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Cultural and Philosophical Understanding of Game-based Learning in STEM Subjects

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ABSTRACT Several reasons have been linked to the high percentage of failure when it comes to Sciences Technology, Engineering and Mathematics (STEM) subjects for college freshmen. The Higher Learning Commission during its annual conference in 2013 did find out that the leading factor, motivation, seems to play a significant role to inspire students to get involved in the course work. Much research, both in academic journals and mainstream magazines, has been published on how traditional methods of lecturing are neither engaging nor robust enough for STEM learners. In this paper, the author explores the Game-Based Learning method (GBL) as a promising platform to assistance students in their transition from high school to college level STEM courses. Additionally it also looks into the fundamental reasons why biologically, culturally and philosophically, playing has become an essential tool in engaging the real world without having to assume the risk of unwanted consequences.

INTRODUCTION

Humans are presumed to be pre-disposed to play naturally. Games in the school setting are meant to alleviate the negativity geared towards school and studying. Abt (1970) came up with the term 'serious game' so as to contrast with the term 'leisure games', to show the purposeful application of games in different scenarios. This however is an oxymoron because of the fact the pleasure of playing conflicts with the seriousness in education. Society wise, education is seen and termed as a duty, which is even enforced by the law all around the world. Education involves examinations and assignments, and it is a life necessity and most importantly in modern days it is a job prerequisite. On the other hand, games are associated with fun, leisure, play and joy. Huizinga (1955) in his book "Homo Ludens" terms play as an activity meant for leisure and not as an obligation nor is there a profit to be gained from it. Play comes with freedom, which greatly differentiates it from education, which has schedules and compulsory classes. When it comes to school students can be forced to go and learn but there is never a moment when children are forced to play. If by any chance play was to be forced, then children would associate it with a duty and they would not experience or even enjoy it. Play is not a means to an end and it has no effects. Mentally, affective and cognitive levels are witnessed during play in people and play is a natural way of learning. Play tends to show learning as universal (Blanchard and Cheska 1985). For example, cubs and puppies tend to lark, growl, and creep and threaten each other as a way of preparing for adult life, and similarly children will play with simple objects such as sticks, stones or plastics and they end up gaining skills. Children and adults both benefit from play intellectually, psychologically and socially. Activities such as music, theatre and film all have play as their element, which has temporary agreed rules and have a shared agreement that is not real life. Play according to Huizinga helps one detach from the real life temporarily and gives room to role-play and fantasise but there are rules that are to be followed. Similarly, in school when new things are being learnt, pretence is required in that learning in a secure environment that needs the application of particular rules and the exercises to prepare the children for the real world. Hence, seriousness and fun do not have to conflict. Fun does not mean easy, and people enjoy 'hard fun' according to Papert (1980) in that they enjoy being challenged and are curious to see how far their abilities can be stretched.

Objectives of the Study

The objectives of the study are:

1. To determine the cultural effect on learning.
2. To look into the philosophical aspect of game based learning.

3. To find out how STEM subjects and game based learning relate.

Features of Games

Opinions on game characteristics vary from scholar to scholar. For example, Thornton and Cleveland (1990) argue that interactivity is a fundamental aspect of a game. On the other hand, Johnston et al. (1993) believe that the fundamental components of games are that they need to be dynamic visually, have rules, be goal oriented and be interactive. According to Baranauskas et al. (1999) however, he believes that the fundamental nature of playing is when the game is not only challenging but also risky. Malone (1981) believes that the four main elements of computer games are fantasy, control, curiosity and challenge. He defines them as follows.

Fantasy, which stands for the 'virtual' world and the setting where the activity is set in. In games, the real world is never affected by the imaginary worlds and all that occurs in the game is not relevant. Fantasy as a context in a game is what peaks the interest of a student and makes learning more effective and efficient.

Players are able to *control* the development of the game through making choices with the opportunities given that have direct consequences. A player can control a game character in a game whereby the character faces problems that she or he is to solve in different situations. Decision and choice making in a game fully relies on the players/learners, for example, in an adventure game, in order to advance from one level to another, one needs to complete puzzles and riddles and this is what makes it fun. Games such as adventure games need not be difficult to execute but should be difficult to conceive.

Curiosity is sustained by the frequent introduction of new information and undetermined results. Despite game activities being set apart from the real world, time and space is still fixed with rules that govern the duration the game lasts. Various rules are put in place to assist players to achieve the game's set goal. System rules characterise the game world, and procedural rules define the actions. For example, "When the time runs out, whatever is on screen will apply as the outcome", and imported rules involve rules where players can get into the game from the real world and allow the game to take place. A second order reality is created by games, for example in games like Sims.

Challenge is encountered at each appropriate level of difficulty. Progressively, difficultly levels such as the increase of tempo or chess option levels being switched, numerous goals have to have a significant meaning to a player, and game design challenges are tailored in accordance to potential participants' activities. When the level of difficulty is low, players are likely to lose interest and look for better alterna-tives. In addition to that, when the game difficulty is too high in relation to the players' abilities, they are likely to lose interest too.

