An Action Research on Gamified Content and Language Integrated Learning in Technological and Vocational Education in Taiwan

Chi-hua Wu, and Tzu-Han Kao
Southern Taiwan University of Science and Technology, Taiwan

Students' lack of learning motivation towards academic subjects has been a long-term issue in Technological and Vocational Education (TVE) in Taiwan, and English as a Foreign Language (EFL) is probably one of most affected subjects amongst which. Underlying reasons includes low economic and/or socio-cultural capital, over-emphasize on academics over practice in traditional value, and course arrangement that poorly respond to individual differences. Meanwhile, widely considered educational gamification provides potential remedy; particularly, tangible games, generally with lower development cost comparing to digital ones, is expectable.

In this study, action research is adopted to investigate the potential of combining tangible game with learning activities under Taiwanese TVE context. Primarily, the popular boardgame of Citadels is chosen for its capacity of containing large quantity of vocabularies; with story and narrative replaced and adjusted to fit class context, it is applied to the "English in Design Profession" course conducted in 2020/21 and 2021/22. In the first round, students' participating motivation are surveyed (80 respondents, 25% effective response rate); as a result, 70% students remembered and is interested in participating in the gamified learning activity repeatedly, yet mostly not autonomously outside of class. In the second round, students voluntarily take pre- and post-test results regarding given vocabularies; their progress are assessed via comparison. After evicting the outlier (78 students, 55.1% effective response rate), 65.1% of student demonstrated a progress of 5% or more, and 46.5% of students demonstrated a progress of 20% or more. The result is potentially meaningful and further quantitative analysis is anticipated.

1. Introduction

Students' lack of learning motivation towards academic subjects has been a long-term issue in Technological and Vocational Education (TVE) in Taiwan, and English as a Foreign Language (EFL) is probably one of most affected subjects amongst which; while bimodal distribution on student performances can be observed in almost every stage of Taiwanese formal education, it needs to be taken seriously (Chen & Tsai, 2012). Main reasons behind this situation are several, includes a general lower status in terms of economical, societal and/or cultural capitals, traditional mindset also values academic knowledge more than techniques; to make things worse, student's individual differences tend not to be taken into account during class arrangement; all this congregate to a general lack of learning motivation (吳明揚, 林雅幸, & 陳培基, 2014; 陳怡靖, 2001).

Pedagogical innovations such as STEM are expected but not without constraints, an obvious one is on resources available to individual educator and is significantly amplified under EFL context due to the fundamental role of language as critical medium in knowledge transferring. Take Communicative Language Teaching (CLT) promoted by Taiwan Ministry of Education as an example, educators are expected to develop modified exams under inadequate teacher training and lack of sufficient teaching resource(Chang & Goswami, 2011; Huang & Yang, 2018). Pushed by increased workload, some teachers then drift back to exam-oriented learning that still inclined toward memorization, grammar and translation (Chang & Goswami, 2011; Chung & Huang, 2009), with a main frustrated perception that students' language ability is insufficient in participating in communicative learning activities (Al Asmari, 2015). Since development of vocabulary is one of the fundamental elements for second language acquisition and having profound influence on reading and communication ability (Barcroft, 2004; Dakhi & Fitria, 2019; Ma & Lin, 2015), to promote learners' immersion into CLT, it is central to firstly facilitate their learning on vocabulary more efficiently, while also taking teachers resource constraint into consideration.

Gamification provides potential remedy. Board game in particular has been applied on explaining some complex scientific concepts (Chiarello & Castellano, 2016). With the advantages of requiring less develop equipment and with its production cost more manageable, the inherent higher tangibility also bears benefits of lowering learners' cognitive risk and keeping their attention (Laroche, McDougall, Bergeron, & Yang, 2004). In this vein, this research aims to investigate how students' intention of engaging in gamified learning activity could be encouraged via tangible game (boardgame), and further explore its effect on learning outcome.

