Gamification and Serious Games: - The enigma and the use in Education

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Abstract
Enhancing teaching and learning using technologies is a needed boost in the field of education. This is more relevant in this era of technology boom supplemented with the arrivals of handheld devices and gadgets that has promoted the use of games in our daily lives. Thus with an element that is as robust and addictive as a game, one can only imagine whether it can be harnessed and used to the fullest potential in educational aspects. Therefore, this research will look into two approaches, which is gamification and serious games. Gamification, is a new fad that looks into incorporating game elements in non-gaming contexts while serious games is a form of game played with the main aim of achieving an intended purpose and are the primary aim is not for amusement. The paper will look at paradox of these approaches and also the elements and mechanisms in gamification and serious games that will support in the use in the line of education.

Keywords: gamification, serious games, game elements, education, educational technology

Abstrak

Kata kunci: "gamification", "serious games", elemen permainan, pendidikan, teknologi pendidikan

1.0 INTRODUCTION
1.1 ORIGINS OF GAMIFICATION
The term gamification was first brought up by a game designer Nick Pelling back in 2004, when at that time tried to use game-like enhanced interface to make electronic transactions such as using the Automated Teller Machine (A.T.M) or in-flight entertainment more eye-catching and engaging. This was meant to create a game like fun to the transaction. He was into infusing gamification into a physical device and at that time was not interested in making use of it in the internet. Thus the idea faded into the dark until its inception into the World Wide Web and later on into the android and apple devices. From this came the definition of gamification; which is the "use of game design elements in non-game contexts". Gamification is used to "change behaviour, to educate, or to motivate". Many corporate gamification systems rely upon rewards and a very thin layer of game elements to engage people through points, levels, leader boards, achievements, and badges. This type of “reward-based gamification has become commonplace, almost to the point of being expected, in new social media and information-based applications”.

1.2 ORIGINS OF SERIOUS GAMES
As stated by the current term of serious games came into its own in 2002 as started by, which is summed up by as "games that do not have entertainment, enjoyment or fun as their primary purpose". It was noted that the similar meanings to these serious games existed way before that. The meaning of serious games that was close to the used by in his book, where he designed games for training and education. Though he primarily made use of board and card games, yet he suggested that it’s applicable in the age of technology.

Even though the game Pong by Atari in 1972 was the first commercially successful video game, serious games have existed way before that. Several games were created with a serious purpose or aim and it can be categorized as:
1. To illustrate a scientific research
2. To train professionals
3. To broadcast message
Examples of serious games usage in illustrating scientific research were computer games that were created by scientists to test out the artificial intelligence; for instance, games that were created to play chess against humans. Serious games that were used to train professionals were started in the field of military. For instance the game called HUTspiel that was created in 1955. It was a strategy game that allowed two players to experience the impact of nuclear weapons on a global battlefield. Finally, a game that was created to broadcast messages is seen in the game of NIM that was created to broadcast the message about the technical expertise of Ferranti programmers. 3

1.3 GAMIFICATION IN RELATION TO SERIOUS GAMES

Gamification is compared in relation against other concepts through the two dimensions of playing versus gaming and parts versus whole. Gamification and serious games can be differentiated through the parts versus the whole, meaning that serious games involves thorough usage of the whole system of gaming to achieve its goals, whereas gamification focuses on the parts of the game elements. Playful design and playing with toys can be differentiated through the playing and gaming dimensions as shown in Figure 1. The use of games in non-gaming circumstances is categorized into full-fledged games (serious games) and game elements, which can be further differentiated into game technology, game practices, and game design refers to "gamification".

Figure 1 “Gamification” between game and play, whole and parts
Source: 7

2.0 SERIOUS GAMES LITERATURE REVIEWS

Several latest researches of serious games in the context of education was chosen and reviewed to see the purpose of the research and what was analysed throughout their research. Table 1 shows the meta-analysis of this research.