Game-based learning is not a better-quality learning method per se. Druckman (1995) believes that the purpose of games is to increase the motivation of students and to increase their interest in the subject matter, although the whether this has led to effective learning is not clear. There were a number of studies that were carried out and they focused on retention of information in learning. Out of the eleven studies carried out, eight proved that there was more retention of information when game based learning was applied whereby the other three proved that game based learning did not yield any results when it came to information retention. Another eight studies were carried out in relation to what students prefer and seven of them showed that students preferred using games while learning. There are however other studies that have been carried out and they are not in favour of game based learning yielding the desired results. Specific educational domains do exist whereby game-based learning concepts and approaches have a high learning value. Skills such as critical thinking, group communication, debate and decision-making are of high value in these domains that contain interdisciplinary topics. These subjects when learned in isolation cannot be applied in the real world.

Main Components of Game Based Learning

Intellectual Component

This base strives to help players or students go through a series of processes that will eventually lead to them gaining the intended knowledge. The process first starts with the learner choosing

which game best suits their needs at that moment (Mayer and Johnson 2010), thereafter whatever information is acquired either visually or verbally is arranged and stored in the memory, and finally the knowledge that was previously gathered and is currently being acquired are integrated. During research, plenty of research methods were used but all in all the experimental studies method was found to be the most suitable, and this was discovered when the games were compared to other forms of media. There are favourable game components that have been put in place by game designers in accordance to this theory. The designers aim to put in place elements that favour learning and its mechanics. According to Adams et al. (2012), the aim of the game mechanics and aspects is to make sure that ways are found of keeping the intended target engaged at all times and the intended objective is realised. One of the vital considerations that game designers have in mind when designing game based learning games is the cognitive demand required for a targeted learner to process all the information being received.

Mayer (2005) particularly suggested that game designers should focus on minimising the unnecessary processing, manage necessary processing and cultivate the investment of mental effort by the learner. Researches carried out on the cognitive approach are uncertain about the effectiveness of using games in the learning process (Tobias and Fletcher 2012).

Mayer and Johnson (2010) did a minor research on different factors such as motivation, games and interest in learning, which turned out to not be successful when it came to cognitive processing. Some of the ways through which cognitive processing has however been successful is through the following.

Signs and Motor Function Component

The use of signs and movement has been used widely used by companies when making games that are meant for learning purposes (Homer et al. 2014). The reason why these two aspects are incorporated is because of desiring to have an effect that is either perceptual, cognitive or both on the learners (Black 2010). The environment that movement and gestures bring enhances the learning experience.

Visual Illustration Component

Design plays a big role on the game world. The visual forms are what are used in the leaning process and they are responsible for the cognitive learning. The more appealing the illustrations the more learners are attracted to partake in the game, stay engaged overtime and retain information received (Plass et al. 2010). Visuals in games are used for symbolic purposes that help young learners in their growing stages to develop their knowledge such as bubbles representing under water. Games have been made diverse and the use of these different formats breaks the element of monotony (Moreno and Duran 2004). Too much diversity in games though, might cause information overload to learners with low prior knowledge (Ainsworth and Van Labeke 2004). In a case where guidance can be given it will be highly acceptable and have a positive outcome.

Scaffolding Component

Scaffolding, according to Wood and Ross (2006), is the process through which assistance offered to a student is gradually shed as time goes by as a task is being carried out. Putting into mind how instructional, complex and instructional digital media has become, games now contain instructions on how adults, tutors or an expert can assist someone with less knowledge not only accomplish a task but also gain the intended knowledge. Scaffolding often goes together with proximal development, and hence for scaffolding to be effective and yield results tasks need to be completed, and experts need to control certain aspects of the given task (Pea 2004). Overtime, the meaning of scaffolding has been 'diluted' and it has hence lost its original meaning. Although Pea (2004) believes that scaffolding involves dynamism and progressive fading. In modern days, games have formulated new ways of scaffolding using tutorials before or during game playing. The game will monitor how the player progresses and offer less and less assistance over time. It is mostly in learning games that scaffolding is utilised.

Circumstance Component

Game based learning and games in general provide an added advantage when it comes to

learning in certain circumstances (Lave and Wenger 1991; Wenger 1998). Some of the benefits of circumstance is that when it comes to game based learning, a learner or gamer is given a problem to solve right at the moment when it is necessary and needed and also the games mimic real life situations, which gives learners an easier time to learn and retain knowledge gained. The two benefits nonetheless have not been proven to be effective according to Gee (2007) and Prensky (2003).

