# GAMIFICATION STRATEGY TO SUPPORT SELF-DIRECTED LEARNING IN A BLENDED LEARNING ENVIRONMENT

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**DEDICATION**

*To my beloved late father,*
*Palaniappan Sinnasamy,*
*to my loving mother*
*Kamalam Marappan,*
*to my adorable children,*
*Siddhicksha and Darsha*
*and to my supportive husband*
*Saravanan Ramasamy*

*Thank you for all the support and guidance throughout my Master journey*

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## ABSTRACT

The growth of educational technology has paved ways for educators to integrate newer approach in teaching pedagogy. The shift into blended learning especially in higher education requires learners to be more self-directed. Yet, learners lacking in their self-directed learning lead to a discontinuity of engagement and motivation along the learning process which eventually affects their learning performance, especially among non-major computer science learners learning programming language. Thus, gamification strategy, use of game elements in a non-gaming context has been infused into blended learning to support the learners self-directed learning in a gamified learning environment. This research measures the effect of gamification on learners' academic performance, investigate their self-directed learning level within gamification learning environment and identify the relationship between learners self-directed learning level and their gamification learning experience. A pre-experimental research (single group) was carried out for a duration of 5 weeks among a group of 29 learners from a non-major computer science course in UTM undertaking basic programming language subject. The learners SDL and knowledge on the subject was measured with a questionnaire and assessment test before and after the gamification learning intervention. A gamification experience questionnaire was used to evaluate their gamification learning experience after the intervention. The learning environment was infused with gamification in the form of competition to earn points, leaderboard ranks and python programmer badge. 25 learners managed to complete the gamified task successfully and earned the digital badge meanwhile the 4 remaining learners did not manage to complete all the given tasks completely to earn the badge. Top 5 highest rankers were rewarded with prize which has been one of the extrinsic motivation factor on the task completion. The learners academic performance has significantly improved ($p=0.000 < 0.05$) after the gamification injection from $M=15.56$ at pre-test to $M=19.44$ at post-test. Leaners self-directed learning level increased and there is a significant difference before ($M=3.59$) and after ($M=4.22$) the gamification strategy ($p=0.000 < 0.05$) imposed. Self-management, motivation and self-monitoring were all at high level with significance before and after ($p=0.000 < 0.05$) the gamified learning activities. The analysis on the relationship between gamification learning experience and self-directed learning showed there is a positive and moderately strong correlation between them ($p=0.002$, $r=0.596$) after the intervention and the self-directed learning factors or dimensions are all positively correlated among one another when their relationship was tested. Overall, the learners showed positive outcome in terms of their self-directed learning and gamification experience from the research. The gamification strategy used in the blended learning environment manage to support learner's self-directed learning.