Table 1 A meta-analysis of serious games

<table>
<thead>
<tr>
<th>Research</th>
<th>Purpose</th>
<th>Analysis Review</th>
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<tr>
<td>Problem solving and collaboration using mobile serious games. 8</td>
<td>The contribution and implementation of a series of learning activities based on Mobile</td>
<td>An intentional sample; was used in selection of schools. The criteria related to the research, were students’ achievement in science, and socioeconomic status of the school. A quasi-experimental research design was applied; the researcher worked in classes where the students could not be assigned randomly to the control groups. Result showed that the trial group accomplished a higher view of their own collaboration skills and a higher score in the arrangement execution measurement of the problem solving cycle than did the non-equivalent control group, uncovering that MSG-based learning exercises may help such learning improvement. The researcher also noted that the intervention needs a longer period of time.</td>
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<tr>
<td>Serious Games (MSGs) for the development of problem solving and collaborative skills in Chilean 8th grade students in science</td>
<td>The main focus of the research is to find out the level of engagement among players who have played Set-Based Concurrent Engineering (SBCE) process game</td>
<td>The design of the game intends to bring a hand-on experience and to narrow the existing gap in understanding the concept of Set-Based Concurrent Engineering process. The results showed a higher level of engagement among players and demonstrated that the elements of motivation introduced in serious game evaluation needs to be associated in designing the SBCE game.</td>
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<tr>
<td>Serious Games in Manufacturing Education: Evaluation of Learners’ Engagement. 9</td>
<td>To describe the experience gained in using entrepreneurship serious games (eSG), as it was still undeveloped and inadequately addressed at strategic level especially at technical universities</td>
<td>Interviews and surveys were given to the three groups; students, teachers and entrepreneurs to find a detailed analysis of the various dimensions, expertise and aptitudes “related to entrepreneurship and their importance ranking according to experts and users”. Based on the survey, there is an agreement in blended learning, ICT usage and simulation and strategy games. The results found that there was clear lack when it comes to product, service innovation, motivational and vocational aspects. The simulation algorithms, which were deemed to be completely impervious, thus failing to provide clear indications and allowing feedback on what the player has learnt and needs to be improved. It was suggested extending entrepreneurship education to lower school levels, allowing earlier development of entrepreneurial mind-set.</td>
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Designing a Course for Stimulating Entrepreneurship in Higher Education through Serious Games. 10
<table>
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<tr>
<th>Serious game-based and nongame-based online courses: Learning experiences and outcomes.\textsuperscript{12}</th>
<th>The study looked into comparing student learning experiences and outcomes between a serious game-based and nongame-based online American History course</th>
<th>The researcher looked into the aspect of time, performance, the relationship between performance and intrinsic motivation based on Self-Determination Theory, and the pros and cons of the courses. The mixed methods triangulation convergence model was used. In the serious game-based online course interact with content using avatars while in the nongame-based online course, students interacted through Blackboard, a content delivery system. The results showed students in the serious game-based online course performed better and additional motivational aspects than students in the nongame-based online course. The time frame to complete the task could have taken longer because of other factors such as additional and more in-depth assignments than students in the nongame-based online course. Thematic analysis was conducted on qualitative data to examine the perception of helpfulness and hindering aspects of the courses. The desirable aspects such as game play, assessments, graphics and online videos while only citing undesirable parts such as character voices, submitting assignments, and technical issues.</th>
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<tr>
<td>Surgical Trainee Opinions in the United Kingdom Regarding a Three-Dimensional Virtual Mentoring Environment (MentorSL) in Second Life: Pilot Study.\textsuperscript{11}</td>
<td>The readiness and acceptance level of doctors in postgraduate surgical training in using virtual mentoring after short period using it.</td>
<td>The virtual world used was Second Life (SL) and MentorSL is the tool used to facilitate mentoring in the virtual world of SL. The users are willing to use the virtual mentoring system in SL despite having low competency in technology thus proving the disposition towards technology. There were discrepancies when it came to the use of avatars and animations as there was less enthusiasm. This may be due to the severity of the medical line that requires priority in information rather than aesthetics. There was low response turnout; this may just mean that the respondents are not used to the current generation emphasizes in networking and aesthetics.</td>
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\section*{2.1 SERIOUS GAMES IN SCIENCE EDUCATION}