Flexible Evaluation Component

For scaffolding to yield results, there needs to be accuracy in the evaluation of learners' skills and knowledge. The evaluation being accurate and well done is not sufficient, it needs to be also dynamic, so as to enable the efficient fading of scaffolding overtime (Plass et al. 2013). The reason as to why evaluation has to be flexible is so that once a learner completes their task and they have adopted the knowledge, then the instructor is able to decide on which task to give next that flows with the progress. It is at this point that the instructor can decide to either increase or decrease the difficulty level (Mislevy and Geneva 2006).

Rupp et al. (2010) states that in the case of game based learning, the evaluation mechanics are inbuilt and the resources needed to assist the learner do not necessarily need to be external in order for the learner to adapt to the games. The intention of creating learning games is so that the learners cannot be just engaged but to also develop their knowledge and skills (Shute et al. 2009).

Application Component

Knowledge that students acquire is usually intended to be used beyond the classroom and school environment. Perkins and Salomon (Perkins and Salomon 1989) state that ways through which acquired knowledge can be applied in real life situations is when the skills are repeatedly done until they come automatically (low road) and through applying cognisant concepts and information (high road). The application of acquired knowledge in real life situations is usually easier when the situations are similar to the learning context (Barnett and Ceci 2002; Haskell 2000). Although, there are some factors that might hinder application.

Learning Mechanics Component

This is simply defined as the act of charting the theories being learnt to instructional approaches (Plass et al. 2015). The learning mechanics are meant to align with the set objectives that are to be achieved. For example, for games that are meant to have the option of one player, collaborative play and competitive play, each showed diverse results. There were noticeable high results in learning when it came to competitive play and when it came to the other forms of play, positive results were observed. The charting process is meant to be systematic so that the set goals are achieved (Ke and Grabowski 2007).

GBL and STEM Subjects

A Game Changing Approach

Why students fail in STEM subjects is a question that has occupied many minds and many pages in modern literature. Several factors as to why students fail have surfaced according to one study published by the Higher Learning Commission (Cherif et al. 2013). In a survey of 739 students, it was found that motivation at thirty-five percent is the lead cause of failure, study habits at seventeen percent, academic preparedness at twelve percent, external fac-tors at eleven percent, attitudes at eleven percent, instruction at ten percent, and relevancy issues at four percent. High failure rates in intro-ductory STEM courses can be very detrimental and discouraging to students that are considering STEM-oriented careers for their future. In fact, the federal government investment programs guided to improve STEM outcomes among the new generations of students has led to the development of special STEM high schools. These institutions have already adjusted their curricula to satisfy the need to engage students' front-and-centre with alternative strategies to teach STEM subjects, rather than only fo-cusing on traditional course content and lectures (Scott et al. 2014; LaForce et al. 2016).

Motivation in Game-based Learning

Motivation is an important component that contributes highly on the effects that GBL has on

students. Motivation is defined by Gee (2007) and Ryan et al. (2006) as the reason or reasons that someone behaves the particular way they do. Some of the elements that bring about motivation in many cases are fantasy, incentives, game methods, musical score and graphic aesthetics. Although some researchers believe that the amount of motivation involved in entertainment games is not equal to that when one is playing an educational game. The higher the motivation, the higher the cognitive process and the more improved learning takes place (Hoffman and Nadelson 2010).

Some of the common theories that explain the concept of motivation are: a) expectancy-value theory, b) self-determination theory, c) self-efficacy theory, d) attribution theory, e) achievement goal orientation theory, and f) interest theory. These theories look into various components and how different factors shape motivation (Zusho et al. 2014).

Intrinsic Motivation

Intrinsic motivation comes about when individuals motivate themselves from within, while in extrinsic motivation individuals are motivated to perform an activity for reward purposes such as receiving a commission. Contemporary theories state that motivation is a process that is constantly rising because of the psychological need of human beings such as relatedness, autonomy and purpose and the self-determination theory argues this best (Ryan and Deci 2000b). When it comes to intrinsic motivation a student might have motivation to play games but not to learn, in that they endeavour to just finish the game. How a game is designed, for example, graphic wise can motivate players intrinsically. In turn, games increase their difficulty at each level, which brings out the core elements of game design, which are curiosity, challenge and fantasy (Dondlinger 2007). In the challenge element for example, games enable motivation by ensuring that the more levels one passes easily the increasingly difficult it gets, which is intrinsically motivating.

Values and Interests

When playing a game, players usually have a goal or set objective that they want to achieve. This is where the expectancy-value theory comes in, as it will identify motivational elements that bring value to the learning process and as a result fulfil learners' expectations in terms of outcome. Interest is a way one stays engaged and it includes both situational interest, which is an instantaneous affective response to an activity, which directs a learner's attention to a task according to Rotgans and Schmidt (2011) and individual interest, is when interest arises owing to an intrinsic desire and affinity to engage in a definite activity. Situa-tional interest tends to grow into individual interest in games well designed for the purpose of learning. An example is when researchers (Miller et al. 2011) introduced an online game on forensic science to high school students' and they noted that after the students played through three possible cases, the students showed a notable improvement in science knowledge in addition to superior individual interest.

