Applying Gamification in Vocational and Professional and Education and Training (VPET) Classroom to Engage Students' Learning

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Abstract
This paper aims to discuss the possibility of applying gamification in various classrooms in vocational education. The application of gamification in education has been explored in recent years. A number of research suggesting that incorporating game elements and game dynamics can enhance students' engagement and motivation by changing their role from being taught to active game players, and thus, breaking the boundaries of communication of traditional teaching and learning method. Vocational and professional education and training (VPET) is under rapid changes, students' learning style and needs are diverse, new teaching strategies are in high demand. The largest vocational and professional education and training provider in Hong Kong, Vocational Training Council (VTC), has been providing great strength in enhancing teaching and learning of various VPET programmes, so as to engage the new generations in acquiring three domains of learning, which are cognitive(knowledge), affective(attitude) and psychomotor(skills) domain as suggested by Bloom's Taxonomy (Bloom et al., 1956). Since the authors of this paper are Education Development Officers, who conduct class observation in various programmes. Some of the classes observed revealed the ways how gamification changes a knowledge-based lesson into an interactive classroom. It was also observed that how the teacher develops students' global vision and critical thinking skills through game-based instruction design. Moreover, one of the class also showed how game dynamics are used to teach practical skills. Last but not least, it will also discuss the constraints and challenges of applying gamification in VPET.

Keywords: Gamification, Motivation, Engagement, Learner Diversity, Game-based Instructional Design, VPET

Introduction

The study is concerned with the application of Gamification in Vocational and Professional and Education and Training (VPET) classroom to engage students' learning, and in particular, how game elements and dynamics can be used to develop students in cognitive, affective and psychomotor domain. More specifically, it depicted the application of gamification for a knowledge-based subject, for teaching intangible concepts, and finally, for a complementary to practice hands-on skills in trade specific subjects. The study first looked at the relevant studies on the concepts of gamification in educational context. Followed by the explanation on implications to investigate how game elements, such as freedom to fail, rapid feedback, progression and storytelling could motivate students and promote learning. With the emphasis of the development of the skills, attitudes and knowledge of the learners in VPET, the paper would borrow the study of Bloom's taxonomy to select the cases in different domains. Class observation was conducted in the selected cases and it showed that using gamification in VPET had positive outcomes, including the increase in students' motivation and participation in attending theoretical lesson, and the acquisition of the intangible concepts, such as critical thinking skills and communication skills; and also the development of practical skills in trade specific subject. The paper further explored the possibility of the gamification in learning by discussing its challenges and constraints in VPET context.

Literature Review

This section highlights the literature relevant to the concept of gamification. To begin with, Karl Kapp (2013) asserts that "gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems." Game designer, Sebastian Deterding (2011) assert that games satisfy the innate need for intrinsic motivation and suggests to use game to redesign schooling and workplace training. He stresses the use of game-design elements in "non-game contexts" that further implies the application of gamification in contexts beyond games, it extends to education and business. Throughout the literature, it is generally claimed that gamification is the use of game elements, game dynamics, game mechanics to engage and motivate people in a non-game context. The applicability of gamification in education programmes and curricular planning to encourage specific behaviours and increase motivation and engagement has been studied and considered in recent years.

Different authors have put different emphases on what game elements are, such as challenge, fun, social connection, immediate feedback, narrative, collaborative problem solving, progress mechanics and music. In the study of "Gamification Revolution", Zichermann and Linder (2013) identify points, badges, prizes, and social reinforcement, onboarding, challenges, goals, and goals markers as the most important mechanics for gamification. Zichermann and Christopher Cunningham (2011) revealed in Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps, point out points, levels, leaderboards, badge, challenges, quests, social engagement, customization, dashboards, feedback and reinforcement as key game mechanics.

Rajat Paharia (2013) suggests the five intrinsic motivations of games which are autonomy, mastery, purpose, progress and social interactions. Among them, Andrew Stott and Carman Neustaedter (2013) concluded four games elements, which are freedom to fail, rapid feedback, progression and storytelling. Huang and Soman (2013) had an in-depth study and defined a five part process for applying gamification to the instructional design of vocational education, which are "understanding audience and context, defining learning objectives, structuring the experience, identifying resources and finally, applying gamification.". The study highlighted the importance of identifying the context in which gamification intends to be used.

A study by Xiang et al.(2014) showed that gamification helped student to learn better; and their learning experience and engagement had been improved. It is also said that students can make use of games to do revision as it makes the learning process more interesting. It is suggested that vocation training and education can leverage on gamification and make the curriculum more interesting so as to engaging students.