A research by \textsuperscript{8} looked into the contribution and implementation of a series of learning activities based on Mobile Serious Games (MSGs) for the development of problem solving and collaborative skills in Chilean 8th grade students in science. The activities and MSGs are related with the “Evolution of Species” content from the science curriculum for 8th grade Chilean education. Three MSGs developed were, “Evolution”, “Museum” and “BuinZoo” and a series of nongame-based learning activities were designed and played by teams of four students in order to solve problems collaboratively. The game “Evolution”, looked at the “process of biological evolution that occurs in nature”; the game “Museum” looked at “problems that consisted of explaining how fossilization takes place and how this process relates to the evolution of species” and the game “BuinZoo” looked into “problem consisted of explaining the morphological, physiological and/or behavioural adaptations that three of the species at the zoo had experienced throughout their evolution”. After the mission, the students participated in group assignments’ that were supplemented by the individual games. The sample was from ten eighth-grade classes from five different schools, with two eighth-grade classes from each school. It was an intentional sample, meaning that the participating schools were selected according to certain criteria that were pertinent to the research, which is the students’ achievement in science, and socioeconomic status of the school. A quasi-experimental research design was applied, as the researcher worked in classes where the students could not be assigned arbitrarily to the control groups. One section, the experimental group, had classes with learning activities based on MSGs while the other, the non-equivalent control group, had traditional classes, without field trips, and did not use the MSGs or mobile devices used by students from the experimental group. A structured, self-applied survey, using scale for the perception of problem solving skills, and a scale for the perception of collaborative skills was used to collect information on perceptions of the project and to evaluate the impact of the intervention. Classroom intervention was carried out in two stages: first stage, which included MSG-based learning activities out-of-school context (field trips) and work activities that were later to be performed in the classroom; meanwhile second stage, which included MSG-based learning activities in-school context, and work activities performed in the classroom. All activities were carried out by students working in 4-member groups, which were permanent throughout the entire study. The worksheet was based on the four stages of the problem solving process according to \textsuperscript{13}; understanding the problem, defining a strategy, implementing and evaluating it. The information demonstrated that the trial group accomplished a higher view of their own collaboration skills and a higher score in the arrangement execution measurement of the problem solving cycle than did the non-equivalent control group, uncovering that MSG-based learning exercises may help such learning improvement. The researcher also noted that a systematic intervention and a longer period of time are needed to see the development of these skills.

\section*{2.2 SERIOUS GAMES IN MANUFACTURING EDUCATION}

A research by \textsuperscript{9} looked into the application of serious game in manufacturing education as it was still at the beginning stages and lacking studies on measuring the effectiveness of serious games on cognitive and affective learning outcomes. The main focus of the research is the level of engagement among players who have played Set-Based Concurrent Engineering (SBCE) process game. The game is played out with the aim to designing four sub-
systems of an airplane, which is the body, wing, cockpit and the tail, therefore allowing a group of four to undertake the task in hand as a team. Though the game exists in computer based platform and a role play game (Lego based game), the researcher used the Lego game as the case company, CAREL industry, preferred a simple and physical game. The design of the game intends to bring a hand-on experience and to narrow the existing gap in understanding the concept of Set-Based Concurrent Engineering process, which is rarely practised in industries. The game is played in two stages where the first stage requires the players to design the plane based on the list of requirements stated by the customer. This is done without following the SBCE process. Meanwhile the second stage, the players are given the necessary instruments to follow the SBCE process. The instruments help players to think of different design aspects while discussion about different solutions with the team to come up with an optimized solutions. A structured questionnaire was done to validate the model and answer the research questions. The survey was given to 36 engineers and project managers whom were working in the Carel Company in Italy and have played the game. The results showed a higher level of engagement among players and demonstrated that the components of motivation found in serious game assessment taxonomies are to be considered in designing the SBCE game. This study was carried out in an Italian company that produces humidification and control system in the HVAC/R market thus the results cannot be used to represent the effectiveness of serious games in other aspects of engineering education. The researcher suggests other frameworks to be used to evaluate the game in order to compare the results and that the game can be used in assessing other companies to investigate the usefulness of the game in different industrial contexts.

2.3 SERIOUS GAMES IN ENTREPRENEURIAL EDUCATION

A research by 10 wanted to look into entrepreneurial education as it was still relatively undeveloped and inadequately addressed at strategic level especially at technical universities. This is critical, when innovation potential is seen coming from the technological studies and researches. The research intended to describe the experience gained in using entrepreneurship serious games (eSG), thus considering the phases of requirement collection and course planning is vital. The progress, placement and valuation of experimental pedagogical plans are based on appealing and instructive serious games (SGs) for stimulating entrepreneurship in Higher Education (HE) students, in particular graduate and post graduate students. For analysing the entrepreneurship profile and the current needs of teachers in charge of training entrepreneurship interviews and surveys were given to the three groups which were students, teachers and entrepreneurs. The survey was done to find a detailed analysis of the various dimensions, expertise and aptitudes “related to entrepreneurship and their importance ranking according to experts and users”. The students’ questionnaire had 41 respondents, with 68% under 25 years old, while 30% were in the age between 25-44 years old (including PhD and Working Master students) thus showing that, most of them had prior experience in business field and interested in using games and ICT in learning yet professed to only having an average ICT understanding and low level ability in entrepreneurship skills. The students had a tendency for blended programs as a learning method while when it came to SGs the students preferred both ICT-based and onsite games; especially strategic games. Meanwhile the survey for teachers was completed by 10 respondents, with majority of them having experience in the business field and preferred the face to face and blended method of teaching whilst the learning method preferred was both active learning strategies and ICT-based materials and computer-based games; of which they had preferred strategy and simulation. Finally entrepreneur’s survey had 5 respondents whom stated that with blended learning environments would be the best option; learning tools and, especially, the strategy, simulation and fantasy games (75%), in particular, they agree on the use of business simulators. Thus there is an agreement in blended learning, ICT usage and simulation and strategy games. After the analysis process, a set of games was selected based on the relation of the three strategies axes important in entrepreneurship:

a) Raising awareness and motivation,
b) Developing the entrepreneurial competencies needed to identify and exploit business opportunities
c) Training to set-up a business and manage its growth.

Based on this, the universities decided to use a mix of games as one game couldn’t meet all the criteria . In conclusion the researcher obtained that while several SGs are available on the market that provide good company management simulation, there is a clear lack when it comes to product and service innovation and the motivational and vocational aspects. Even more important, the simulation algorithms are completely opaque, failing to provide clear indications and allowing feedback on what the player has learnt and needs to be improved. Based on these, the researcher wanted to take the next steps of the project to involve extensive tests in the real courses. In a longer term, eSG aims at providing a conceptual basis for extending entrepreneurship education also to lower school levels, allowing earlier actions for supporting the development of entrepreneurial mindset.

2.4 SERIOUS GAMES IN DOCTORAL(MEDICAL) EDUCATION

A research by 11 looked into thoughts of doctors in postgraduate surgical training regarding the readiness and acceptance level of using virtual mentoring following a short stint using it. The virtual world used was Second Life (SL) and MentorSL is the tool used to facilitate mentoring in the virtual world of SL. From the 57 doctors whom participated in the mentoring process, 35 of them successfully completed the questionnaires pre and post demonstration. It is to be noted that the participants were within the first four year of their postgraduate training and also had prior experience of mentoring as a component of “Foundation Training” that includes an “Assigned Educational Supervisor”. The results showed that the users are willing to use the virtual mentoring system in SL despite only 11% had having experience in using 3D Web 3.0 Technology, thus proving the disposition towards technology. Yet there were discrepancies when it came to the use of avatars and animations, there was less enthusiasm, with only 40% of the respondents agreeing on its existence. Based on the research, it can be noted that the response rate of the participants was very low; at only 61%. Besides that it can see that cosmetics add-ons such as avatars and animation are not needed and wanted by the users. This may be due to the severity of the medical line that requires priority in information rather than aesthetics. Yet with low response turnout, this may just mean that the respondents are not to use to the how the current generation put emphasizes in networking and aesthetics.

2.5 SERIOUS GAMES IN HISTORICAL EDUCATION

A research by 12 looked into comparing student learning practices and results between a serious game-based and nongame-based online American History course. The researcher looked into the
aspect of time, performance, the relationship between performance and intrinsic motivation based on Self-Determination Theory, and the pros and cons of the courses. As curriculum is important in improving students’ motivation, as if the students get used to concept and aims, integration is possible thus leading towards positive effects to study and learn. It is noted that the mixed methods triangulation convergence model was selected based on the practical use of multiple instruments used to gather data within the same timeframe and to take advantages of the “... differing strengths and non-overlapping weaknesses of quantitative methods (large sample size, trends, generalization) with those of qualitative methods (small-N, details, in depth).”