# ABSTRAK

Perkembangan teknologi pendidikan telah memberi ruang kepada para pendidik untuk mengintegrasikan pendekatan baru dalam pedagogi pembelajaran. Peralihan ke dalam pembelajaran teradun terutamanya di pengajian tinggi memerlukan pelajar untuk lebih cenderung ke arah pembelajaran kendiri. Namun, pelajar yang kekurangan amalan pembelajaran kendiri, menyebabkan penglibatan dan motivasi mereka sepanjang proses pembelajaran terganggu dan akhirnya mempengaruhi prestasi pembelajaran mereka, terutama di kalangan pelajar sains komputer yang mempelajari bahasa pengaturcaraan. Oleh itu, strategi gamifikasi di mana penggunaan elemen permainan dalam konteks bukan permainan telah dimasukkan ke dalam pembelajaran teradun untuk menyokong pembelajaran kendiri pelajar. Penyelidikan ini mengukur kesan gamifikasi terhadap prestasi akademik pelajar, menyiasat tahap pembelajaran kendiri mereka dalam persekitaran pembelajaran gamifikasi dan mengenal pasti hubungan antara tahap pembelajaran kendiri pelajar dengan pengalaman pembelajaran berunsurkan gamifikasi. Penyelidikan pra-eksperimen (kumpulan tunggal) dilakukan selama 5 minggu di antara sekumpulan 29 pelajar yang terdiri dari pelajar bukan jurusan sains komputer di UTM yang mempelajari subjek asas bahasa pengaturcaraan. Tahap pembelajaran kendiri pelajar dan pengetahuan mereka dalam subjek yang dipelajari diukur dengan soal selidik dan ujian penilaian sebelum dan selepas intervensi pembelajaran berunsurkan gamifikasi dilakukan. Soal selidik pengalaman gamifikasi digunakan untuk menilai pengalaman pembelajaran berunsurkan gamifikasi selepas intervensi dalam pembelajaran teradun. Persekitaran pembelajaran diselitkan dengan unsur gamifikasi dalam bentuk persaingan untuk memperoleh mata, kedudukan papan pendahulu dan lencana pengaturcara python. 25 orang pelajar berjaya menyelesaikan tugasan yang diberikan dengan jayanya dan memperoleh lencana digital sementara baki 4 pelajar tidak berjaya menyempurnakan semua tugasan untuk memperolehi lencana. Pelajar yang berjaya menduduki 5 tempat teratas diberi hadiah yang menjadi salah satu faktor motivasi ekstrinsik dalam melengkapkan tugasan yang diberikan. Prestasi akademik pelajar telah meningkat dengan ketara ($p = 0.000 < 0.05$) selepas suntikan gamifikasi dari $M = 15.56$ pada ujian pra hingga $M = 19.44$ pada ujian pasca. Tahap pembelajaran kendiri pelajar meningkat dan terdapat perbezaan yang signifikan sebelum ($M = 3.59$) dan selepas ($M = 4.22$) strategi pembelajaran gamifikasi ($p = 0.000 < 0.05$) dilaksanakan. Ketiga-tiga tahap pengurusan kendiri, motivasi dan pemantauan kendiri berada pada tahap tinggi ($p = 0.000 < 0.05$) selepas aktiviti pembelajaran yang berunsur gamifikasi dijalankan. Analisis mengenai hubungan antara pengalaman pembelajaran gamifikasi dan pembelajaran kendiri menunjukkan terdapat hubungan yang positif dan kuat antara mereka ($p = 0{,}002$, $r = 0{,}596$) setelah intervensi serta semua faktor pembelajaran kendiri menunjukkan berkorelasi positif. antara satu sama lain ketika hubungan mereka diuji. Secara keseluruhan, pelajar menunjukkan peningkatan positif dari segi pengalaman pembelajaran kendiri dan gamifikasi melalui dapatan kajian. Strategi gamifikasi yang digunakan dalam persekitaran pembelajaran teradun dapat menyokong pembelajaran kendiri pelajar.

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| | | |
|---|---|---|
| BL | - | Blended Learning (BL) |
| SDL | - | Self-Dircected Learning (SDL) |
| GE | - | Gamification Learning Experience (GE) |
| ICT | - | Information Communication and Technology (ICT) |
| UTM | - | Universiti Teknologi Malaysia (UTM) |
| CTM | - | Conventional Teaching Method (CTM) |
| GTM | - | Gamification Teaching Method (GTM) |
| MTurk | - | Mechanical Turk (MTurk) |
| Q1 | - | Quiz 1 (Q1) |
| Q2 | - | Quiz 2 (Q2) |
| Q2 | - | Quiz 3 (Q3) |
| AT | - | Assessment (AT) |

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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

The growth of online learning via the expansion of information and communication technology (ICT) provides the flexibility and self-directed learning among learners suiting their learning methods, which not only cater the face-to-face learning but integrates online lessons and game based elements in teaching and learning. Educational technology carries out an important role in the growth of worldwide education. With the advert technological learning tools availability, learners can directly engage in gaining knowledge themselves rather than attending face-to-face classes alone. In par with the growth of technology, our society as well changes to adapt to the growth. Higher education is leaning more towards learner-centred approach as a response to our changing society, where the ability to think critically, adapt and perform continuous learning through life is required.

Blended learning provides the best of two world of traditional classroom with online learning that enables learners with flexibility and interactive learning environment without bounding them to time and location. Blended learning combines both online learning and traditional classroom approach in teaching and learning. Three features of blended learning that makes the approach is suitable to increase learners' motivation in learning by supporting self-directed learning are:

i) Face-to-face learning, where both educators and learners will be present at the same physical location at the scheduled time for lessons to commence.

ii) Self-paced online learning, where the learning process is related to learners ability to learn at their own pace and time on own using the technological tools without interaction with educators or other learners in a cooperative pedagogical approach.

iii) Live online learning, where the use technology is necessary in the teaching and learning environment as well the presence of both educators and learners required at the same time in the online platform but not necessarily at the same location.