Case Studies

In Hong Kong, Vocational and professional education and training (VPET) (formerly called Vocational education and training (VET)) has received more attention in recent years. With its rebrand, VPET has been "covering programmes up to degree level with a high percentage of curriculums consisting of specialized contents in vocational skills and professional knowledge to better equip VPET learners with practical skills, attitudes and knowledge" (Lam and Ng, 2015). The following case studies depict the application of gamification and evaluate its possibility in VPET.

Cognitive Domain

The cognitive domain involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills (Bloom, 1956). The module we observed was "Pharmaceutical Product Regulation and Registration" of a Higher Diploma programme in the discipline of Applied Science (AS). The original teaching and learning materials were plain text without visuals aids and be presented in PowerPoint slides. Teaching and learning strategies were mainly lectures and a few tutorials. The delivery of lectures were in traditional style, i.e. chalk and talk, thus students' engagement was relatively low.

The module learning outcomes are: On completion of the module, students are expected to be able to: 1) explain the implication of the laws and regulations related to pharmaceutical product regulation to the pharmaceutical industry practitioners. 2) determine the registration classification of a pharmaceutical product in compliance with regulatory requirements in Hong Kong, mainland China and other representative countries and areas. 3) conduct technical review to ensure correctness and completeness of registration application materials.

As the learning contents include quite a large amount of contents mentioning law, ordinance and regulation related to pharmacy, which is regarded as a knowledge-based lesson. Gamified learning activities were used to arouse students' learning motivation and increase their interests in the subject matter.

The teacher briefed the students the module learning outcomes, learning content and assessment tasks early in the first lesson. He also asked the students to form group as they would be working in groups for the group project and other learning and teaching activities. Some rapport building was made which help implement the gamified learning process later in the module.

In the second lesson, the students formed teams and participated in the gamified learning activity called "Register Your Product". The scenario was in a pharmaceutical company. Players worked as an officer who is responsible to submit registration of the drugs produced by the company. Their mission was to complete the "Application Form for Registration for a Drug/Pharmaceutical Product/Substance". The team who registered the product successfully could be the winner. This gamified learning activity used the game mechanics "mission" and challenge to engage the students. Moreover, game mechanism "collaboration" was included. As pointed out by many research that collaboration, challenge and mission are ones of the most frequently used game elements and game mechanics. Collaboration is heavily embedded in the module. The students were asked to play in groups to participate in the game-based learning activity. They were also required to work in groups for the assessment (group project) at later stage. This collaboration allows students to solve problems and complete their "mission" together. The mission or goal gives a purpose of the gamified task for the players to have a goal and strive to achieve it (Xiang et al., 2014). In this lesson, the students had an opportunity to solve authentic problems which they might encounter in workplace and have chance to solve problems collaboratively and in teams.

Similar gamified learning activity was found in the fifth lesson. The Role Playing Game (RPG) was called "Make a change". Players worked in the same team and in a same company as in the previous game. Each team received an order from the boss to apply for a change of a registered pharmaceutical product. They have to play in teams to amend the information, justify the suitability and submit relevant documents for the application. Like the gamified learning activity "Register Your Product" in the second lesson, game elements of collaboration, mission, challenge, peer support and pressure were used in this gamified activity, with the game mechanism of competition to encourage team players to achieve their goals and shared accountability (Oda and Lister, 2014). The students were assigned a mission and a role (an officer in a project team of a pharmaceutical company) in the class which imitated a real life workplace problem. The motivation to achieve the mission was intensified by the mechanism of competition, they needed to complete with other teams in order to win and obtain their boss's (the teacher's) positive rewards.

The above learning activities showed that it is possible to add some game elements, game mechanics in a knowledge-based lesson. To help students develop in cognitive domain might not be teacher-centered or only through lecturing. Constructing new knowledge by making good use of students' prior knowledge and daily life experience could also be helpful in designing classroom games in VPET.

Affective Domain

Through a class observation of the lesson for student development discipline, we examine the use of gamification to deliver the concepts of global vision and some soft skills, such as problem solving skills, critical thinking and communication skills.