Achievement of Goals

Goal orientation types that have been proven to assist students are mastery goal orientation and performance orientation. In mastery goal orientation it plays out in situations whereby students concentrate on acquiring new skills and mastering material. Performance orientation on the other hand, makes the most of evaluating capabilities that work in their favour (Elliot 2005). The adaptive patterns of motivation and education are in mastery goal orientation and this has encouraged a few studies that have delved into goals that edu-cational games achieve. The results from the studies expressed that collaborative, individual and competitive play showed strong mastery goal orientation in students.

Affective Perspective in Game-based Learning

Affective perspective is defined as the beliefs, feelings, moods and attitudes that a player experiences and also how the environment of the game will impact their engagement with others. Additionally, affect looks into impact, social, cultural and cognitive aspects of learning. Theories have been formulated by authors to attempt explaining if interaction between learners and their environment could or could not attribute to a source. The cognitive process of an individual

can either be influenced or not by experience of affect, either directly or indirectly as a mood and the outcome of this is schema. Schema is defined by Izard (2009) as: *"The dynamic interaction of emotion and cognition representing processes involved in the dynamic interplay of emotion, appraisals, and higher order cognition."*

So as to conjure affect in learners' or players, certain elements such as musical score, aesthetic design, narrative and game mechanics can be incorporated in games. These games that are designed are created with the intention of making learners experience different emotional rollercoasters such as fear, happiness or anxiety (D'Mello and Graesser 2014). Consideration is a priority when the affective approach is used in games meant for learning. This is because the intention of the game designer is to tap into the emotional part of play and the impact it brings about on the part of a learner's engagement. The goal of having a playful learning environment and optimising the engagement of a learner to the game is due to the fact that playful learning helps learners who were disengaged from academic learning and are not able to reengage using any other possible methods. However, on the other hand, there are researchers that dispute this theory and argue that emotional regulation in some games may cause learners to be overwhelmed such as in instances where a great amount of sympathy may be required (Huang and Tettegah 2010). Emotion can nevertheless also positively impact learning, and hence emotional design.

Design by Emotion

This is defined as the employment of features of design with the intended purpose of evoking emotions that are beneficial in learning (Plass and Kaplan 2016). Up to date, emotional design has focused on two methods of stirring emotions, that is, through game mechanics and illustration of information. Visual design as a way of representing information has an impact on emotions and augments learning outcomes. Research was carried out on how colours evoke emotions and results showed that warm colours evoked positive emotions that make learning more comprehensible (Um et al. 2012). Game mechanics play a part in learners' affect in ways such as bringing frustration, joy or boredom but studies have not proven that they provide outcomes.

Other design elements that have an effect on players' emotions include music, that is, where music impacts in a highly intricate and diverse way by either creating a hyper or sombre mood. In addition, affect produces outcomes through movements, gestures, game events, narratives and game characters although none of them have been proven to have educational outcomes (Ravaja et al. 2006).

Sociocultural Foundation of Game-based Learning

Learning is considered as being socially constructed and motivated in game based learning when it comes to the social cultural perspective. Games have the ability to incorporate opportunities that can improve learning through social engagement and provision of contexts. The goal of learning designs that have made social and cultural aspects their focus is to find ways through which participation of learners can take place in groups, utilise collective knowledge to achieve goals, relay learning to characteristics of cultural standards and identities and utilization of social and cultural influence as motivation for learning. This is done through the features of game play that more distributed and immediate.

While learning, it is difficult to divide social and cultural aspects from the already discussed foundations, as the affective and cognitive aspects play a big role in the cultural and social contexts (Turkay et al. 2014). The factors unintentionally still tend to have an influence on designers and hence in their designs via their values and personal experience. For example, certain colours and shapes are unconscious-ly used by game designers especially if they have been socially constructed in a cultural group as being lucky or unlucky. Certain colours and shapes will not be used in games by designers because culturally they are known to have negative consequences. Nonetheless, being that it is hard to separate the cultur-al and social aspects from other design factors, games still are reliant on and make the most of the two factors that are considered separately. Cognitive, social cultural and affective elements, though all important, are believed to be either privileged or underprivileged in any type of game.

Anticipated social interaction plays a leading role in increasing the motivational value of games

and encourages players to continuously play a game (Steinkuehler and Duncan 2008). This mostly applies to games where people interact with each other and take part in quests and activities that require teamwork. A learner can feel worthy or worthless as an effect from playing in a group via self-perception. Perception by other individuals plays a vital role in a person's identity formation. This is majorly influenced by interactions with others, which in turn influence views on self-efficacy and performance in learning. Game based learning from a cultural and social perspective puts emphasis on engagement and motivation in the same way as affect. The purpose of cultural and social factors in relation to designing of game based learning is meant to have a positive influence and supporting contexts of learning in a social manner. Even though socio-cultural factors may detract or aid learning, they do not necessarily result in learning. This is where now design principles come in and take over the part of creating opportunities that are motivating other than specific strategies for instructing learning. The principles of design hence deal with provision of opportunities other than content that is strategically for instruction.