Blended learning which features face-to-face learning, self-paced e-learning and live e-learning shows the role of educators in the learning environment as content creator and facilitator as well as responsibility of learner in the knowledge acquisition and self-directed learning (Kaur, 2013). A blended learning requires learning to be more self-directed as it one of the crucial skill that will be applied in their lifelong learning process. Learners of this current generation adapted to be a part of the network of learning which consists of a large web-based community. In their perspective, blended learning is not bounded by the weaknesses and limitation in learning resources as well as the constraints of traditional learning. With the emerging technological tools and hardware to support online learning, gamification based learning contents can be easily integrated in the learning process. In other note, the game element adapted from the games into the educational learning environment is expected to promote learners learning experience via gamification activities. This is especially important among learners whom lack in engagement and motivation in blended learning process. This has paved ways for gamification approach which uses game elements in non-gaming aspects.

## 1.2 Background of Study

As technology advances, the way teaching and learning perceived by educator and learner changes. Nevertheless, traditional learning, which is face-to-face classroom sessions, has been a dominant and prominent way of pedagogical approach for centuries and still on-going strong. Yet, the inflexibility of teaching and learning approach in this 21st century has made educators to shift to other means to engage learners. Traditional learning focuses mainly on physical classroom education, which is restricted to a preset time and duration at a specific location, where the learner needed to be physically present to participate in the learning process. Learners will

need to take part in the group discussions and provide feedback as well join all the prepared group activities by the educator. This makes the learner more social and exhibit proactive behavior, in addition to full supervision by educator and the entire learning process happens in a controlled learning environment. Meanwhile in online learning, learners can prevent all these, the learning is more flexible, and learners perform the learning process using the technological learning tools according to their convenience.

Although online learning seems to be convenient, with lack of social connectedness among peers and educators, learners tend to lose their motivation and engagement somewhere during the learning process. It is important to have facilitation from educators and at the same time flexibility of learning process to present. Thus, the blend of traditional learning process (face-to-face) together with online learning leads to the usage of blended learning into the teaching and learning environment. The differences of traditional, online and blended learning process are as shown in Table 1.1.

Table 1.1: Differences of Traditional, Online and Blended Learning

| **Learning** | **Traditional Learning** | **Online Learning** | **Blended Learning** |
|---|---|---|---|
| **Method** | Face to Face | Online | Face to Face and Online |
| **Time** | Scheduled (Not flexible) | Unscheduled (Flexible) | Scheduled and Unscheduled |
| **Location** | Physical Classroom | Any Location | Classroom + Any location |
| **Technological Tools** | Not necessary | Necessary | Necessary |

In contrary to face-face learning process alone, blended learning creates path to educators and learners to make use of ICT to create an online learning environment and communication channel to share resources, work together with educators and access course materials conveniently within a flexible time frame. Moreover, it aids educators in the creation of communication means which encourages learners to share their experiences and process their learning (Orhan, 2008). The outlined methods

encourage learners to show higher interest towards the learning contents and eventually be more responsible towards their own learning. Blended learning trigger learners to take charge of their own learning and engage in more active roles and was identified as a success and effective only when learners show determination and responsibility in their own learning (Graham, C. R. 2009).

Of course, in a blended learning environment the control of the learning process is hold by the learner and it is undeniable that there are issues, obstacles, and more chances for learners on effective use of the learning resources. The control referred to is the learners' Self-directed learning capabilities. Self-directed learning (SDL) is an instructional strategy where the learners, with facilitation from the educator, decide on their own learning (what and how). This can be achieved either individually or through a group learning, but the main objective is for learners to take the ownership of their respective learning. In addition, a self-directed learner normally engages actively in the learning process by accumulating information, plan the learning activities and evaluate them upon completion. Strategies imposed in active learning can increase learners' engagement and improve their performance and learning process (Freeman et al., 2014). Technological tools usage in the blended learning induces learners' self-directed learning in online learning environment compared to traditional classroom setting. Learners who shows more self-directed behavior and prone to technological tools tends to have a better grasp on blended or online learning setting to achieve the set learning objectives (Law, K. M., Geng, S. & Li, T., 2019). According to Garrison (1997), learners should be given enough freedom to select their preferred method on how they would like to perform the learning process.