2. Literature review

2.1 Educational Gamification

Gamification, as a potentially viable way to promote motive, roughly referring to the use of game design elements in nongame contexts, or to draw inspiration from game and introduce into other human activities (Deterding, Dixon, Khaled, & Nacke, 2011; Morford, Witts, Killingsworth, & Alavosius, 2014). Other game-related concept aiming at promoting education and training includes Serious Game, Game-Based Learning, both involved with facilitating knowledge transferring or skill development via playful means for the purpose of human performance engineering, health, public policy, and strategic communication (Greitzer, Kuchar, & Huston, 2007; Zyda, 2005).

Nonetheless, discussion around tangible board games and higher education are scares in current literatures as the focus is more on electronic games; yet, still a useful guideline for the design process of games for learning involves balancing the need to cover the subject matter with the desire to prioritize game play (Plass, Perlin, and Nordlinger (2010)，轉引自 Plass, Homer, and Kinzer (2015)).

2.2 Tangibility in Game

In terms of gameplay, tangibility matters. Suits (2020) defines a game to be comprised of Goals, Means, Rules, and Lusory attitude; amongst which, Means and Rules embodied a large part of what is to be perceived by players and are more closely related to tangibility.

Rules are prior to Means. To further elaborate, game rules can be used either descriptively or prescriptively; for example, the rules are used descriptively while we are talking about a game and are used prescriptively when we are "playing" it (Suits, 2006). Under its prescriptive context, an important characteristic of game-playing is that the players "using only means permitted by rules" (Suits, 1967, 2014). And in doing so meaning that, before a game started, players must have had good enough epistemic access to its goals and rules so that they can be guided by the rules and goals (Kreider, 2011; Schwengerer, 2019). In this vein, an obvious conclusion is that the presence of Rules is prior to Means; Means are player behaviors and activities toward certain Goals guided by the Rules, which can only be proposed from aspect of designers.

Rules lead to tangibility (which is considered as the direct opposite of intangibility in this study). According to Shostack (1977), tangible means palpable and material, and tangibility can further be categorized into three dimensions: generality (how clear one could be described), physical (accessibility to the sense), and mental (how easy one could be mentally represented) (Laroche, Bergeron, & Goutaland, 2001; Laroche et al., 2004; Shostack, 1977). From aspect of generality, how clear a game could be described is associated with numerous if not infinite possibilities of game mechanisms and its combinations, hence difficult to come to a meaningful inference at this stage. From aspect of pure mental tangibility, player's perception and recognition towards game rules and mechanisms making the very foundation for believing the existence of a game. From aspect of physical tangibility, if specific object is required for a game, given object must be identified or referred to in the game rules; for instance, a basketball game requires the presence of a ball, which would be referred in the rule as "putting the ball into the basket to earn score". Therefore, in this study, it is argued that physical tangibility is suitable if we are trying to define "tangible game", and the number of and degrees of involvement of critical objects in a game might be of some operational importance.

2.3 Vocabulary acquisition in EFL

Vocabulary acquisition is taken as subject matter for this study, for that the development of vocabulary is one of the fundamental elements for second language acquisition, and is having significant influence on student's comprehension and communication abilities (Barcroft, 2004; Dakhi & Fitria, 2019; Ma & Lin, 2015). In terms of which, number of vocabulary comprehended is considered a core indicator (Bult, Housen, Pierrard, & Van Daele, 2008), making more efficient learning strategy a research focus.

Some approaches exploring learning strategy can be identified from current literatures, including intentional/incidental, direct/indirect Learning Strategies (e.g., Khoii & Sharififar, 2013; Naeimi & Foo, 2015; Shintani, 2011), implicit/explicit cognitive processes in incidental vocabulary acquisition (e.g., Ender, 2016), while game-related practices focusing on vocabulary acquisition also yield various results providing interesting insights (e.g., Mehregan, 2014; Silsüper, 2017; Zhonggen, 2018). In general, in terms of learning strategy, interaction is a pivotal factor influencing vocabulary acquisition apart from memorization, and the nature of gaming interaction is considered a research direction (Schmitt, 2019).

