural values. For instance, Asian students, including Taiwanese, are generally passive in articulating their personal opinions in class; hence, it is challenging to motivate them to engage in a fully-flipped class. The findings of this study show that using two different teaching methods simultaneously, namely, a partially flipped classroom and traditional lecturing, was able to meet the needs of a group of diverse Taiwanese university students in a business education setting. This finding corresponds to that of Waldrop and Bowdon (2016), who also found that partially-flipped teaching appeared to be better than fully-flipped for an entire semester. It is challenging for some adult students to adapt to inverted learning; hence, it may be easier for those who are uncomfortable with technology, or new to flipped learning, to receive only small segments of their course using this method until they become more familiar with it.

5.1.2. Care for learning styles and gender differences

Some conclusions could be drawn to address the research questions from the examination of the three sets of opinions expressed in Factors A, B, and C. To begin with, the EA, SME, and ID groups of participants in this flipped classroom utilized three distinctive learning styles. Although they expressed diverse preferences and opinions of digital badges, they had some themes in common. Interestingly, the EA group contained six of the nine female participants (66.67%), which implies that the perception of gamification may be gender-specific. This finding is consistent with the finding of Koivisto and Hamari (2014) that gamification provides women with greater social benefits, which suggests that instructors and curriculum designers should strive to understand gender differences in respect of the diverse incentives prevalent in flipped classrooms. Such socially-relevant features may be vital, especially for educators who wish to recruit users to help in the design and implementation of gamification. This result differs from the finding of Wang et al. (2004) that there was no significant difference between gender and learning styles in a web-learning environment.

According to Felder and Silverman (1988), active learners prefer to collaborate in teams in order to discuss, question, argue, brainstorm, experiment, or reflect. It was found in the present study that EAs with higher grades interacted more frequently during the course. This finding supports Huang et al.'s (2012) conclusion that the sensory/intuitive dimension of a learning style indirectly predicts the learning performance through the mediation of online participation. This increased online participation results in a better e-learning performance. This finding is consistent with that of Wang et al. (2004). The finding in the present study is aligned with the conclusion of Cela et al. (2015) that learning styles may yield insights, which educators can use to provide opportunities across learning styles and develop opportunities for students to use their individual strengths to improve their learning outcomes.

5.1.3. Challenges to formal and informal learning

Every participant earned all 26 badges and received a personal Google Fundamentals of Digital Marketing certificate. They practiced for hours after class at their own pace and with their own targets without receiving instruction; hence, they took responsibility for their own learning, as well as nurturing an interest in the subject. As Song and Bonk found in 2016, with such a wide range of online resources and emerging technologies, the potential for an increase in informal, self-directed learning is growing. However, the badge-issuing system linked to those goals is regarded as a constraint of freedom in the context of formal and informal learning.

The participants in the Self Motivated Explorer group, who tended to be self-challenging risk-takers, answered the Moodle questions voluntarily in advance of classes; hence, gamification appears to have contributed to better engagement with their studies, which Hamari et al. (2016) also found to be the case. Chen and Chen (2018) observed that some educators divide their course materials into different levels. They assist students to work to the level of their capability by providing all students with the required pre-class materials, but giving higher performers optional learning resources. Most learners in Factor B, which was 83.33% male, appeared to derive more benefit than females from information sources and more demanding work. This revelation may prove to be a critical factor in gamification design and application.

5.1.4. Competition on the leaderboard

All the EAs, SMEs, and IDs strongly believed that digital badges could motivate students to learn. This finding is not consistent with that of Facey-Shaw et al. (2020), who found that badges did not enhance students' intrinsic motivation in an introductory programming course. Leaderboards emphasize the social feature of badges by displaying the ranking of players in descending order. The relationship between gamification, points awarded and the function of leaderboards was highlighted as an extrinsic motivator in past studies due to seemingly enhanced performances as learners saw themselves climbing up the leaderboard (Mekler et al., 2017; Seaborn & Fels, 2015). It was found in this study that members of the Interactive Designer group were the only ones to oppose the idea of displaying their badges publicly; hence, one of the drawbacks of a leaderboard is that it could demotivate some students to the extent that they may leave the game altogether.

However, there are alternatives for providing learners with a better sense of their relative ranking. For instance, instructors could assign each student an online pseudonym at the beginning of the semester, although this strategy should be treated with caution because some researchers have found that anonymity may lead to more negative electronic contributions, causing social "loafing"; i.e., when people are part of a group, they tend to exert less effort. Social loafing can be reduced by providing comparative feedback about each group member's

performance, such as displaying the average points/badges earned in each relevant category and the student's rated position within the overall distribution (Le Hénaff et al., 2015). Another option is to distinguish the higher achievers by indicating where they fit into a predetermined top percentile group, such as 10%, while not disclosing their individual information to their classmates.