However, the encounters and hurdles of many self-directed learning environments involve less impromptu feedback and supervision, learner procrastination, being overwhelmed by the resources made available by the instructors or learning designers (Graham C.R, 2006), low self-preparedness (Du Toit-Brits, 2015) and low motivation (Oh, 2017). Therefore, it is vital for researchers to have a better understanding on the aims and objectives as well as the obstacles in a blended learning process in order to succeed in the blended learning environment.

At the same time, the background and characteristics of learners is a key factor in consideration of success of a teaching and learning process and design of the learning environment. Non-major learners tend to show lack of interest, demotivated, disengaged and lost in grasping new knowledge from a multi-disciplinary subject from other field of education. When a non-major learner required to take up other discipline course, their perceptions and attitudes towards learning a non-major subject and their understanding of the subject's core concepts become one of the major problem faced by them (Malik et al., 2008). Learner's capability to self-direct them in the learning process and making use of the technological tools can bring changes into the learner's efficiency in their learning. Self-directed learning in terms of self-management, self-monitoring and motivation is important for these type of learners to prevent non-completion or withdrawal of course. Programming language is one of the multi-disciplinary course that need to be studied, not only in the field of Information Technology, but also a common or elective course in most of the education field including Education, Engineering, Science and Mathematics at tertiary education.

Gamification is referred to utilization of the prominent characteristics and gaming design principles in a non-game setting (Deterding, et al., 2011). Most of the games use the fundamental principles of video games design which are the origins of card games, multiplayer games and board type of games. The gaming principles like competition, scoring the points, collecting items, player status, forming a theme, awards like medals and so on are all inter transferable between games and usually very effective in various combinations or mixture as well works in a non-gaming environment. Besides, gamification is mostly enforced to increase the productivity and efficiency in industry. For example, a leaderboard with displayed with accumulated scores for each task assigned in industry (work related) and target achievers as published on the board will be rewarded financially (Duggan and Shoup, 2013). These type of activities in industry are often the one that are compulsory in the project. The elements of scores, a competition and financial reward are one of the dominant motivational force (extrinsic).

Gamification is one of the trends in education of late due to its ability to attract learner and keep them engaged and motivated. Gamification is defined as mechanics

of game design are used in non-gaming contexts (Deterding et al., 2011). Gamification is beneficial for learning because it is proven that gamification could increase learners' motivation (Buckley, P., and Doyle, E. 2017), engagement (Suh et al., 2016) or even memory retention (Groh, 2012). This is because the game elements' nature and capabilities to attract today young and tech savvy learners (Kalinauskas, M., 2014). Normally, when individuals are motivated internally, they feel a sense of satisfaction, which leads them to feel skilful and possess a self-determining attitude as well at times; they experience a continuous flow in their behaviour (Deci, E.L., & Ryan, R.M., 1985). As for flow, it is referred to how a particular person are extremely into completing a task or an activity, where they totally unaware and ignore their surrounding aspects (Csikszentmihalyi, M., 1990). On this note, it is said that invoking ones' motivation is the fundamental in ensuring their action is voluntary and self-directed.

There are emerging researches showing that gamification together with technology can support learning in various education field (Aleksic-Maslac *et al.*, 2018; Yunita *et al.*, 2017; Molnar, 2018; Permana and Kusumo, 2018; Yue and Ying, 2017; Pasic and Kucak, 2018). This suggests the potential of gamification in SDL. Gamification learning environment can assist learners to enact their SDL strategies by fostering motivation. Therefore, it is crucial to enact a way to sustain and increase learners' motivational necessities through a type of engaging method like gamification which can enhance learners' performance in their learning process. In a research by Permana and Kusumo, (2018) and Ibanez, Di-Serio, & Delgado-Kloos, (2014), there was a positive outcome surfaced when gamification was applied in the computer science courses.

