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Feasibility Study of Hologram Gamification in Sri Lankan Higher Education Distance Learning

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Abstract: When a global pandemic occurs, every industry faces the risk of unable to continue their usual processes and must go to business process continuity with instant change management. Considered the education industry also need an alternative solution to keep moving without failure. As experienced in such case distance learning is the best solution to conduct lessons. But the issue with normal distance learning is the learner's interactivity with lessons. To improve learners' interactivity with the help of technological advancement, higher education needs to deploy innovative teaching-learning methods including games, simulations, and holograms. Meanwhile, researches have proven that learning is not only a response to delivery but more than an active, constructive, cognitive, and social process by which the learner strategically manages the cognitive, physical, and social resources to build their knowledge. To enhance these aspects gamification can be a great deal, and which provides users with instant access to vast amounts of information without effort regardless of geographical or economic boundaries. Holographic technology might be another resource that could change the way to create and share knowledge. Gamification has been using for the learning and teaching process, but the hologram projection for learning is still new to the education industry but it has the potential to revolutionize aspects of teaching and learning experience. The sole purpose of this review study is to determine whether learners would perceive the gamification activities inbound with hologram technology positively and will it help to enhance the interactivity in the teaching-learning process. Finally, increase the engagement of the distance learning process. To gain this outcome must study the feasibility of gamification in line with hologram technology regarding achieving distance learning objectives.

Keywords: Game-based learning, Simulations, Holographic projection, Distance Learning

Inroduction

Traditional learning and teaching is the base of any education system regardless of the level. And meantime due to some difficulties or inevitable reasons learners cannot come to the physical place, learn and focus on teaching and learning process. But considering geographical limitations, most of the learners cannot enrol or proceed with their expected foreign university. Also, when occurs a global pandemic even local university students have the difficulty of completing their academics. In this case, here it comes the concept of distance learning. People started to learn remotely, create learning materials, learning objectives and modules for distance learning. Nowadays there are plenty of ways to perform distance learning. But there are some issues to be considered as attracting learner's attention and make them want to learn more, which is still a difficult task to achieve. In that case, educators need to find new ways to achieve them and mitigate the risk of learner turn over due to unsatisfactory of the distance

learning technique. Responsible people for content creation of distance learning already using tactics like Augmented Reality (AR) which is quite successful. But in the long run, this same module with the same AR will be uninterested to the learners and the lecturers. So that there should be an alternative solution to proceed with this distance learning with some attractive, unique, changeable, and active technique. In this scenario, the famous gamification and hologram can use for the betterment of distance learning. Still, gamification and hologram technologies are two separate techniques. But can merge them techniques, build and expect a uniquely powerful platform for teaching and learning process. Upcoming topics describe, analyse, conclude and crucial factors to be considered when implementing such a system for Sri Lankan higher education.

Effectiveness in General Distance Learning Methods

Distance learning has become a norm in the past few months even though it is been there for the past decade. The reality is, even though it was here for a long time, was never the mainstream learning method and helped to the traditional learning methods. Because of this, the general population never paid much attention to how effective distance learning can be as a standalone learning method. However, with the current pandemic situation question has been arising; does the distance learning methods as effective as traditional learning? The survey conducted among university undergraduates (sample of 60 persons) helps to determine the statistical situation regarding this matter. In this survey researches considered main two Distance Learning methods: Online Video Conferencing and Sharing Learning Material. So far, these two methods widely considered as best distance learning methods. 1st method is Using Online Video Conferencing to interact with the student in real-time. For that this survey considered mainly two main platforms; Microsoft Teams and Zoom. 2nd method is sharing specially prepared study materials for self-study, for this method, the study also considered two widely used platforms; Google Services (Classroom, Drive) and University LMS.

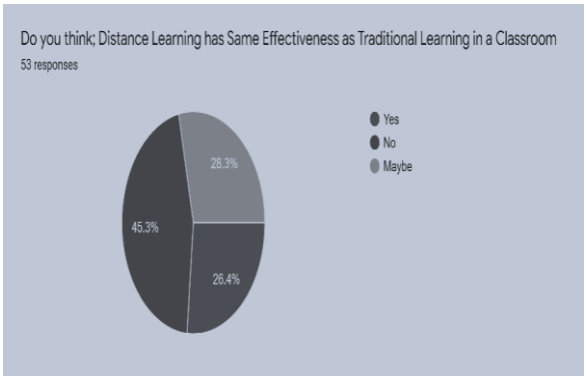

Figure 1. Pie chart of effectiveness regarding Traditional learning method and Distance learning method

The results reveal that the distance learning techniques do not yield the same result as traditional learning methods like Classroom Teaching. By looking at the below chart, the result shows that distance learning does not have the same effectiveness as Traditional Learning methods. Compared to traditional methods it has a considerably low rate. Further survey results reveal that many other factors affect distance learning (Figure 2).