2.4 Synthesis

Targeting at the problematic situation of Students' lack of learning motivation towards academic subjects, a priority concern for this study is to encourage student's sense of achievement with learning strategy that is more operable to both educators and learners. With this in mind, also considered that words with a high frequency of exposure are less difficult to learn and retain (Reynolds, Wu, Liu, Kuo, & Yeh, 2015), which is getting support from evidence gathered with Chinese advanced EFL learners whose native tongue is closer to Taiwan (e.g. Zhu & Huang, 2021). In this vein, taking English vocabulary in design profession as subject matter, higher frequency of exposure as learning strategy, the incorporation of both into tangible games with adequate interactions is then a potentially viable solution.

3. Methodology

To investigate how students' intention of engaging in gamified learning activity could be encouraged via tangible game, an educational board game is firstly devised based on the popular board game of Citadels, for its capacity of containing large quantity of vocabularies, with story and narrative replaced and adjusted to fit with the class "English in Design Profession".

Furthermore, to demonstrate the efficacy of the devised educational game, two rounds of action research are conducted, each to investigate its effect on student's motivation of participating/engaging and explore its effect on learning outcome.

3.1 Action research

Action research is an open and flexible way of research that frequently adopted in education field, it is productive for classroom practitioners as it focuses on issues and questions related to immediate practice and application, and especially in applied linguistic, it is seen as an engaging way to refresh their teaching and extend themselves professionally (Burns, 2009).

A distinguishing feature of action research is to get into an organization and be engaged with the practitioners there; further elaborating, the action is usually associated with identifying and exploring an issue, question, dilemma, gap, or puzzle in one's own context of work, and the research in action research involves a systematic approach to collecting information, or data, usually using methods commonly associated with qualitative research (Bradbury-Huang, 2010; Burns, 2009).

Major steps of action research consist of planning, action, data-collection, and reflection. Data could be collected observationally, documenting transcripts of classroom interactions, audio- or video-recordings of classroom interaction, etc., or non-observationally with interviews, surveys, collecting classroom documents or samples of student writing or tests (Burns, 2009; Feldman, Altrichter, Posch, & Somekh, 2018).

3.2 Research design

Junior students of product design profession in a Taiwanese technical university is taken as participants of this research. In terms of planning before the two rounds of action research, as aforementioned, the board game of Citadels is taken and adapted.

Figure 1 Action research structure of this study

In the action phase, students participated in the gamified learning event where they play the adapted education board game; it takes 2 hours per week and totally 4 weeks for each round.

For data collection, in the first round, Awareness-Interest-Desire-Action model in communication theory is adopted as analytical structure (Beck, Beukel, & Poetz, 2018), whereas students' awareness of event content, interest to participate, desire for engagement, and whether they had played the game autonomously are surveyed using 7 point Likert-scale. In the second round, a focus is put on evaluating learning action and resulted knowledge retention rate (e.g. Chittaro & Buttussi, 2015); therefore, pre- and post-tests are conducted using one vocabulary test containing 84 multiple choice all from vocabularies used in the new education game. For research ethics, all questionnaires are answered voluntarily, all participants are numbered only for self-comparison while all test results are having no effect on their grading and are strictly limited to research purpose.

Table 1 Meta-data for each round

Rounds	Period	Participants	effective response (rate)
1	2020/9 to 2021/1	80 junior students (Male/Female)	20 (25%)
2	2020/9 to 2021/1	78 junior students (Male/Female)	43 (55.1%)

4. Research finding

4.1 Students' motivation for participating in the gamified learning event

In this round, there are 80 participants and questionnaires issued, 20 effective responses, effective rate is 25%. As a result, the descriptive statistics shows that above 70% of effective respondents agreed that they can "remember event content clearly", "felt interested", and is willing to "join the event again"; demonstrating strong motive for participating.