In VPET, the curriculum is always stressed on the practical training and skills-based learning. Students tend to be more engaged in hands-on practice. To teach generic subject, like whole person development programme, the instructional design of a lesson is a crucial factor to enhance the learning effectiveness. In our observation, the module named Global Vision, consists of 13 curriculum hours, which includes 8 hours in workshop and 5 hours in tutorials and presentation was conducted with the gamified elements. The intended learning outcomes are 1) apply critical think skills to analyze global issues in environmental, social, and economic aspects; and 2) make recommendations to the global issues relevant to the trade of study. We observed a 2-hour workshop. The original lesson planning was that the teacher firstly talked about what global issue and global citizenship are. Secondly, teacher asked students to express their ideas and views on the topic. Thirdly, the teacher explained the attitude and method on how to be a critical thinker and stressed the importance of academic honesty. Lastly, the teacher introduced reliable resources and citations in APA format. To cater for the different learning styles and needs of the Higher Diploma students, the teacher had adapted the lesson plan by adding the elements of gamification, to flip the lesson into a student-centered and more interactive one. The revised lesson plan was like this: through the game of "Guessing the beginning of a story" (The ending of a story was told, students had to guess the beginning of a story by asking yes/no question), the teacher introduced the topic of "critical thinking" and how to be a critical thinker. Then, the teacher talked about global issue by playing the game of "Pick a pic" (selecting the specific picture that related to a global issue, mentioned in a video). After that, the teacher let students watch a video clip, which was about the advertisement of bottle water and play a game of "Tasting water" to select the bottle water that is shown in the video. Finally, some more videos on global issue were played and students were asked to discuss the issues. At the same time, the teacher explained the common features of global issues and debriefed the topic of global citizenship.

We can see that after the modification of the lesson plan, game-based activities are used throughout the lesson. In the following paragraphs, we are going to explain the details of lesson delivery, and how the gamification takes place in a lesson which teaches affective domain.

The affective domain includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes. The module aims of "Global Vision" is to enable students to broaden global horizons and enhance sense of responsibility of a global citizen in maintaining a balanced and sustainable career development in various context. (Krathwohl, Bloom, Masia, 1973) In order to achieve the aims, gamification is used in the lesson planning and delivery. Students are involved in various games to learn the topic of global vision and also the critical thinking skills.

In the introduction, teacher used “Guessing the beginning of a story” to arouse students’ motivation and as an introduction of the topic. The game is like this: four teams were divided, and with the ground rules were set, each team had to guess the beginning of a story as so to win the game. The teacher told the ending of a story, which was someone, was killed. Then the teams can ask yes/no question to get the clues for guessing. Each team had tried to ask questions, students were actively participated in game. Some students who had known the answers were asked to keep quiet and be an observer. The learning atmosphere was active and enjoyable. Students were excited to shout out the possible answers and until the correct one was came out. During the process, the students learned how to ask questions tactically, how to select the useful hints to solve problems, and to make conclusions by compiling the information on hand. In this game, the four elements in game design, namely freedom to fail, rapid feedback, progression and storytelling are shown. All groups have freedom to fail which means there is no limitation in asking yes/no questions and also are allowed to have multiple attempts to guess the beginning of story. In the meantime, rapid feedback would be received as the teacher would answer the yes/no question immediately for the groups to collect new information and clues. During the process, students have to think critically and select the appropriate information and eliminate the irrelevant factors so as to guess the correct answers. The element of progression was found as Kapp (2012) noted that “purposefully sequence events within the flow of the entire game to continually grab and hold the players’ attention.” Obviously, the “Guessing the beginning of a story” game was about storytelling. In our example, a murder case was used in the story and students were asked to be detectives to find out the reason and the ways on how a murder happened.

Another game was used in the lesson to achieve the intended learning outcomes, i.e. “apply critical thinking skills to analyze a global issue”. The game “Pick a pic” is like this: players formed a group of five to six. Each group will be given a set of photo and a set of global issue examples. Players have to identify one global issue among the photos with reasons in five minutes. Then they have to present the answer to the class, the group can get one point if they got the correct answer and reason. By applying the game elements we have just mentioned, storytelling, rapid feedback and progression were used. The photos used in the game are about the stories in the real world. Some are local issue and some are global one. As Kapp(2012) notes, most games employ some type of story, as people learn facts better when the facts are embedded in a story rather than in a bulleted list. The players would found easier to figure out the global issue by comparison of different stories and applied the critical thinking skills which just learnt from the previous game. After the player picked the photo and present their reasons, teachers had debriefed the game by asking three questions: 1) why some incidents are global issue but some are not? 2) how to define a global issue? 3) could you find some common features about global issues shown in the presentation? Through the repaid feedback, teacher had further explained the above points and drawn to a conclusion. The players were progressively learn the topic by apply critical thinking skills in the first part of the game, and think about the reasons and analyzing the common features of a global issue. Finally the teacher facilitated them to summarize the common features which help them to identify what a global issue is.

The third game of “Tasting water” was used to further apply the critical thinking skills in identifying global issue and global citizenship. Two advertisement videos were shown to them of two bottle water brands with different prices with some basic

information introduced. Then players were asked to taste two cups of water to identify which one is the more expensive bottle water and which one is less expensive. Since the water does not differ much in taste, players were reminded to use critical thinking to analyze the connection between product quality and price: Does higher price equal to better quality? Furthermore, the assumption of "Bottle water is cleaner" was discussed and challenged in the following discussion. Up to this point, the players have learnt progressively on understanding what critical thinking is and how to apply the skills in identifying global issue. After this game, they gradually learned more on global citizenship and what global issue meant to them. The teacher used three games to achieve the intended learning outcomes in an interactive and engaging way.