The gamification teaching strategy appears to be very promising, and hopefully will be a promising method to enhance learners' performance and engagement among those whom are not from computer related major, which adds more challenges due to their background of education. The use of game elements in teaching and learning can motivate educators to introduce gamification in their teaching, especially in programming courses to non-major learners. At the same time, this can be an aid to

many learners whom are from the new generation of digital natives. The learners may able to connect the gamified lessons into their everyday learning process.

## 1.3 Problem Statement

In a blended learning (BL) environment, self-directed learning is essential for learners to independently guide themselves in obtaining knowledge as well enable them to develop their understanding to unravel problems in their learning. These learners usually participate actively in learning resources, learning activities and setting goals in their learning process. Nevertheless, the learners find difficulties in retaining their self-directness throughout the learning process in blended learning environment.

Self-Directed Learning (SDL) is an approach in the field of education where learners take charge and be responsible for their self-learning. These learners are referred to as self-directed learners. They possess the ability to decide their own learning methods, materials and consequences in their journey to reach their anticipated objectives. SDL can be executed via scaffolder instructions. Scaffolding is supporting cues which assists learners in forming the needed skills and knowledge. The scaffolder instructions can be cascaded via online technological tools. Blended learning can improve the facilitation of self-directed learning among learners. It has the means to support all types of teaching and learning process with the aid of technology that is readily available in this 21$^{st}$ century. Learning through self-direction can be enhanced with the integration of blended learning to the traditional classroom learning. Blended learning can be established with the readily available online platforms and communication channels that can be benefited for teaching and learning process. Course materials, information sharing, and assessment can be done online anytime and anywhere with blended learning if compared to traditional classroom method. Apart from that, blended learning strategies normally differs according to the field of study, education level, characteristics of the learner and the learning objectives as the learning environment design should focus on the learners as it is a learner-centered approach. Besides that, a blended learning can increase learners' access in

the learning environment, and it is flexible. At the same time, it also increases the level of active learning and the learners can achieve a better learning experiences and objectives. Learners who show more self-directed behavior and prone to technological tools tends to have a better grasp on blended learning setting to achieve the set learning objectives (Law, K. M., Geng, S., & Li, T., 2019). When it comes to teaching and learning process, a mix of both online learning and traditional learning methods were looked as the best approach for learner as pointed out by Finlay, Desmet, & Evans (2004) and Hannay, M., & Newvine (2006). However, it is still an ongoing research to promote motivation component in the SDL dimension (Du Toit-Brits, 2015).

There is a significant potential found in game-based learning mainly in higher education as mentioned by Prensky (2001). Vogel et al. (2006) made a discovery that an effective approach where interactive games can improve academic achievement and plays and important role in cognitive development. According to Hwang et al. (2013) and Oak & Bae (2013) by engaging in video-based games, it directly shows a positive impact on individuals thinking abilities, motivational aspects and development of their emotions. Based on their findings, as the advancement of the technological tools, it is wise to fully utilize them into gamifying lessons in the learning process of the education field. On the other hand, there are other factors to be considered such as the cost that will incur, duration taken to develop the games before implementation of game-based learning. But it is not easy to implement game-based learning into the teaching and learning environment due to its shortcomings such as the cost of development and timeframe taken in creating the suitable games. Thus, the suitable and more feasible approach known as gamification learning environment with the infusion of game elements like points, scores, ranks leaderboard and etc. seems more practical rather than creating a whole new game from scratch for the education sector (Deterding et al., 2011).

Based on a research done by Hartley and Davies (1978) on the dynamics of attention spans during class lectures, a normal learner's attention gradually increases during the first ten minutes of the learning process which is lecture but eventually reduces right after that point. The approach to tackle this problem and recapture the usual attention of learners is by evolving the learning environment during a lecture,

such as through a short recess (McKeachie, 1999). On the other hand, that is not a case for video gamers as they are able to engage without break for hours. Video gamers tend to maintain a high level of attention, that in at times cases can even last without intervention for long hours (Green and Bavelier, 2006). Not only that, the gamers also portray a distinct characteristic where their aim is to score "epic win" as described by Jane McGonigal (2010). Almost all gamers possess these factors that are usually common among gamers like urgent optimism, social fabric, blissful productivity, and epic meaning, that makes them super encouraged and encouraged individuals (Huang and Soman, 2013). Alternatively, when they face a complex learning environment, learners tend to feel stunned; there was no immediate satisfaction or short-term victory to keep them motivated and engaged. One of the promising ways to address these undesired feelings is to design learning environment using a similar technique that is found in established gaming environments.