Interactions, social learning and interactions in the real world have a tendency to have an influence on learning and this can be integrated in game play. Next the study will look into the approaches and theories that are related to the socio-cultural aspects of game based learning and also look into the challenges and how to address them.

Activity Theory

Many studies have depended on the activity theory to expound on social interactions that are within players with artefacts and players (Jonassen and Murphy 1999). Games, being dynamic, has made the activity theory attractive because of the fact that they are situational, artefact and skilfulness of players varies all through play. As conditions change, the players and artefacts also change in both positive and negative ways and the activity theory acknowledges this. This change is due to mediation of facts and the surrounding social factors. Due to the fact that social and cultural interactions are based on interactions with objects, game designers have to put into consideration how interactions with objects can be incorporated in games. For example, when an object requires more than one person so as to facilitate learning as compared to when just one person is required so as to facilitate social interaction. Actor network theory and rhizomatic analysis have been used to explore and document why affordances and artefacts as being vital in social play and players in addition to how cultural foci, social and learning interact (Banks 2014).

Vygotskian notions of identities and Moll's Funds of Identities have argued in their studies that perceptions of individuals are determined by the interaction of artefacts with groups and individuals. The perceptions are the belief one has in their capabilities and oneself as a learner. Research that was done on social interactions that looks into why and how interactions take place and how they link to learning and mostly qualitative measures have been used. Cultural and social interactions in learning have been fluid and flexible while traditional experimental methods have always been standard. Biometric, log file and eye-tracking collection of data during game play has been able to give insights in occurrences in and across social groups and how these interactions and movements affect learning. Acknowledgment for games being an experience socially for adolescents needs to be there in game based learning by the designers. Social experiences help teenagers to form communities through play. In 2008 (Lenhart et al. 2008), the American Life Project and Pew Internet came to the conclusion that games are considered social activities, and approximately seventy-five percent of teenagers take part in game playing with other people.

Additionally, of the aforementioned seventy-five percent teenagers, more or less sixty-five percent will play games with individuals that are in the same room as themselves, and twenty-seven percent will play with individuals that they have connected with online. Likewise, motivation in accordance to Ito et al. (2008) has shown to be a big influence to teenagers when socially interacting and participatory communities. The significance of friendship and interest driven involvement in activities related to the media were noted and they showed how engagement relates to participation friendship and interest driven wise and also via media. This interaction and flexibility between friendship and interest driven structures

of social participation suggest that game designers should take into consideration designing game activities that support social interaction, social networking and friendships in specific activity that supports learning (Jenkins 2009). For example, game designs that allow for players to have profile information from which teams can be formed so as to maximise on bringing about structures that are friendship and interest driven.

Social Context of Learning

Social contexts enable learning by frequently allowing the players to be involved in practice communities that regard the beneficial results of collaboration (Boellstorff et al. 2012). Games become social spaces when their expectations and designs give players the experience of community and participation in actions and in decisions. Multiplayer games evidently need decision-making and social interaction, while single player games also have social interaction through competition and support structures. For example, there are leader boards in single player games and it shows how players are doing. The leader board brings out the competitive nature in social groups and it tends to determine how frequently a player plays, the effort she or he puts into it and the attention given to the game. Therefore, even though leader boards give feedback and falls under the category of designs, they too show social presence (Tamborini and Skalski 2006) in relation to a bigger group of players. Cards, badges, feedback items and other visible reinforcement are usually components of game designs. These components, though motivating, can nevertheless, if not designed to match the intrinsic learning goals, be counter-productive because the extrinsic rewards are for their own benefit.

Participatory Learning Culture

User-generated content, forums, blogs and cheat sites are part of the game community and have the social aspects of playful learning despite the fact that they are not part of the actual games. Venues such as the aforementioned come up with and sustained by game publishers such as Sim City while others are create by the players themselves such as the game Simtropolis. Platforms such as these assist players to learn by supplying resources and clues that help solve puzzles and quests but they offer assistance in various ways in and out of the game environment. A good example is when the World of Warcraft community in 2014 raised funds for a member with cancer by having in-game events (Newman and Wade 2016). Likewise, cultural learning occurred in game play of Star Wars Galaxies: An Empire Divided according to Leander and Lovvorn (2006). In the study, a teenage player in the USA formed a friendship with another teenager in Finland via a social network by interacting through a game. It is through the two interacting online that the teenager in the USA, was able to learn Finnish and a face to face meeting was arranged between the two teenagers' families when the USA teenager decided to study in Finland for a year. What started as a game interaction led to the formation of a friendship, all out of interest. Nevertheless, in this case, the learning took place outside the game though the social connection happened online.

