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Gamification-embedded eLearning courses for the learner success of competency based education: Case of Technical and Vocational Education and Training

Abstract

To stimulate and sustain learner's motivation through effective methods is empirically proven as a predominant issue in eLearning and particularly in the context of Technical and Vocational Education and Training (TVET), which defined as the attainment of practical skills, underpinning knowledge and right working attitudes towards learning of technologies and vocational competencies. Learner success in TVET programs are heavily dependent on learner's engagement and motivation towards achieving intended competencies.

Although online courses can facilitate time and place flexibility for learners, they are not designed to increase engagement and motivation of learners. In finding an effective solution to above issue, gamification support for eLearning courses quests a new paradigm of teaching and learning process which addresses on how to enhance engagement and motivation of online students to achieve high competency in education.

This paper discusses how gamification (game dynamics, game mechanics, and game elements) can be embedded into online learning courses in order to enhance engagement and motivation of students. The paper further elaborates the modalities of applying game dynamics such as constraints, emotions, narrative, progression and relationships driving the game mechanics such as rewards, challenges, competition, feedback and cooperation, towards competency based education in TVET to reduce high dropout rates of online courses among demotivated learners.

Introduction

Acquisition of practical skills, underpinning knowledge and right working attitudes towards learning of technologies are defined by Technical and Vocational Education and Training (TVET) and further the vocational competencies in various sectors of economic and social life apart from the general education (UNESCO-UNEVOC, 2012). When learning happens through the electronic means, typically over the internet is called Electronic learning or "eLearning", and it is an emerging trend in education and training in many fields. Introduction of Web 2.0 leads emergence of social web and crowd-based activities, which resulted in development of e-content with collaborative efforts. Psychological principles are used in instructional design of eLearning where it needs to handle the learner's motivation in conjunction with web and internet technologies. Appropriate use of virtual learning environments eventually helps to gain knowledge, practice and assess the achieved competencies.

Academic achievement, engagement in educationally purposeful activities, satisfaction, persistence, attainment of educational outcomes, and post-college performance have specifically led to "student success" or "learner success" in vocational and higher education (Kuh et al.,2006). The "competence" in terms of academic achievement, knowledge and skills, is a main factor when considering the learner success and moreover, the "persistence" and "engagement" play vital roles in learner success (York el al.,2015). Subsequently, learner motivation and competence are identified as major critical success factors in eLearning (Selim, 2007).

There is a high demand for technicians and technologists due to rapid technological progress, the economic pressure and the cultural changes happening in recent past (Adrian, 2007). Correspondingly, in education, the learner's perception has changed and therefore teachers face issues of learner's motivation and engagement in traditional pedagogical methods (Simõesa, 2013). Accordingly, education technologists are entrusted to design approaches such as "Gamification" which uses game thinking and mechanics in non-game contexts (Huotari & Hamari, 2012) to inspire learners to fully engaged in the learning process (Deterding. 2011). In other words, gamification is the process of game-thinking and game-mechanics to engage users and solve problems (Zichermann & Cunningham, 2011). Gamifying courses in technical and vocational education could be promising and powerful engagement tool

in order to deliver content effectively and to trigger emotions, eventually fuel competitive spirit for learner motivation.

eLearning in Technical and Vocational Education

Information and communications technologies are increasingly used in the Technical and Vocational Education (TVE) due to its flexibility, affordability and reachability (Tondeur et al. 2008). Technical and vocational education and training yields advantages of ICT by introducing delivery of courses through eLearning to overcome pedagogical, organizational and technological challenges (Bullen & Janes, 2007).

TVET relies on competence which is an ability of an individual to perform a particular job rather than pure academic programs. Well-defined performance criteria help candidates to identify, develop and perform in terms of skills, knowledge and attitudes of a workplace through education and training. eLearning delivery in TVET sector is challenging in terms of delivering skills and attitudes than knowledge component. Suitable mechanisms in implementing eLearning in TVET sector are needed in developing competence using appropriate strategies and technologies.

Integrating e-learning tool in teaching and learning leads to innovation in education and facilitates TVE graduates to compete in a technology biased programs (Bappa-Aliyu, 2012). Furthermore, the development in internet connectivity, availability and affordability of internet services, enable TVE students to download virtual lecture materials and laboratory manuals and perform laboratory experiments effectively in virtual labs at distance. Possibilities need to be explored by training institutions to realize eLearning benefits overcoming challenges outlined above and full deployment of tools to enhance the teaching and learning of engineering related disciplines and service occupations.