Psychomotor Domain

In VPET, most of the modules involve competency and practical skills training. The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution (Simpson, 1972). Under the Augmented Reality / Virtual Reality (AR/VR) Project), some modules are selected to do pilot-run in conducting hands-on practice though AR/VR technology. In one of our observation, a module under Electrical Engineering was selected to use AR/VR technology to develop students' skills on examination of life safety devices. To set the scene, the concept of gamification is also used in designing the lesson of "Lift Examination Practice".

The game is a Role-Playing Game (RPG) which works in this way: the class was divided into four teams, each of them are given a role and a mission, in which the players acted as engineers to carry out lift maintenance and examination work. In the game, some residents are trapped into the lift and the engineers have to rescue them. Incorporating with AR/VR technology, the engineers can enter to lift and car cage and carry out all required procedures to preform lift works and to save the lives in given time. The team that can recuse the residents in shortest time will be the winner. In this example, the game elements of freedom to fail, storytelling and rapid feedback were used. Players were given opportunities to open the car cage and perform different kinds of safety check-up, in which they were encouraged to experiment without fear of causing irreversible damage by allowing them to start again at the most recent "checkpoint". This game employs a story which is about saving the lives of residents who are trapped in a lift. It provides a good example of how even a simple integration of storytelling can be utilized to good effect. Rapid feedback will be given in forms of debriefing after the completion of the game. Teacher highlighted the points in maintaining, testing and examining lift safety devices. Therefore, we can see that practical skills can be developed in the means of gamification together with AR/VR technology so as to enhance the learning effectiveness and students' engagement.

Constraints and Challenges

The case studies reflect that game elements can motivate the lower-achieving students. The game mechanics found in gamified learning activities could engage students. While this study discusses how gamification has been applied in VPET classroom to help students to develop cognitive, affective, and psychomotor domain of knowledge, it also explains the constraints and challenges that may hinder the implementation of

gamification. One of the criticisms towards gamification in learning concerns the time availability for learners and that for teachers. Some learners may not prefer participating in gamified experience because it may not be situable for their learning styles. Teachers may criticize that gamification is time consuming to implement gamification for learning, considering that some game mechanics require great efforts to design, prepare and sustain. There is a lack of in-depth study that prove game elements are more effective than linear presentations of educational content or hands-on practice in trade-specific modules in VPET. Some of the studies question whether gamification is more suitable in developing students' practical skills in vocational training education; whether the game elements and game dynamic are necessarily related to the content or fit for propose. There are studies pointing out the importance of understanding different types of students, for what motivates some does not work for others (Hakulinen and Auvinen, 2014). Therefore, one of the challenge is to understand students' needs and learning characteristics, and estimate their response to which gamification will be used. Last but not least, class size is also a concern for the implementation of gamification. Some game dynamics are difficult to adopt and manage with a relatively large class. For example, in VPET, some core modules are delivered in a large lecture due to the large number of students. Gamification may benefit to students to a rather skin deep level, i.e. arouse their motivation and draw their attention back with little games.

Conclusion

In our research, we have put on the glass of gamification to view the three types of lesson, which are cognitive, affective and psychomotor domain, and see how we add game elements in teaching so as to enhance student's motivation and engagement. From the above explanation, we can see that gamification, which refers to the application of game dynamics, mechanics, and frameworks into non-game settings (Stott and Neustaedter, 2013), has been used in both lesson planning and classroom delivery in VPET. Students in those classes enjoyed it much and actively participated in all the games. Laughers and cheers were found throughout the lessons. To deliver knowledge-based lesson, it is always an obstacle for a teacher to deliver tons of information, theories, ordinance, and hard facts to the students who have low attention span. Games would be a good option for students to receive information and data in fun and natural way. In opposite, generic skills, or soft skills such as thinking and communication skills, are sometimes too ambiguous for students to understand or even apply them. By playing games, they could easily grasp the skills and apply them in classroom setting. One thing that we may have to consider is, when developing students practical skills, is it feasible to add game elements as the psychomotor lesson would have plenty of hands-on practices, students may not have the room to play games in such context? In our example, incorporating with AR/VR technology in the game-based lesson would be a choice. Yet, in most of the trade specific modules or competency-based training, many curriculum hours are used to conduct hands-on practice, in which the teacher have already spent much effort and time in developing students' practical skills through demonstration and hands-on practice, games, in this sense, seems like less effective than when it is used in conducting cognitive and affective domain. Further research on which domain is best fit for using gamification to enhance the motivation is yet to be conducted. By having more observation on various classes, we may collect more information and evidence in finding out how much can gamification help in VPET's teaching and learning.

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