Social Aspects

The previously mentioned example in the previous section shows that learning is indeed goal-directed behaviour and agency is significant in goal orientation and motivation. There are three sectors that are able to accomplish a person's goals in relation to agency according to Bandura (2002). They include:

- Proxy agency occurs when people influence each other.
- Collective agency occurs when people get together into groups and act in unison.
- Personal agency is done individually.

In well-designed games, all the three kinds of agency are supposed to appear so as to maximise the social views of play however collective and proxy agencies are more applicable. The act of being a guild master, being a group leader of games, being identified as part of a tribe, creating alliances or taking part in group quests are good examples of the collective and proxy agencies socially. The aspects go beyond the learning of just specified skills to learning more abstract areas that are considered modern.

For the purpose of the social aspects, proxy and collective social agencies are designed for game based learning so that there would be knowl-

edge of teamwork, achievement of community and personal objectives, setting of joint goals, and collaborative learning. Collective agency goes together with distributed cognition whereby problems are sorted out within context of social norms.

Observational Learning

Observers of play in a social setting are also affected by video games. The interests of non-players are usually peaked when players are playing games that are motion controlled when they are in the same rooms (deHaan et al. 2010). Involuntarily, the non-players become as equally engaged and focused with what is happening on the screen just as the ones playing and even mimic the same body movement that is similar to those playing. Observers in some circumstances have been known to gain more than the players. Advice and encouragement to players usually comes from the observers in the game's social environment. The surrounding world and the game world become integrated and blurred, as players are aware that there are observers present as they perform.

In-world, in-game and in-room according to Stevens et al. (2008) have boundaries that are not strongly bonded and this enables them to easily influence each other. The three authors believed that the reason as to why the youth are used to and play video games for most of their lives is because it has become part of their culture. Video games have now become a way of life for most teenagers and youth and can be found in most households. Actions and relationships outside the game relate to the social actions in and around a game and other authors together with Shaffer (2006), have noted that games that put players in positions where they are professions that end up gaining knowledge the expectations and norms of a certain profession and what is expected in the profession. The expectations and norms are socially and culturally influenced and the society has expectations that the actions of individuals match what is expected of them. Medical doctors for example are expected to act in certain ways despite the fact that they have skills and knowledge. Games have a tendency to teach what is considered social norms. Whether it is knowledgeably, intuition wise or intentionally, game designers incorporate their culture and social values in games subjects. Game based learning being explicit socially and culturally is actually necessary and significant, as it has been argued. Learning can take place when there is enculturation that prepares a learner to gain knowledge not only in the future but also transfer it (Reese 2007). Role-playing and learning expectations and practices around events and professions that take place outside the game environment in their day-to-day life is known as social practices. Hence facilitation of learning how to utilise knowledge ways that have been encountered in life is an effect of social aspects in games. Playing has been termed by others as being and having an impact on learning in the future, and not necessarily at the moment (Dede 2009).

Relatedness and Self Perception

The self-determination theory supports the opinion of relatedness that is a feeling one has of being con-nected to other individuals. The desire to play a game repeatedly, engage and have game satisfaction are important factors that come about when players socialise and form a sense of connection with individuals in and out of the game world (Ryan et al. 2006). Relatedness links to the sense of presence and choices players make in a game. Avatar customisation goes hand in hand with choice, which gives players strong identification with their avatars (Turkay and Kinzer 2014). The progress one makes in a game is related to the person's social status, as the abilities and levels of one player may be higher compared to that of other players. Players would rather be observers before they participate in games so that they are not seen as beginners. Once they achieve their threshold of ability, relatedness becomes more vital (Ducheneaut et al. 2006). Nevertheless, a player's motivation and relatedness is lessened when overtures relating to participation are rebuffed. Therefore from the perspective of the sense of relatedness, game designers should consider that player cohorts should move and interact with other people who are higher, have more knowledge and of similar abilities.

Social Interaction Design

The presence of mobile devices has made it easier for people to access games especially learn-

ing games that can be played increasingly each day and where real world artefacts are incorporated (Squire 2011). Most if not all augmented reality games utilise information from the real world in game play other than using what is needed for a game to be played in a self-contained game context. For example, a game like Resident Evil 5 uses buildings, areas of different towns in Africa, the Nigerian currency and Swahili language wherein players need to explore and complete quests. In this category there are also crowd sourced games that include a large number of people who while playing, give real and useful information that are resolving problems in the real world.

In this section the study looks more into crowd sourcing environments and less on competition, collaboration and social interaction. As a way of resolving large-scale problems, designers have come up with games that can be used by a large number of a population and lead to large collection of both analysis and data collection mostly through observation. Games under Citizen Science are an example of crowd sourcing games that people from different backgrounds, with different expertise in areas being played in take part in the common science affiliated activity. Citizen games have a way of reaching the goal of a project by players being provided with individual games through which they are able to collect data that is of importance to the real world. For example, migratory bird patterns tracking, grouping of astrological images and providing weather data. It is through these games being popular that there has been engagement and motivation that is affiliated to group play. In arithmetic games, Plass et al. (2013) found that middle school pupils had increased enjoyment, mastery goal orientation and interest when it was collaborative and competitive. The challenge still remains that designers need to create games that keep motivating players in crowd sourcing games. Crowd sourcing games usually draw players, as they know they are doing a greater good and this is made clear from the beginning. The social impact of taking part in crowd sourcing games is what determines the main design factor in games similar to that of Citizen Science.