5.1.5. Customization of badges

Pedro et al. (2015) found customization through digital badge awards to be an important empowering element. However, it was found in this study that customization should be considered carefully, especially in view of the ID group's desire to design and award badges themselves. Therefore, customization based on capturing the personalization of badge design and badge-issuing, and the self-awarding of badges and peer-issued badges via an automated Learning Management System (LMS) platform, should be given due attention.

5.1.6. Communications and interactions

Sun and Wu (2016) reported that interactions in an FC had a positive effect on students' learning achievement, but their findings regarding teacher-student interactions revealed that learners in both the experimental (flipped classes) and control groups (conventional classrooms) primarily conversed with peers and teaching assistants, but had little interaction with the instructor. However, it was found in this study that, as learners endeavored to build their knowledge outside class, they learned how to articulate their opinions and reach out to their peers or instructor for advice. As with the Engaged Achiever group, the Interactive Designer group perceived that teacher-student and student-student relationships were built within a collaborative space. Therefore, gamification using digital badges was found to have the potential to encourage learners not only to interact socially with their peers, but also with their instructors via out-of-class activities.

5.2. Conclusion

Educators' recognition of students' diverse preferences and different learning styles has been reinforced by the findings of this study based on its three groups; consequently, the use of digital badges and partially flipped classrooms needs to be encouraged at individual levels for teachers to appreciate the contrasting and concurrent perspectives of students driven by different motivations. For instance, it is suggested by the findings of this study that most female students pay more attention to social connectedness, whereas the majority of males are more interested in information seeking and challenging; hence, gamification may be gender-specific. The preliminary results of the study, as demonstrated by the EA, SME and ID groups, show the positive effect of digital badges in motivating and energizing students to engage in an educational milieu based on the Self Determination Theory. Above all, implementing these measures across the board could contribute to enhancing the effectiveness of the gamified digital badges system.

However, some elements of gamification appear to be changing the fundamental concept that physical rewards motivate students in both formal and informal learning settings. As the ID group questioned the appropriateness of using digital leaderboards, educators should be wary of their negative impact in terms of being demotivators, together with badges, especially when they are both compulsory and publicly displayed. Nevertheless, although still in the early adoption stage, badges may open up new possibilities for credential and assessment purposes; indeed, it has been shown in this study that instructors could use them to set clear expectations, offer choices, give interactive assignments, and provide timely feedback on individual students' progress in a flipped classroom setting.

5.3. Limitations of the study

The preliminary findings of this study should be interpreted with caution due to the small sample size; however, researchers may use the Q-statement results as starting points for hypothesis-testing research because they shed light on both the opportunities and challenges of new credential and assessment methods in FC. They may also be the precursor of an innovative instructional strategy centered on increasing adult students' motivation and eagerness to learn. However, due to the nature of Q-methodology, the results have not been statistically proven, pending further investigation, therefore the three types of learning styles that emerged from this study may only be considered as impressionistic. Since the integrated badges in this study were designed and implemented on the Moodle Learning Management System, the results cannot be generalized across other learning platforms or

enhanced learning environments, such as augmented reality (AR) or virtual reality (VR). Unlike the emphasis on reliability and validity in R-methodology, these factors are not applicable to Q-methodology; rather, the views of the participants are what really matter when assessing the delivery of valuable results.

5.4. Recommendations

The research for this study was based on the use of gamified out-of-class activities in a flipped classroom in a business-oriented university. More research is needed to examine the effects of gamification on both in-class and out-of-class activities in similar conditions, with a particular focus on both in-class activities, based on the Self Determination Theory, and the value of using digital badges to foster gamification-centered positive learning outcomes. Learning styles should also be explored and the competitive context of digital leaderboards should be examined in depth for a better understanding of the social comparison effect on learning. Despite the promising findings of this study, it remains unclear whether leader badges, as described by the Factor C participants, have the same positive learning effect on low performers.

Additional proof is required by applying considerable effort to a discrete methodology to supplement the experts' opinions of the learning preferences identified in this study. Further investigation is also needed to determine if gender differences can affect students' perception of various gamification elements. A similar investigation should be conducted with a larger sample, different course, and various levels of education, for a more multi-faceted analysis of students' opinions and learning outcomes. Above all, future researchers should explore how academic institutions utilize digital badges with a view to benefitting all students' careers, as well as helping to fill a competency gap.

Acknowledgement

This research was funded by the National Science and Technology Council and the Ministry of Education, Taiwan, R.O.C. under Grant no. MOST 108-2511-H-216-003 and 108-Z27-MO-004.

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