Learner Success in eLearning

Student success is defined as “academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational outcomes, and post-college performance” (Kuh et al., 2006). But researchers argue that this definition lacks clarity and operational mechanics and advocate the need of advanced, expanded and viable definition.

Cognitive development and direct measure of learning outcomes affect learner success in different ways. Moreover, motivation, aspirations, grades and individual learning achievements are some other dimensions for learner success. The competency defined by skills, knowledge and values, is recognized as a major reason for student success. Student’s engagements and commitment to success are some supportive elements to foster the learning. Moreover, according to Autor et. al. (2003) non-routine interactive and analytical skills are in demand for developing career skills than the manual and routine cognitive skills.

Academic success is said to be “academic achievement, attainment of learning objectives, acquisition of desired skills and competencies, satisfaction, persistence and post-college performance” (York et al., 2015), which is considered to be more realistic. Researchers further argue that academic achievement should be direct outcome of acquiring required skills and competencies and attaining learning objectives. Furthermore, their study revealed that satisfaction is not direct component of academic success and may be an outcome of perceptions on institution’s climate and goal achievement of students.

Vu et al. (2014) clearly identifies that motivation contributes the most for learner success in eLearning but satisfaction seems to be an outcome measure for contextual elements of learning environment and energizer for the success. Studies of Beaudoin et al. (2009) revealed the critical success factors of eLearning are more on self-determination than the institutional support which turns up the motivation factor.

When comparing and contrasting different elements/definitions of the learner success, it is clear that knowledge, skills and attitudes as measure of competency achievement are prime of all elements which are central to technical and vocational education. Dissimilar to academic pathway, TVE mostly focused on practical abilities and measure competence through continuous assessments which is vital for the quality assurance of courses. In fact, the student’s engagement is vital to achieve the learner success throughout the course. With the purpose of achieving above two,

student's motivation plays the dominant role in keeping learner enthusiasm and ultimately accomplish the learner success in the TVE.

Gamification Defined

According to the Gamification Encyclopedia, "Gamification is the concept that you can apply the basic elements that make games fun and engaging to things that aren't considered a game". Some other definition is "The use of game-thinking and game mechanics to engage users and solve problems" (Zichermann & Cunningham, 2011). Werbach & Hunter (2012) defined gamification as "The use of game elements and game-design techniques in non-game contexts".

It could be derived by definitions that gamification needs game-thinking, game-design, game-mechanics and game-elements. Idea stresses that it is used in non-game contexts primarily to engage users and solve problems. Apart from serious games, which simulates real-world events or processes designed for the purpose of solving a problem, gamification is known to be reverse engineering, what makes video games effective, fun and grafting them onto business applications in addition to education (Werbach & Hunter, 2012).

The concept of gamification" is not a new one. Teachers have a habit of using games and game dynamics for teaching learning process since the inception of education specially to make clear and elaborate difficult concepts to the students. Few popular game elements are points, levels, leaderboards and badges. Businesses use gamification in promotions for years for employee motivation and customer loyalty programs. Despite of performing normal daily activities, people are happier when they play games, which keep them out of negative feelings such as depression, frustration and loneliness etc. (Werbach & Hunter, 2012).

In order to understand how gamification works, the behavioral models of human are useful. The classical conditioning and operant conditioning (Skinner, 1938) were basic concepts and then evolved as stimulus-response which is central to both concepts. In particular, the reinforcements and emotions play a vital role in motivation, which defined by the Self-Deterministic Theory (SDT). The competence or mastery of something and the autonomy in making meaningful choices and relatedness, which represents by social interactions, are main drivers of the SDT (Ryan & Deci, 1987).