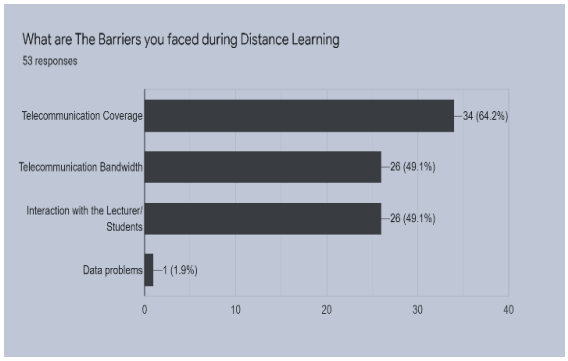

Figure 2. Major barriers for Distance Learning

Since Sri Lanka is still a maturing country technology-wise, the above chart proves the main barrier to Distance Learning is technology efficiency and literacy. According

to survey results, the study concludes that still, general Distance Learning Methods are not as effective as Traditional Learning Methods in Sri Lankan higher education sector. So that researchers suggest that to overcome this matter, use new interesting technology which is hologram along with gamification experience to improve the current situation of distance learning in Sri Lankan context and get more engagement in teaching and learning experience using distance learning.

Hologram Technology in Teaching and Learning Environment

In this era for education purposes, can take advantages of holograms in different forms. For example, holograms now allow learners to be taught by a "virtual lecturer" who could be an indifferent geographical area. The relevant process goes beyond video conferencing in that the hologram lecturer appears to be in the classroom and can see and speak to the learners as if they were all in the same room. The system used by Edex, the largest supplier of Internet connections to the UK education market, at the BETT2000 educational technology show in London. Moreover, hologram technology can enhance the educational process by bringing famous characters to life again from the past, and they speak about themselves and/or explain something like an assistant lecturer. For an example in Seoul's Alive Gallery Project, holograms and 3-D animation technology bring the Mona Lisa and that hologram answering questions from students, like "Why don't you have any eyebrows?" and she is answering, "When I was alive, a woman who had big forehead was considered a beauty ... so most women had their eyebrows taken off for beauty".

Considering the history hologram was invented in 1947 by Dennis Gabor and won the Nobel Prize for Physics in 1971. His idea consists of a three-dimensional photograph executed with a laser beam through an object so that a second ray is projected onto the reflection of light of the first ray which allows obtaining three-dimensional optical images. It can be explained that although this technique is not new, the illusory effect that it transmits has become very popular at that time. Then the holographic projection was advanced in time and relate with the visual improvement of the technique called 'Pepper's Ghost' which was developed in the mid-19th century. In present days, this technique is applied with improvements in the quality projection of the image and binocular vision, which makes it an animated hologram almost real to the original. The technique 'Pepper's Ghost' is based on the fact that the viewer is in the main room but the viewer cannot see that there is a compartment hidden under the stage (that is where the actor is located). On the top of that, there is a glass or reflecting surface that shows the floating and project "ghostly" figure of the actor, as a result of receiving the light that impacts on it and reflects on the surface located on the stage. The room, where the person or object to be projected is placed, should be perfectly black or dark to highlight luminous colours on the reflecting surface. So basically, Pepper Ghost is the official starting point of hologram projection.

Then the project of creating an interactive hologram for teaching science or other subjects was inspired by the research papers of Balogh “An interactive multi-user holographic environment”[22] and their collaborating research “A large scale interactive holographic display”[23] done by Agocs. Then both made a project in which they used different optical modules that sent light to a holographic display to show a hologram without the need for additional use of lenses. Meantime, Agocs{23} used diverse optical modules besides mirrors to obtain certain interactivity.

Other studies such as[24], who developed a device composed of a field light visualiser

that allows human eyesight of binocular type to be able to see an image formed in 360 degrees. This is possible thanks to a high-speed projector, which transmits images to a mirror with holographic diffuser and an electronic circuit to decode digital video signals. As a result, a projection of the object is obtained which can be observed without the need to wear special lenses and which also avoids the restriction of seeing yourself only from a reference point. Then the study done by Ghuloum[25] tested that the effectiveness of holograms in education is the one performed by with 400 teachers. The results showed that educators considered this technique potentially effective in achieving meaningful learning.

Still, the researchers work on a way to use holograms for educational purposes, some researchers are based on analogic or transmission holograms which are in static plates and are not in motion. They deal with interactive holographic applications through posterior projection or mobile prisms whose objective is to create interactive contents of both commercial and institutional applications.