For the research a sample of 92 students for each course were randomly selected (n = 184) for the quantitative data analysis. For the qualitative data analysis, a sample of eight students (four from each course) and four teachers (two from each course) were selected as only eight completed and submitted the necessary informed consent and assent forms. The serious games used were “Conspiracy Code”, and both courses were offered by Florida Virtual School and were aimed to meet the Florida Sunshine State Standards requirements for a full credit high school course of American history. Throughout the research the students in the serious game-based online course interact with content using avatars while the assessments are “mini-games, multiple-choice questions, writing assignments, projects, essays, oral assessments and discussions”. In the nongame-based online course, students interacted through Blackboard, a content delivery system while the assessments are “self-checks, multiple-choice questions, writing assignments, projects, research papers, essays, oral assessments and discussions”. The results suggest that students in the serious game-based online course have performed significantly higher and reported additional motivational aspects than students in the nongame-based online course, due to the intrinsically motivated through their positive social interactions and through the support of their innate psychological needs yet students in the game-based course reported an additional motivation than their nongame-based online course peers as they were motivated by their desire to interact with the game. The time frame to complete the task could have taken longer because of other factors such as additional and more in-depth assignments than students in the nongame-based online course. This was evident through the student and teacher interviews. Thematic analysis was conducted on all qualitative data to examine the perception of helpful and hindering aspects of their courses. The students and teachers of both courses stated the many aspects of each course format as desirable (game play, assessments, graphics, online videos, etc.) while only citing a few aspects as undesirable (character voices, submitting assignments, technical issues, etc.). Students and teachers also added that the serious game-based courses’ videos and online format as being helpful to learning and but lack of a teacher, lack of deadlines and time management as hindering learning. The results from this study inform instructional designers, teachers, education stakeholders and educational game designers by providing research-based evidence related to the learning experiences and outcomes of the serious game-based online course.

### 3.0 GAMIFICATION LITERATURE REVIEWS

Several latest research of gamification in the context of education was chosen and reviewed to see the purpose of the research and what was analysed throughout their research. Table 2 shows the meta-analysis of this research.

<table>
<thead>
<tr>
<th>Research</th>
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<th>Analysis Review</th>
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<tbody>
<tr>
<td>“Gamifying” a library orientation tutorial for improved motivation and learning.</td>
<td>The purpose of this gamified tutorial was to help students meet the Information Literacy Standards for Science and Engineering/Technology, as well as introducing them methods of finding out the right resource for their studies</td>
<td>The idea of the “gamified” learning system was aimed to create incentives for learning, to allow for self-paced learning, and to introduce students to the professional body of knowledge they will need as professional engineers”. By “gamifying”, activities offers a new approach to teaching that evaluates outcomes, and in comparison with the previous pre-game version of the activity.</td>
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<tr>
<td>Operationalising gamification in an educational authentic environment.</td>
<td>The research was aimed to create an authentic and immersive scenario based simulation that will have a complete support of info exchange and repercussions and also aimed at infusing game mechanisms to increase student engagement</td>
<td>Overall student were more motivated and attained library search strategies; and there was improved learning transfer to subsequent course activities. Therefore, gamification offers motivation in the educational setting that activates the competitive nature of engineering students, enabling faster development of skills than prior methods.</td>
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<tr>
<td>Removing Gamification from an Enterprise SNS.</td>
<td>Analyzing the effects of removing aspects of gamification from an Enterprise Social Network System (SNS)</td>
<td>The built in assessment and feedback options allowed students to feel engaged and motivated to the authentic environment and try out the scenarios of learning that were given. By allowing the students the opportunities to get used to real life scenarios they will be able to try and retry situation that may be impossible to re do in real life.</td>
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<td></td>
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<td>The existence of extra life allows the students to re-sponsor if they die doing a task, rewinding the tasks to repeat crucial task. The use of ghost images that can allow save an action and replicate certain tasks again when retrying the scenario later on. Other elements such as awards to the ones motivated and attained the points scheme influenced dramatically at first, the contribution levels of the new users yet later gradually it went down. The outcomes showed a negative impact on the user activity after the removal of points. This was evident through</td>
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### Gamifying learning experiences: Practical implications and outcomes. 19

<table>
<thead>
<tr>
<th>Empirical study at the tertiary level of education in the subject of “Qualification for users of ICT” where gamification was used in giving the students optional exercises that is meant to help the students grade in the final exams</th>
<th>The design of educative exercises has to embraced from the very beginning the concept of gameful design to make them more interesting for students. The quantitative analysis suggested that there were less impact when it came to the cognitive aspects of gamification as the students from traditional exercises and gamified exercises performed similarly in overall score.</th>
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<tr>
<td>The researcher also pointed out that adaptation of cognitive characteristics of video games cannot be infused in the traditional educative content without entering in the field of entertainment or serious games.</td>
<td>The course was carried out in a completely synchronized method using Moodle. The findings showed engagement improved significantly, through course attendance and via the number of posts made by the students. No improvement when it came to the grades of the students. There was a notion of meaningless gamification seen in this course as some challenges were bypassed as it was perceived to be of no use to them. The users felt the need of Avatar that can create an online identity for them and creating an opportunity for cooperation among students.</td>
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### Engaging engineering students with gamification. 20

| The purpose of this empirical study is to look into the prospects of engaging engineering students with gamification. | The researcher identified that inclusion of assessment as a manner that compensates the storyline of the game not only helped in the assessing the users but also in keeping them engaged. Findings showed the learners completed more levels, played the game for a longer duration, and were much quicker when given assessments. |