Gamification is beneficial for learning because it is proven that gamification could increase learners' motivation (Buckley and Doyle, 2014), engagement (Suh *et al.*, 2016) or even memory retention (Groh, 2012). Pasic and Kucak, 2018). This suggests the potential of gamification in SDL. So, this research will try to explore blended learning with gamification learning environment towards learners' self-directed learning and improvement in academic performance among learners in Malaysian education system.

## 1.4 Research Objective

This research aims in addressing these following objectives:

i. To measure the effect of gamification on learners' academic performance.
ii. To investigate learners' self-directed learning level within gamification learning environment.
iii. To identify relationship between learners' self-directed learning level and gamification learning experience

## 1.5 Research Questions

This research aims at investigating and providing insights to the following research questions:

i. What is the effect of gamification on learners' academic performance?
ii. What are the learners' self-directed learning level within gamification learning environment?
iii. Is there any relationship between learners' self-directed learning level and gamification learning experience?

## 1.6 Research Hypotheses

This research outlines these research hypotheses in order to best answer the research questions. The null hypotheses used in the study are as following:

Ho1 There is no significant difference between pre-test and post-test score after gamification injection.
Ho2 There is no significant difference between participants' SDL before and after gamification strategy in learning environment.
Ho3 There is no significant relationship between learners' Self-Directed Learning and Gamification learning experience (GE)