Games, Simulations and Gamification

A. Games

In modern days, the interest in examining game use in higher education has increased. This includes educational games [11] digital game-based learning (DGBL), and applied games [12] Besides, learners sometimes include interactive exercises video games [13] or even expand to next-generation video games in the category of games. Considering web-based games, the technological platforms that implement digital game code include computers and consoles [14]. They can run on a web browser on mobile phones and other mobile gaming devices [15] like tablets. Without being affected by the very large game types, there is a lack of clear, shared definitions and terminology among learners and lecturers, which has led to "terminological ambiguity" [16]. However, the need for shared terminology remains when discussing the different forms of games and simulations in higher education. Although academics and game developers may use various classifications to categorize games, the majority broadly agree on the seven major genres[17]; Action games - categorized as response based video games, Adventure games - the player solves problems to progress through levels within a virtual world, Fighting games which means these involve fighting with computer-controlled characters or characters controlled by other players, Role-playing games - players assume the roles of fictional characters, Simulations in which games modelled after natural or man-made systems or phenomena and players have to achieve pre-specified goals, Sports games - these are based on different kinds of sports and Strategy games which recreate historical scenes or fictional scenarios, in which players must devise an appropriate strategy to achieve the goal.

Recently, several studies investigated the effects of serious games on learning outcomes have been published. Researcher Sawyer refers to serious games as those games produced by the video game industry that have a substantial connection to the acquisition of knowledge [18]. Researcher Zyda expands Sawyer's definition, adding that serious games are games whose primary purpose is not entertainment, enjoyment, or fun [19]. Serious games or say as educational games and virtual worlds developed for educational purposes shows that the potential of these technologies to motivate the player beyond leisure activities. In meantime there, there are considerable learning benefits offered by game-based learning (GBL), which can be defined as the use of game-based technology to deliver, support, and enhance teaching and learning

experience and evaluation the learner progression.

B. Simulations

Simulations mean they create a scenario-based environment, where learners interact and apply previous knowledge with their practical skills to solve real-world problems, also allowing lecturers to reach their own goals. During this kind of scenario-based training, the player gains important skills such as teamwork, leadership, communication, decision making, task prioritizing and stress management [20]. The practical scenario may be carried out individually or within the team [21], leading to collaboration and knowledge sharing. With the explosion of such technology, increase the opportunities to interact with technological applications in an active and promote information access, share their ideas, knowledge sharing and content creation. In digital simulations which engage learners in the interactive and self-driven process of gain knowledge, is adopted in higher education. Some people define game-based e-learning as a digital approach which delivers, supports, and enhances teaching and learning experience, and evaluation the progress of the learner. Game-based e-learning is differentiated from GBL, discovering which tends to cover both computer and non-computer games. Delivering the related platforms are an essential fact for game designers when creating and distributing games and simulations, which can be a console, computer, video, online, mobile or 3D game. Designers have to consider and pay attention to game characteristics such as technical challenges, modules and techniques which are associated with the game design, the players involved in gaming, and the teaching modes; that can be single-player, multiplayer, collaborative or synchronous. The above-mentioned game classification is presented below (Figure 1). The main difference between games and simulations is the games are tools which are artificial and pedagogical, they include conflict, rules, and predetermined goals, but simulations are dynamic tools, representing reality, claiming fidelity, accuracy, and validity.

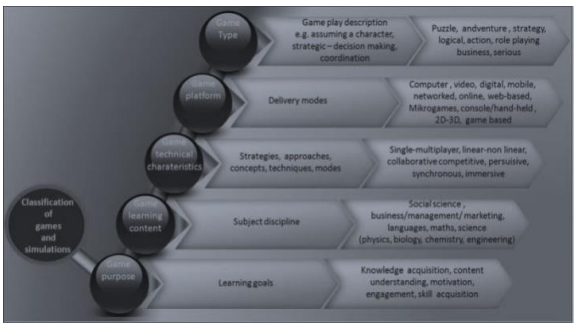

Figure 3. Classification of Games and Simulations

Source: Vlachopoulos and Makri International Journal of Educational Technology in Higher Education (2017) 14:22 Page 4 of 33

Hologram Gamification and Expected Distance Learning Outcomes

Considering the gained knowledge there is a possibility to build a hologram gamification system for distance learning. So, the study proposes a Hologram Gamification system to battle shortcomings of general distance learning methods. By using Hologram gamification system, can expect some outcomes such as, Increase students attention span, Gamification experience increase the interest for learning which helps to improve the learning curve of each student, Increase the overall learning yield, holograms make a clearer image on the subject matter, helps to increase enthusiasm to try to become innovative and students tend to use logical approaches to solve problems and learn subjects. Which leads to improve the logical thinking and analytical skills of the student through gamification than normal distance learning method. Overall, there is a probability to increase more than 50% of students' knowledge, interest to learn the relevant subject.