### “In-game assessments increase novice programmers’ engagement and level completion speed”. 21

| The aim was to determine how integrated, explicit assessments in an educational computing game affects engagement and task completion speed in self-directed learners, and to identify the extent of these effects. | Integrating assessments in a manner of story created a flow, which has the player helping a game character in a fun way, appears to keep learners engaged, even when these tasks are still obviously a test. Though programming can be a tedious task, it is found that the users were learning programming indirectly and achieving satisfactory results along the way. |

#### 3.1 GAMIFICATION IN ENGINEERING SCIENCE EDUCATION

Besides the virtual world (online), gamification can be used in real-world (offline) scenarios as well. Games in the real world highlights the opportunities in active, experiential, problem-based, and learner-centred learning whilst immediate feedback to the students. These diverse learning helps empower and to take charge of their own learning. The research on “gamified” library orientation tutorial was designed to introduce engineering students in the Engineering Science program at the University of Toronto to many of the information sources that are essential to the engineering field. The gamified tutorial was in achieving the Information Literacy Standards for Science and Engineering/Technology, as well as introducing them methods of finding out the right resource for their studies. The evaluation was done to compare the current understanding among the students in comparison with the previous years. This is because before the gamified system was used, they used station based assessment for introducing the students towards using the libraries resources. The students concluded the time constraints imposed at certain stations made the students that were working groups; causing time constraints that made it difficult to acquire the skills in a station. Another fault with the station based system was that it was rigid and the students were not given the opportunity to explore other section of the library; as the tasks were limited to one section. Besides that, there was no continuity between the stations, thus leaving the students disconnected with the given tasks and that the scaffolding methods used before was constricting. The gamified system countered these problems by firstly promoting exploration; allowing the students to choose by themselves any section that suits them. Successful completion of the tasks at these sections rewarded the students with stamps/points of approval to go to the next tasks. This promoted self-directed learning among the students as they made their own decision in choosing the path of activity they prefer to progress. This meant that they managed their own time and method in organizing their group. This is because they were given the opportunity to assign tasks for their teammates to undertake the tasks thus creating an individual objective setting. Finally the tasks chosen for them were relevant to their studies allowing them to get used to the field of studies and the relevance of the lecture and task ahead. This is important as after the tasks, students will do a presentation on what was achieved via the gamified tasks. During this presentation, the students will be assessed based on the depth of the understanding. Therefore with the introduction of the gamified system the students’ use of complex sources in subsequent course assignments and projects were the indicative of deep learning through the live-action library tutorial. In conclusion the idea of the gamified learning system was aimed “to create incentives for learning, to allow for self-paced learning, and to introduce students to the professional body of knowledge they will need as professional engineers”. The idea of gamifying activities for
students offers a new approach to teaching and evaluating in terms of outcomes; in comparison with the previous pre-game version of the activity. Overall student were found to be more motivated and attained library search strategies; and there was improved learning transfer to subsequent course activities. For these reasons, gamification offers motivation in the educational setting that activates the competitive nature of engineering students, while enabling faster development of skills than prior methods.17

3.2 GAMIFICATION IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT EDUCATION

A research into the usage of authentic approach into implementing a gamified educational element was done by 18. This is due to inauthentic gamification used to implement in education. Though this may create a gamified system and environment yet it doesn’t reach the genuine feeling and aim to the system. The main aims of this research are to re-create a real world based application focusing on the logistics and supply chain management. The researcher aimed to create an authentic and immersive scenario based simulation that will have a complete support of info exchange and repercussions. The researcher also aimed at infusing game mechanisms to increase student engagement. Basically the researcher wants to create a simulation that enables the student to have felt of the real life element of logistics and supply chain management and also with repercussions that allow them to have the feel of real working life. The researcher designed an NDIVE (N-dimensional immersive virtual environment) framework to create an authentic virtual world to help in the skills training of the students. The built in assessment and feedback options will allow the students to feel engaged and motivated to the authentic environment and try out the scenarios of learning that are given. By allowing the students the opportunities to get used to real life scenarios they will be able to try and retry situation that may be impossible to re do in real life. The existence of extra life allows the students to re-spawn if they die doing a task, rewinding the tasks to repeat crucial task, slow motion to allow the users to observe the step properly, save points allowing users to stop and return back to the same point of lesson. Finally the researcher states that other elements such as awards to the ones with respectable attitudes within the game, multi-player elements that allow interaction and networking among users. Meanwhile the use of ghost images that can allow save an action and replicate certain tasks again when retrying the scenario later on. In conclusion it was suggested that to further improve the effectiveness of gamification in the context of teaching and learning not only engagement is important, but also immersion as this will allow the students to go the next stage of learning.