Game Dynamics in Competency Based Education

When designing gameful experience, game dynamics, mechanics and elements are to be appropriately used in the design process of the gamified system of competency based education. Researchers have divided game design experience in to five stages as shown in *Figure 1* (Bartel et al., 2015):

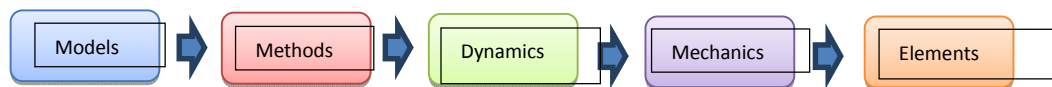


Figure 1: Game Models to Design Elements

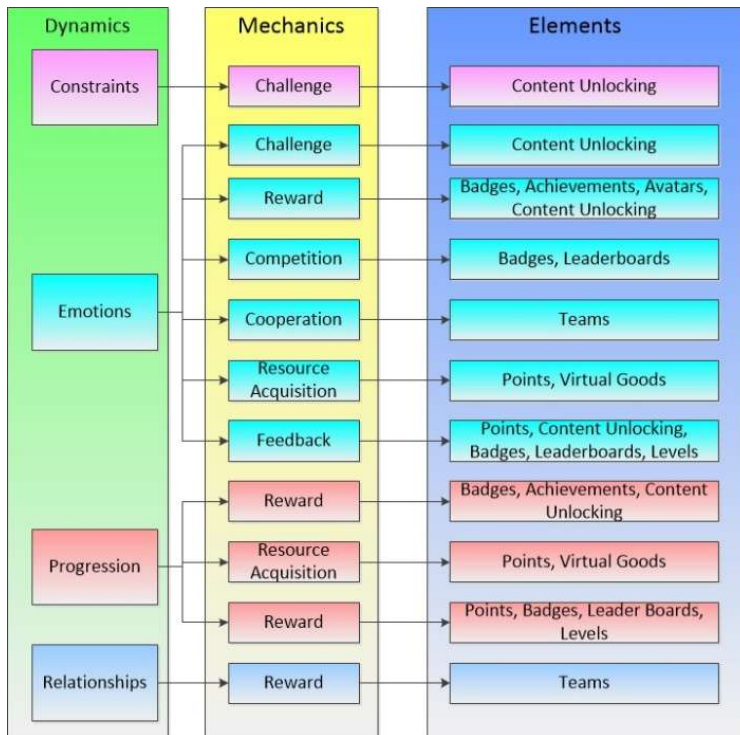
As shown in *Figure 1*, elements are the lowest degree of abstraction towards game design, which employed points, badges and leaderboards etc. The next stage, denoted by higher level of abstraction called mechanics used for game design patterns, drive player's engagement to produce a meaningful outcome. The principles of game design are known as dynamics, which represent the player's response towards game mechanics. Models and methods are not directly related to game design which represent extreme abstract level and therefore not considered for the operational model building in this study.

In competency based education, gamification elements are structured in to three categories called elements of behavior, feedback and the progression. The competency is defined as "an individually or inter-individually available collection of prerequisites for successful action in meaningful task domains" (Weinert, 1999), which implies that competency is comprised of skills, knowledge and the attitudes. Competency based education refers to applying psychomotor skills, which is different to general education or full academic education, mostly focused on cognitive skills (Erpenbeck, 2010). Therefore, it satisfies the conditions which are: more focused on professional practice leads to active and constructive process; defined as competency based, clear and transparent learning

outcomes; self-responsible for learning with the guidance and supervision of instructors and trainers; inherent to competency development, based on motivation and emotions of learner.

Obviously, it is necessary to understand the modalities of applying game dynamics such as constraints, emotions, narrative, progression and relationships driving the game mechanics such as rewards, challenges, competition, feedback and cooperation, towards competency based education (Bartel et al. 2015) in TVET to reduce high dropout rates of online courses among demotivated learners. Linkages of dynamics, mechanics and elements are shown in **Figure 2**, which clearly shows, how elements are driven by game dynamics and mechanics as a sample chart.

Figure 2: Linkage Diagram of Game Dynamics, Mechanics and Elements



Gamification Operational Model for TVET

Implementation of gamification techniques in virtual learning environment is reflected using concrete and clear model. This model facilitates the operation of gamification tools in learning management system which contributes towards the intended learning outcomes of students. At the initial model building stage, the scope is defined first and contextual inquiry is performed to identify the relationships to construct the model. The contributing gamification elements are then identified using a contextual review. The model formation is carried out with regard to learner success in gamified eLearning for TVET sector in achieving the intended objectives.

Proposed model is shown in **Figure 3** which is based on the gamification models of Urh (2015), Deterding et al. (2011), Simõesa (2013), Kim and Lee (2013) and baseline model (Suh, 2015) that explains operational model for the relationship between game context, social context, learning management system and user engagement.