## 1.7 Conceptual Framework

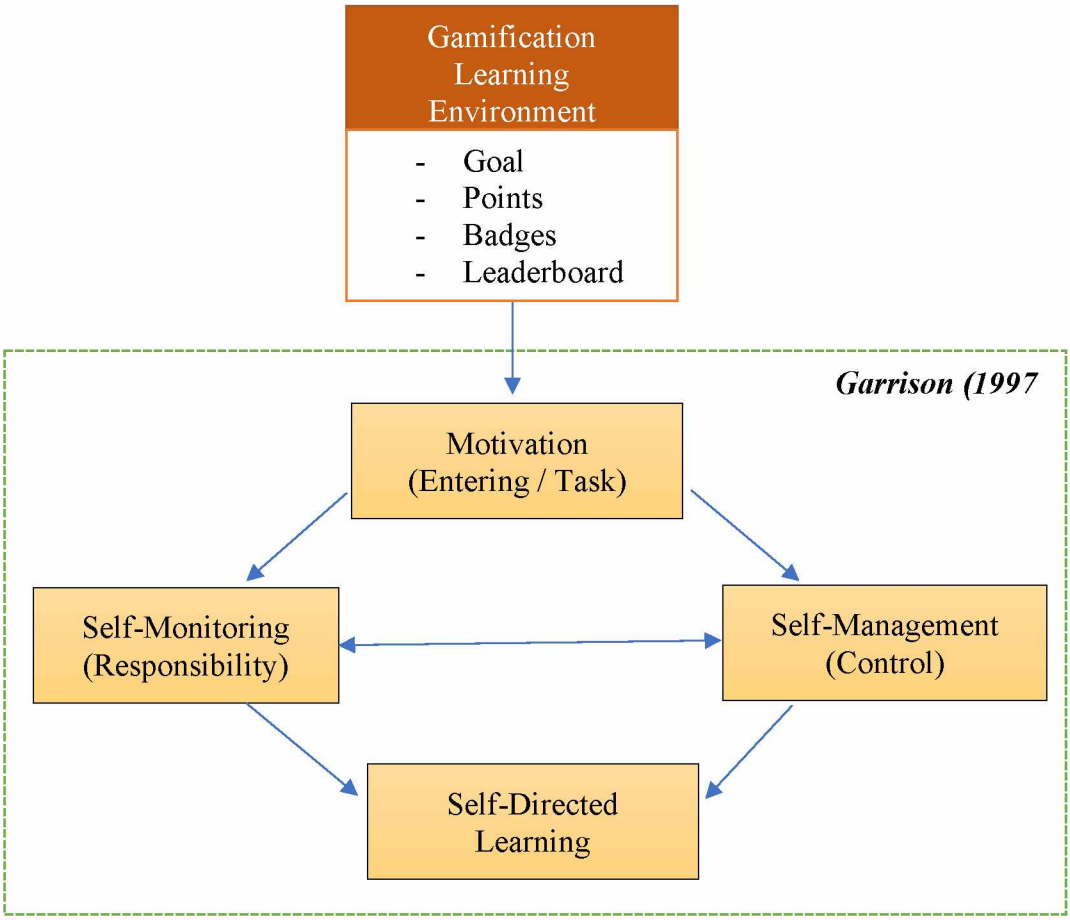


Figure 1.1 Conceptual Framework of the research

The conceptual framework of this research is shown as in Figure 1.1. According to Garrison (1997), Self-Directed Model (SDL) is accomplished by three dimensions interacting with each other: self-management, self-monitoring, and motivation. The focus of Garrison's model is on resource use, learning strategies use, and motivation to learn. Garrison explained that self-management involved learners taking control of the learning context to reach their learning objectives. The motivation component in this model will be added with the gamification strategy because research shows that gamification could increase learners' motivation (Buckley and Doyle, 2014), engagement (Suh *et al.*, 2016) or even memory retention (Groh, 2012). Furthermore the game elements' nature and capabilities able to attract current generation of young and technology savvy learners (Kalinauskas, 2014).

## 1.8 Scope of Study

The scope of this study is Universiti Teknologi Malaysia (UTM). The teaching and learning resources sharing method is via UTM e-learning platform. In this study, the learning environment focuses on Year 2 undergraduate learners from one of the non-major computer science courses focusing on those enrolled to study basic programming.

## 1.9 Significance of Study

Blended learning usage in teaching and learning has increased drastically in teaching and learning environment. It is very likely to emerge as a future predominant teaching model with the combination of best features of online learning and face-to-face education (Watson, J., 2008). An integration of online teaching with traditional classroom environment is essential to improve learners programming skills and self-directed learning. Self-directed learning is essential for learners especially among higher education learners. It is a process where learners weigh and takes on the lesson in accordance to their abilities and interests. Learners are able to set their goals, choose their learning approaches, learning resources and assess their own learning without any support. Learners can communicate with others with similar interest to get knowledge and educators act as facilitators and resource to self-directed learners (Knowles, 1975). It is important to assess self-directed learning possessed by learners and how gamification improves their SDL in learning programming through blended learning environment. The need to possess twenty first century skills, digital literacy among learners and demand in workplace has encouraged the adoption of technology in blended teaching and learning process.

Universally known, self-direction within the learning environment goes way back in history as far as the Greek philosophers like Socrates, Plato and Aristotle (Brockett & Hiemstra 2018). Most of the studies on the 1800s which were in the form of autobiographies and also biographies that highlights SDL were about famous and well established public figures that were mainly self-taught (Kett, J. F., 1994). According to Knowles (1975), there are three different parts in SDL which are mainly

the learner, the educator and also the set of learning materials. Self-directed learning is actually a form of psychological process where learners work their way into gaining knowledge and developing an understanding on ways to solve faced problems by exhibiting self-directness among themselves (Long, H. B., 1994). Self-directed learners normally engage actively in the learning process by monitoring their progress, participate in the given learning activities, setting up goals of their learning and actively involves in online resources (reading materials). Inhabiting a high level of self-management is crucial in SDL whereby the learners at the same time need to be familiar with various strategies in tackling problems that arise in their learning (Teo et al., 2010). In a learning environment especially when involve the online learning platforms, they were widely used by self-directed learners to get learning resources. In the study done Teo et al., (2010), on self-directed learning with technology, showed that learners' insight on learning collaboratively can improve their self-directed learning. At the same time SDL is an important contributor to internet communication technology usage in collaborative learning (Lee, et al., 2014).