3.3 GAMIFICATION EFFECTS IN SOCIAL NETWORK SYSTEMS

A reverse engineering research in gamification was done by 20 in removing aspects of gamification from an Enterprise Social Network System (SNS). Basically the Enterprise Social Network System (SNS) system awarded points to encourage content distribution such as lists, photos or comments in the system. It is stated that comments helped more visitors back to the Enterprise Social Network System (SNS) while the accumulated points allowed a levelling up component with 4 tiers. Badges where also rewarded based on the status, whilst a leader board highlighted whom received the most points. To see the impact of points, the researcher ran a pre-test by allowing part of the user’s access to the points, whilst the other half were unaware of the existence of the points system. The results showed that the incentive scheme or the point’s scheme influenced dramatically at first, the contribution levels of the new users yet later gradually it went down. As a whole, new users that contributed content were about the same as the point earning and non-point earning users. Ten months into the study, the researcher decided to take the points system out of the Enterprise Social Network System (SNS). The results showed that there was a clear negative impact on the user activity after the removal of points. This was more evident when it came to reduction in contribution by the users. Therefore the researcher concluded that the discontinuation of game like mechanics will have motivational impact on the users, especially the new users. The researcher suggests that a new form of game mechanics need to be introduced if there is flatness of previous elements, thus ensuring continuous motivation.

3.4 GAMIFICATION IN ICT EDUCATION

A research by 19, an empirical study at the tertiary level of education in the subject of “Qualification for users of ICT” where gamification was used in giving the students optional exercises that is meant to help the students grade in the final exams. A Blackboard plugin was created to assist in providing these exercises in a gamified way. The main objective of this plugin was to motivate the students in completing optional exercises through the use of game elements (rewards) and competition mechanisms. Therefore this the researcher tried to bridge the gap between theory and practice and study the design and consequences of applying gamification in real educational settings. There was 73 students used in the control group, while 123 students participated using the gamified system. The results found that through the experiment qualitative analysis, gamification can have an emotional and social impact of students via the reward systems and competitive social mechanisms. The reward systems encouraged the way progress was represented within an online educative experience while through leader boards the competitive social mechanisms where the students can compare their progress with other classmates. Though it is found that good results do not happen for everyone. This was because the system was not inspiring enough to invoke the sense of participation throughout the course for some and while the where a few that stated the system was ominous, as there was no fun factor in competing with other for a rank in the leader board. Meanwhile the quantitative analysis suggests that cognitive impact of gamification over students is not very significant as the students who followed traditional exercises and gamified exercises performed similarly in overall score. The researcher also pointed out that adaptation of cognitive characteristics of video games cannot be infused in the traditional educative content without entering in the field of edutainment or serious games. Although gamification impact on the cognitive aspects of educative content is limited, yet changing content design and structure to make it more fun can have great motivational impact. As per suggested by 2, that design educative exercises embracing from the very beginning the concept of gameful design to make them more interesting for students.

3.5 GAMIFICATION IN ENGINEERING EDUCATION

An empirical study by 16 looked in the prospects of engaging engineering students with gamification. It was a two year plan to look into the effects of gamifying a course taught in their Department, whereas the first year a normal course was carried out, followed by the gamified version of the course. The decision to gamify the course came after looking into the motivational pull of games; for instance in tools like the Microsoft Ribbon Hero; that teaches users to explore Microsoft Office tools, and Adobe
LevelUp that uses the same concept for learning Photoshop. The course was carried out in a completely synchronized method using Moodle; an online platform. The same staff was used throughout the two years, the amount of students/users whom participated were 42 in the first year and 35 in the second year.