METHODOLOGY

An example of a study that was done on games was in Turkey. Deductive analysis was used in the study, which was qualitative. There were categories that were chosen beforehand and they were used to group the chosen games used in the study. In the study, scientific methods were used to analyse the effects of a grand total of 421 traditional games that were selected (Korucu et al. 2016). Both the role and value of the selected games were looked into qualitatively in addition to the earlier mentioned universal values. Below the researcher look into the ten values and the concepts that are related to the value:

- Self-direction, which delves into privacy, curiosity, freedom, selecting own goals, independence and creativity
- Power in terms of wealth, social recognition, preserving public image, authority and power socially
- Benevolence as in honesty, forgiveness, real relationships, being helpful, having a spiritual life, meaning of life, mature love, loyalty, responsibility, helpful and forgiveness
- Conformity in terms of self-discipline, obedience, politeness and honouring parents and elders
- Achievement, which looks into intelligence, success, capability, self-respect and ambition
- Hedonism, which includes self-indulgence, pleasure and enjoyment
- Tradition by being acceptable of life as it is, respecting tradition, being devout, humility and moderation
- Universalism in terms of unity, open mindedness, wisdom, peace, harmony, beauty, environment conservation, social justice, togetherness with nature and equality
- Security in terms of family and national security, health, favour reciprocation, sense of belonging, cleanliness and social order
- Stimulation through exciting life, adventure and varied life

OBSERVATIONS AND DISCUSSION

The traditional method of teaching science classes has mainly focused on transferring information to students without paying enough attention to the meaning of the information and the practicality or situational application of it. A significant STEM meta-analysis of 225 earlier studies on the benefits of experiential learning and related active learning exercises, shows final

course grades were six percent higher when faculty taught with an active learning pedagogy.

Gaming is probably one of the most widespread activities in the animal kingdom, proper not only for humans but also common to many other species. It serves different purposes such as training cubs and youngsters on forthcoming adult activities in a friendly environment. Playing introduces and reinforces the strengths and abilities needed to succeed in the future within the group, while building self-assurance and self-confidence to learn and practice new skills under supervision and training of expert adults in any particular area. In modern human society, events like the super bowl, the Olympics or the World Cup bring more people together than any other activity that one can possibly think of. All these gaming activities are essential, as they spark interest, and boost adrenaline and passion needed to reignite people's attention and interest. With the cell phones so widely available these days, one has an open window of opportunity to breakthrough and colonise a very fertile ground for learning and enjoyment, if one presents the material sufficiently attractively and relevant enough to catch students' attention and interest

These are only some of the elements needed in games in order to create the desired learning environment.

Player Engagement

As a way of having a successful and favourable learning using digital games, there needs to be involvement. A player being engaged can be through involvement that is behaviour related, commitment and emotional related. The sociocultural aspect is not to be forgotten in the social interactions of a particular cultural aspect. A game thus has the capacity to foretell how characters are likely to behave and interact in a virtual environment by the use of gestures such as inviting other players to take part in certain tasks or input in the game. It is through these characters that one is able to involve users emotionally and give them alter egos digitally and how the characters collectively offer support to each other and enable socio-cultural transfer.

Motivation

Motivation is one of the significant factors that make sure that players are engaged all through the game experience and remain interested. As a way of putting this factor into action, structures (Rotgans and Schmidt 2011) of incentives are put in place such as trophies, leader boards, badges and medals among others. This is the reason as to why during the process of implementation there needs to be a wide variety of incentives that are attractive to the gamer. Through this there is a high chance of various kinds of information in form of video, text and audio can be released and that will facilitate the contents of interest.

Adaptation

Adaptation entails the game player being immersed in a way that shows a definite circumstance. Adaptation in reference to a player can be applied through the present level of knowledge, cognition skills and emotions among other variables that relate to adaptive design. For this to be possible there needs to be use of scaffolding, guidance and feedback in that particular order (Steinkuehler and Duncan 2008). The design principles that have shown to be effective tend not to be included in educational games. How education is offered in such games is another point that needs to be put into consideration. In the course of the design phase, it becomes a necessity to primarily focus on the variety of players and the features in games that can be incorporated into the structure that is centred on the person and player in educational games.