Considering lecturer side this hologram gamification helps them to increase their

knowledge technology-wise and make their lives easier than traditional teaching-learning or distance learning using normal technology like video conferencing.

So, the overall outcome using hologram gamification system happens to be positive and it is promising to increase engagement of teaching and learning experience in distance learning,

Implementation Challenges and Limitations

Although the concept of gamification has been around for years, the model of gamification techniques for teaching and learning process is relatively new. There are limitations involved in the gamification process that must be addressed and continuously evaluated through time to understand the full benefits of gamification.

To track the correct data to the teaching and learning process needed extensive training and pilot experiments must be conducted to stop confusing problems that could occur to the effectiveness of the virtual game. Both lecturers and game developers must be given the necessary time to learn the techniques of the games to be sure it is understandable and attractive to both audiences.

In addition to that, the design of the gaming system must provide meaning to the user/learner of the game. Without proper meaning, the learner and lecturer may lose their interest in the game quickly and become frustrated or lazy with their actions. If the sole purpose id not meaningful, un or attractive to the user, the user/learner have a great chance of misunderstanding the ultimate goal of education-based gaming in the first place. By not meeting the expected outcome could lead to the user to stop playing the game. Which may cause a great disadvantage for the first place and give a bad image to the game developers who involved in the project. This affects negatively to the game developers and when rescheduling and operate the project again with the same institute. To mitigate this risk factor game developers must keep a well-targeted audience and procedures in mind when designing game processes.

Hologram and virtual games can be so expensive to implement, especially the game requires high tech, high graphic resolution. For a considerably small institution might not be so ready to fund for such project and available to implement necessary components. Also, can be difficult to offer high tech pieces of equipment for a wast audience of higher education institutions. This fact can put high education institute in a difficult position. In the meantime, they may lose a competitive advantage over another institute in the higher education marketplace if a competitor institute can implement this kind of project without any problem. Considering game developers aspect just because of the high cost for developing, implement and maintain such game they will be unable to sell their game or can see the reduction of their revenue due to this high-tech game.

Also, the security monitoring, implementation and training costs can be high considering normal game-based e-learning system. Lack of knowledge in technology among lecturers and learners will be effective for user training and make things difficult.

Technological issues could arise during the implementation and maintenance, which must be quickly fixed if occurred when playing in real-time. Otherwise, the game will be rejected by the users. Also, hardware and operating systems must be upgraded before the gaming system launch, otherwise, most of the parts in the gaming system will not function well or stop functioning due to unmatching system components. This also provides a huge expense for an institution.

Gamification can also, costly to build and take a considerable amount of time. The concept design, initial production, editing, trial and publishing/implementation processes take much more energy and time to produce an effective product. Another problem is the user/learner spends more time learning the concepts and rules of the game than playing the game itself. If game developers are not fully dedicated to the gamification proposal and make it easier to understand to the user, it might not worthy for even trying to build a one.

If the gaming strategies are build using separate teams, it may be difficult to monitor the individual performance of selected participants in user testing period. When the game developers designed the game, they must consider getting teams with more collaborative in terms of developing. Also, even if it is very difficult must have an idea about learners or educators background, lifestyles, personalities, and cultural values. If not, there is a risk of clash over their ability to complete the game successfully.

Considering hologram technology as a single entity that also has some disadvantages. Number one problem is the cost., then, hologram needs to be connected to a fast Internet, next-generation broadband Internet network like 5G with a minimum guaranteed constant speed of 20 megabits per second needed to implement. Finally, to use this technology perfectly, need a screening room with compatible lighting and video technology, which costly when it comes to installing, as well as a display screen for viewing the holograms on also costly.

Conclusion

The main two problems to implement such system for a country like Sri Lanka; lack of technical knowledge, then that leads to hologram become an unreachable technology to build and the unbearable cost for such high-tech system implementation. Even the 5G network is still in implementing stage and the cost to install a hologram gamification system will be unbearable for most of the Sri Lankan higher education institutes. According to the analysis and found factors, can conclude that holographic gamification experience is still far to reach for a country like Sri Lanka. But instead of adding hologram as an alternative can implement adaptive gamification to the higher education stream in Sri Lanka. That will help to build the Sri Lankan Game development community and increase the quality of Sri Lankan higher education sector.

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