Gamification of the course incorporated game elements (experience points, levels, leader boards, challenges and badges). In this gamified course, the challenges play a key role as it was used to judge to students in awarding the points and badges throughout the course. The scoring process was accumulated manually via downloaded logs from the Moodle platform. The updating process and analysis was done by the faculty staff at least two to three times a day, after which the status of the student’s points, leader board and badges are updated. The findings showed improvement in engagement via the course attendance and the number of posts made by the students. It was found that there was no improvement when in students grades. There was a notion of meaningful gamification seen in this course as some challenges were bypassed because the students perceived that those challenges were of no use to them; for instance awarding the most attentive student that found “typos” (typing error) in the lecture notes. The students also felt the need for achievement stages, in which some achievement can be unlocked only after the previous task, was completed. The users felt the need of Avatar that can create an online identity for them; also need for group tasks to create an opportunity for cooperation among students.

### 3.6 Gamification in Learning Programming

A research by 21 looked into a debugging game in from which the learners play through a series of levels, finding and fixing defects in a robot’s (Gidget) programs. This incorporated gaming elements with motivational elements, represented true games and gamification which also teach introductory programming skills. This is because the learning systems, were not emphasize on points and badges on implementing the tasks, instead allowing users to tackle the problem of a task with the guidance of the system. The aim of the study was to determine the integration of explicit assessments in an educational computing game and its effect on engagement and also the task completion speed in self-directed learners, and the effects. For Gidget, where the researcher created a storyline to create an engaging environment where the players will help Gidget, a small robot that has been given the task to clear a chemical spill at a factory but as the story goes; the robot has been slightly damaged when it was transported there. Therefore it can only provide partial code to solve each task, thus enabling the users to learn coding while being immersed in the storyline and gameplay. It was found that the inclusion of assessment as a manner that compensates the storyline of the game; not only helped in the assessing the users but also in keeping them engaged. This is seen in the study where the learners completed more levels, played the game for a longer duration, and were much quicker when given assessments. Integrating assessments in a manner of story created a flow, which was framed in a way that has the player helping a game character in a fun way, appears to keep learners engaged, even when these tasks are still obviously a test. Besides that though programming can be a tedious task, it is found that through these researches that the users were learning programming indirectly and achieving satisfactory results along the way.

### 4.0 DISCUSSION

Based on the literature analysis we can sum up the attributes of serious games and gamification in table 3. Therefore based on the comparative analysis of the serious games and gamification, we can see several similarities and differences. On the aspects of similarities, both approaches can be seen looking at networking as an element that need to be cultured as the current generation prefers being able to interact with others, yet when it comes to serious games; for example as stated by 11 some do not put preferences into networking and the creation of online avatars as the medical line is seen as a serious and fast paced profession. Meanwhile on the part of aesthetics, it can be clearly seen that serious games have a more attractive design as compared to gamification. Yet the down side of this will be the cost in implementing the design and the time needed to create these games. Unless, it has already been created by a third party, it would be seen as difficult fo a teacher to create a sophisticated environment of learning as seen in majority of the serious games. 8,10-12 Though it can be noted that both serious games and gamification can be implemented online and offline method, 9,16 allowing immersion into a normal traditional classroom and online or both, thus promoting a productive hybrid learning environment. On the elements of motivation, engagement, both serious games and gamification succeeded, except for the research by 11 which was tended to a generation who is not into technology and perhaps feel disassociated with the virtual learning environment as they are more used to hands on aspects of the field. Also based on 20, disassociation can occur if the gamification users find the elements of the game being meaningless, thus rendering a feeling of boredom, thus making the users skip the tasks. On the aspects of knowledge transfer; for the serious games there is evidence to prove of increase in grades among students, 8 but when it came to gamification there was no clear proof, 19,20 in improvement. Despite a research by 21 stating that there is cognitive improvement yet we can see the tendency of the their research going towards serious games. Finally in the aspects of time frame of implementation , we can see that both Serious games and gamification requires a longer time period to see the effects of immersion in it . Though from the research by 18 it can be seen that the lost of game elements can lead to the quick disengagement from the system. It can also be seen that game elements such as points, badges and leaderboards are not the main aspects of serious games as seen by the research of 11,12 that only emphasized on games that were objective orientated meanwhile for gamification it is games element orientated.19

### 5.0 CONCLUSION

As a conclusion, we can see the similarities and differences of gamification and serious games leading to the usability in
education. Both serious games and gamification proved to have influence in engagement and motivation, implementation in a blended environment. Though the downside of serious games in educational aspects is that it may be costly to create from scratch and it may take time to design it. Whilst gamification may be easier and cheaper as it only requires infusing game elements in an existing system of learning or educational technology. Despite gamification review showing a lower knowledge transfer as compared to serious games, more analysis is needed into matter to identify the gap in education related aspects, more so in the secondary schools.

References