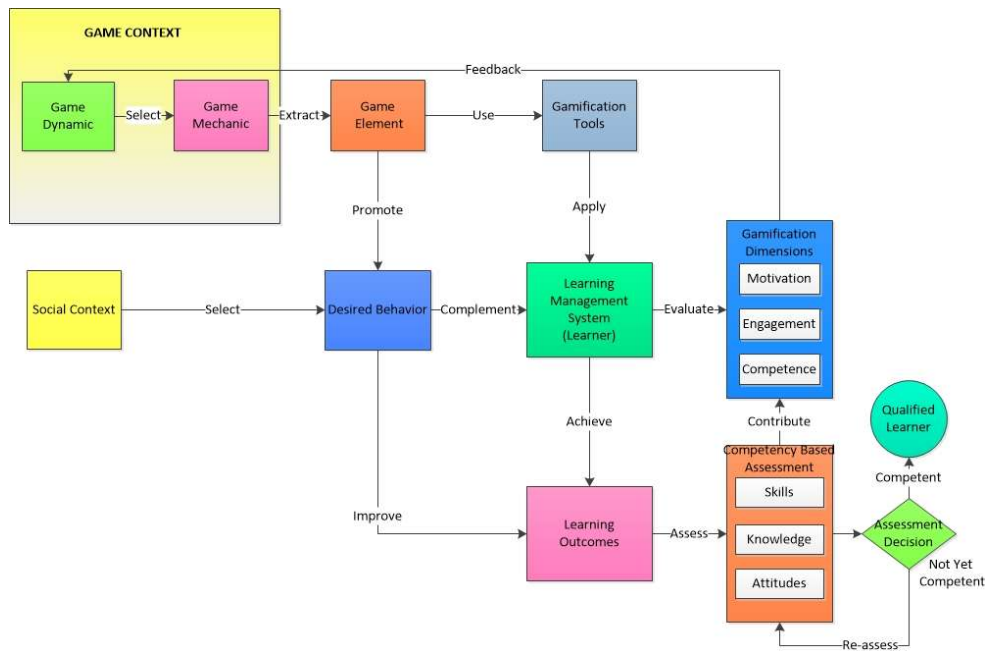


Figure 3 – Proposed Operational Model for Gamification in eLearning in TVE

Rubrics of the model for gamification design in eLearning for technical and vocational education sector depicted in **Figure 3** are discussed in the next section.

The model aims to operationalize the basic concept of gamification, application of game elements in non-game social context. The game elements extracted from game context is used to promote desired behavior in the social context. The game context is comprised of game dynamics and game mechanics which drive the game elements. The game elements that extracted from game context is then used by gamification tools which are eventually applied as strategies, tools and techniques in Learning Management System (LMS). The desired behavior of the learner is complementary to the LMS to achieve the learning outcomes in each module. Further, the desired behavior helps to improve the learning outcomes as it complements with game dynamics, mechanics and elements from the gamification design. Once the learning objectives are achieved, the learner is assessed against competency standards to measure the competence. Competency based assessments evaluate the learner in terms of skills, knowledge and attitudes using different evaluation techniques and modified competency based assessment matrix. If the learner is competent, he/she will be issued with the qualification or otherwise direct to re-assessment in case of “not yet competent”. Competency based assessment will contribute to gamification evaluation system and feedback will be used to fine tune the influence of the gamification design through gamification tools. The different and changing behavior of learner is supported by this dynamical model to vary and adjust gamification elements to complement the desired behavior of the learner.

Conclusion and Future Work

As concluding remarks, gamification techniques are increasingly used in different domains to motivate users and could be effectively used in education, where user engagement and motivation are crucial. Use of game dynamics in competency based education shifts traditional thinking of cognitive delivery models towards psychomotor aspects, using online learning. The proposed operational model for gamification design support embedded game dynamics, mechanics and elements to realize motivational design for teaching and learning excellence.

Consequently, the user engagement, motivation, and competence are to be enhanced due to gamification in TVET in competency based education to gain more and more potential towards reducing higher dropout rates in TVET compared to the general education. For future works, each game element needs to be applied into online courses and empirically be tested according to a given context of eLearning in TVET to find the impact on learner success.

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