Generally, a learner with self-directness will participate actively in the learning process and they have good adaptability of their learning setting based on the set learning strategies. A learning environment rich in technologies can offer learners with great opportunities and abilities to engage their learning in a self-directed manner (Fahnoe, C., & Mishra, P., 2013). The blended learning process provides learners with opportunities to mediate with instructors and peers face-to-face through discussion and self-controlled access to multimedia learning resources. Self-directed aspects of learning (the choice of what, when, and how long to study) have significant effects in the effectiveness of users' learning efforts (Tullis & Benjamin, 2011). When a learner face uncertainty in the online learning environment, they need to adapt or devise their own highly preferred learning strategies. It is expected that an individual with high self-directedness are more likely to involve actively in the online learning process by imposing questions as well as participating in the discussions, compared with learners having low self-directedness. Moreover, a self-directed learner also has a stronger eagerness to achieve the learning objectives or goals.

According to Garrison's (1997) model, he put emphasis on using learning strategies, motivation for learning and using resources. Thus, self-management directs learners to have control over the learning process to reach the learning goals, moreover, he revised his model that if learner has control over learning, necessarily it does not result in independence; as an alternative, it refers to collaboration with other peers.

## 1.10 Operational Definition

The operational definition of the main elements of this research is as described in this section.

i. Blended Learning (BL)

Blended learning (BL) is a mixture of two styles, online learning and traditional classroom. Kaur, M. (2013) has described three features of blended learning which are the face-to-face learning, self-paced e-learning and live e-learning. Blended learning allows educators and learners to apply all the knowledge on technological tools, innovations, ICT, and most importantly the Internet and networks as a means for improving teaching and learning process and also for crafting a learning environment with the best of the learning strategies.

ii. Self-Directed Learning (SDL)

Self-directed learning (SDL) is a learning process where learners initiate and take responsibility for their own learning (Knowles *et al.*, 2005). Garrison mentioned SDL is achieved by three dimensions that have interaction with each other; the three dimensions are self-management, motivation, and self-monitoring.

iii. Gamification Learning Experience (GE)

Gamification is usually defined as the use of game design elements in non-game contexts (Deterding et al, 2011). These game elements refer to features that are

found in most games, such as awarding points, ranking in leader boards and badges. It indicates the design outline pointed at giving game-like feel to users, normally with the aim of influencing users' behaviour.

iv. Motivation

Motivation is important for initiating and maintaining effort towards learning and achievement of cognitive goals. Motivation falls into two categories which are the task motivation and entering motivation (Garrison, 1997).

v. Programming skills

Programming skills refer to the skills in coding and analysing it. The mastery among employees has been increasingly in demand by the employers in workforce (Burning Glass Technologies, 2016). Through mathematics, logic and algorithms in coding, individuals develop computational thinking, meaning that people are able to solve problems like a computer scientist (Selby, 2014).

vi. Academic performance

A measurement of achievement in an academic course is referred as academic performance of a learner. The academic performance are assessed by educators after a planned learning process completes via tests, assessments, quiz or by any means of classroom assessment tool to produce a score or grade. An assessment test was used to measure learners prior knowledge and post knowledge after the teaching and learning process on the particular course complete and before the term ends.

vii. e-learning

The delivery of a learning, training or education program by electronic means. E- learning involves the use of a computer or electronic device such as tablets and mobile phone in some ways to provide training, educational or learning material

(Derek Stockley, 2003). It is a platform that serves as a virtual classroom in which all the teaching and learning resources including the learners' work are gathered.

viii. Online Learning Environment

According to Wilson (1995), online learning environment is a comparatively open system that provides room to access resources and interactions with other users. Learners are capable of accessing the contents as per their own time by following the set paths to get through the academic resources. Online learning enables learners to establish communication via interactions and discussions (Kim, 2010).

ix. Traditional Classroom

In this research, traditional classroom is a room in where learners and educator meet each other face to face in order to discuss and learn the course information (Kreitzer, 1999).

## 1.11 Summary

The most important objective of this research is to access the SDL among higher education learners when gamification in learning was introduced in learning programming. SDL is a process through which learners take the responsibility of setting their own learning objectives, identifying and filling gaps in the process of learning, recognizing resources, choosing and adopting suitable learning strategies, and assessing their learning. A particularly promising area for SDL research is the online environment in the blended learning. With the injection of gamification in this environment, learner's motivation is expected to improve in learning programming courses among non-major computer science learners.

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