The targets are:

a. Mechanics that involves speed, qualifications and skills of the competition possesses.
b. Sequence of events and duties, and this entails the capability to arrange the details of the levels and later the delivery in learning, giving tricks and trips through mentorship that promotes accomplishment of the tasks and customisation of the scenarios in the games based on the style that aids a player in learning.
c. Worlds and objects that revolve around the fact that one can be able to change the level of difficulty in games, pass the difficult levels and look forward to incentives or by collectively working with other players that they share similar goals with and share suggestions.

d. Feedback, that is, immediate feedback in the form of incentives can be offered based on one's success or failure in the game or they can be delayed at the end of a mission of completed level (Ryan et al. 2006). A prominent feature that stands out is the affective orientation when it comes to feedbacks, both negative and positive, being offered in the case of there being a negative outcome. When the feedback offered to a gamer is too good then it is referred to as 'juicy feedback' that is meant to offer reinforcement in learning by offering rewards for accomplishments. In return, the negative feedback strives to promote players to attempt and succeed while concurrently letting go of the feeling of failure.
e. Tasteful failure

As discussed in the latter paragraph, it is advisable for a player to expect failure and to be graceful about it. In the natural process of learning one will encounter errors and must learn through them and not lose the progress that has been achieved by the character chosen (Kapur and Bielaczyc 2012). Through this, the player will be motivated to adopt new risks (Hoffman and Nadelson 2010) and to do various researches in scenarios that are virtual concerned.

It is because of these gaming encounters that involve failure that have advocated for the adoption of different strategies that are meant to yield desired set objectives. Normally in small games it is feasible to look into the risk likely to be met, as there is an increase in rewards (Barab 2011). One's capacity to fail gracefully tends to favour adaptability, motivation and commitment. The sharing of tricks and tips are often offered as support for motivation, which in turn explains how to effectively deal with repeating a game. Experience can also be gained through the use of game aids used in previous games and as a result it is likely to increase a player's wealth of experience that leads to success in gaming.

CONCLUSION

The ludic nature of the human species seems to be connected to a complex mixture of skill, abilities, behaviours, individual and social patterns that modulate personality and perception not only individually but also collectively. The multidimensional character of playing overrides space, time, and any physical limitations giving the power back to the gamer allowing him or her to create favourable conditions to regain control and reach the desired outcomes. The more practice the gamer accrues the sharper his or her skills become and the easier for them will be to discover new information buried within the game to reward gamer's focus and dedication, ideally, the objective is to reach a cognitive flow where the gamer or students gets to a point of non-return, and his or her desires to continue playing will motivate them to progress until the quest gets sorted out.

There is a generalised idea among many students about the difficulty of the STEM subjects and the unfavourable appraisal when it comes to understanding real-life applications of most of the theories and concepts addressed in basic sciences. Information is bombarded to students without any meaningful context and teachers pressured to complete content only makes things worse. As comprehension escapes throughout the window only memorisation stands to face assessment trials. As memorisation takes a lot of mental space, it gets cleared up often in order to open more space for the new upcoming information, leaving as a result only a fragmented and incomplete picture of the topic presented, and that is why it is so common to hear teachers and faculty complains about how frustrating it is to see how their pupils seem to have never heard about a topic that has been previously presented to them as most of science classes build up the content upon a scaffolding structure where previously explained concepts are used to present the new topic. This is just a consequence of a lack of comprehension, as the absence of experiential component does not give a fair chance to the brain to figure out the real meaning of random concepts presented out of any meaningful context. The ludic experience somehow bridges the seemingly disconnected concepts, as the gamer must build upon the necessary appropriate steps to progress in the game, rules and concepts will be presented and used as needed within a meaningful scenario where the gamer is in control.

The emotional involvement is a critical component for a meaningful learning experience to occur because it builds a relevant association to places, conditions, people rather than merely a data memorisation, as emotions are powerful an-

chors of human experiences. A well-designed game will trigger positive emotions on the player, which will entice the gamer to make progress on his or her quest, providing a desirable cognitive flow needed to engage students' interest in making progress in their learning process. A meaningful emotional experience will boost motivation, which has been described as one of the important components needed to maintain students' interest. When it comes to STEM subjects there is a common misperception among students who end convinced of their lack of skill or talents to perform well in such disciplines, and this predisposition to failure makes students' interests for these areas to significantly decrease in comparison to other academic fields. Because of the fun nature of GBL and the fact that positive emotions can be generated out of gaming, it makes sense to utilise science themed academic video games to help students work their way through these topics while building a rewarding association in doing science work.

RECOMMENDATIONS

More systematic studies utilising games in the teaching practice must be conducted in order to determine the actual impact in the learners' academic outcomes. The unforeseen revolution created by the COVID-19 pandemic in the teaching practice has created a unique environment to introduce video games tools to support students' learning process, particularly in areas traditionally challenging such as STEM subjects. This is still a relatively new area that could help enormously instructors and teachers to boost students' interest and success in their academic goals.

ABBREVIATIONS

STEM: Science, Technology, Engineering and Math
GBL: Game-Based Learning

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