Figure 2 Results of Motivation Survey

A sharp decline can be observed when asked whether they have "played the game on their own", only 7 participants (translated to 35% of respondents) reported to play the game autonomously after class. There are two potential reasons to it. First, accessibility to the adapted board game is limited; as only 8 sets of games are made due to budget limitation, those are considered teaching aids by the administrative hence not placed in public space. Second, students typically spent more time and effort on core curriculum, that are courses training design process and skills, while "English in Design Profession" is more peripheral.

4.2 Effect on elevating learning outcome

There are 78 participants in the second round, 45 respondents gave effective responses on both pre-and post-tests, the effective rate is 55.1%. In terms of data processing, number of correct answers from the two tests (T_1, T_2) are converted to percentage, then calculate individual improvement rate (P) as followed.

$$P = \frac{T_2 - T_1}{T_1} \times 100\%$$

After evicting Mild outlier (NIST, 2012), meta-data of students' learning outcome are analyzed.
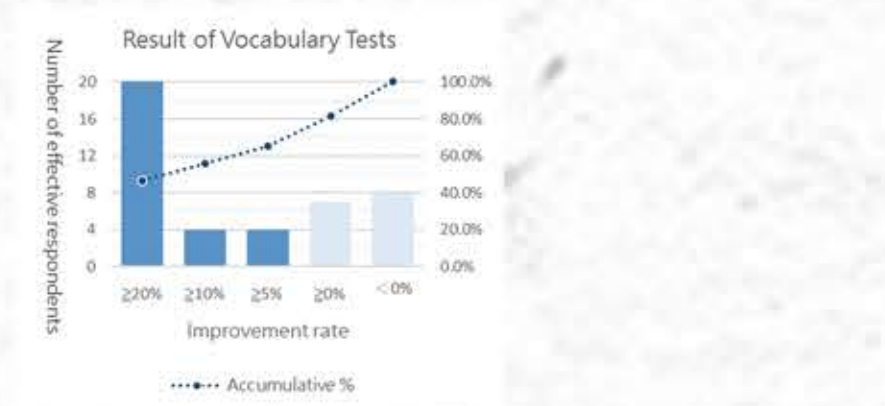

Figure 2 Result of Vocabulary Tests

As data suggest, there are 20 respondents reached an improvement rate of 20% or above, occupying 46.51% of respondents (or 25.64% of all participants); 4 respondents reached 5% and another 4 reached 10% improvement rate, each occupying 9.30% of respondents (or 5.13% of all participants). In sum, 65.12% of respondents (or 35.9 of all participants) reached an improvement rate of 5% or above. This is considered a success given only 8 hours of total learning time.

5. Summary and future research direction

Two preliminary conclusions can be drawn from the two rounds of research. Firstly, potential framing effect in event introduction is observed; by describe the learning event as "playing (game)" or "learning" seems to make a difference. In the first round, it is described as playing, yet in the second round, it is unintentionally addressed as "learning" for several times; although amendments are made instantly, the subtle change on classroom atmosphere is felt. This indicates that the way an educator address the event is having effect on whether a learner will engage it with lusory attitude (Stenros, 2017). Future researches should take this into consideration.

Nonetheless, the gamified event still demonstrating certain degrees of improvement on participants learning outcome, pointing out two future research directions. Firstly, does gamified event really have significantly positive effect on learning outcome, or the improvement is just inevitable result of combining certain factors, such as low baseline participants, learning material that requires memorization and could be simply improved with Mere Exposure Effect, whereas gamification is only a binder and not really central to language learning. Secondly, how the aforementioned framing effect might affect learning outcome. Considering participants still show a certain level of improvement in the second round, there is reason to believe that gamification might not be completely positive for learning. In other words, best or conditional best framings for the gamified event might be expected and further explored with more comprehensive or larger scale researches.

CREATIVE PRODUCT DESIGN 創新產品設計系　南臺科技大學 Southern Taiwan University of Science and Technology