

The Role of Gamification in Education: Global Citizenship and 21st-Century Skills

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ABSTRACT During the pandemic of 2020 brought about by Covid-19, many teachers, students and pupils found their learning environment had to move on-line at very short notice. This proved harder than some people might have expected and involved changing some practices, most importantly increasing the importance of pupils and students doing more work on their own. One promising solution to this difficulty was gamification, which is designed to make learning more interesting and motivating by turning learning into a game. In this paper we review some of the purposes that games have served in education, and evaluate some of the claims that have been made for gamification, and how the principles of gamification have been implemented in specific cases. We conclude that gamification is not a panacea, but can work in some circumstances to stimulate motivation, and we examine how the learning environment can be optimised to promote self-managed learning.

Keywords: Gamification, Global Citizenship, Education, China

Introduction

Ancient Chinese Games

Playing and learning are areas of concern to all parents, teachers and educational policy-makers. Discussion of play in learning spaces tends to focus on formal games (and computer games in the context of 21st century learning). Throughout history, games have influenced (and been influenced by) education. This paper examines some areas of research around games and education, to support the overall investigation of the use of games in learning.

China Daily published an article, “Children’s games in ancient China” (Nan, 2017). The article reflects on the culture in ancient China, and contrasts it with culture today. Culture in the 21st century is framed by the use of smart phones, and the different forms of technology, while in the ancient times, children had different kinds of games. The article claims that these games were played in ancient China, but does not investigate the origin of each of these games, their development in different cultures/times, or how each game contributed to education. The six games presented in the article were Stone balls, Flying kites, Hide-and-Seek, Watching shadow plays, Playing Diabolo, and Firecrackers. Figures 1 to 6 present images of these games. Some of these games are still current, but it is worth reflecting on what they might contribute to education.



Figures 1 to 6: Images of the six ancient Chinese games presented in China Daily

These games may develop some skills in education, including the application of mathematics, eye-hand coordination, and communication skills. They may even develop some 21st century skills, such as creativity and critical thinking. For example, playing with the kites, for a mathematics class, can stimulate students to use their creativity and apply geometry principles while designing kites. In this discussion, two distinct concepts may be confused; using games to elicit and strengthen the cognitive skills students already have, and using games to provide the students with cognitive skills they presently lack. The former is about the application of a skill that is already there, while the latter is about developing a skill that is not there. The latter approach is more problematic; how can a skill be developed, if it is not there? But this approach may have a kernel of truth. Teaching kites as a geometric shape in a mathematics class can be considered new knowledge that extends the student's cognitive ability. Yet, teaching a course on design would appeal only to those who already possess the creativity skill which the course aims to develop.

Teaching a class of mathematics in which the educational approach is to design a kite will only be effective if the geometry of kites and the creative skills have a basis in the student's pre-existing cognitive ability. Playing with kites will develop 21st century skills only if the students are in some way ready. They may need a special preparatory course to prepare them for game-based learning, or a step by step guide. This question is pertinent in the context of computer games, where at least some researchers argue that all learning can be gamified.

The Promise of Gaming for Education

Gaming is often the first method that children use to explore skills of creating, assessing, analysing, and applying new knowledge. Many games encourage inter-

player contact, cooperation, and rivalry. Most immersive games have a rich narrative that generates creativity and imagination in their players. Games may be able to teach and test their players, depending on their design.

Some important elements of games relate to the mechanisms they use for motivating and providing incentives. Teachers use incentives to guide student behaviour when using games in the classroom. Students can perform as leaders as they move through particular curriculum levels (Christy & Fox, 2014; de Byl, 2013). A system of rewards can fit to the work target of a class – students distrust rewards that are too large (Korman et al., 1981). Rewarding education and motivation can coexist (Berridge, 2000). This is the application of the logic of gamification, where students are rewarded for playing well.

Gamification often involves points, scores and rewards. Many supporters of educational games discuss their ability to engage players. Some researches focus on the "flow" state, in which players are fully immersed. Intrinsic motivation and decision (self-determination) are connected with the flow state. Extrinsic rewards are not imposed. Shapiro (2014) argues that the mechanics of gamification may work against the flow state:

Education based on games is not Gamification. I see when I see my children playing video games for themselves. And guess what, they're not looking at the ranking, they're not paying attention to the prizes, and they're not looking at the points. They're not even interested in levelling up. It offers new challenges the only thing they care about levels up. Again, it's fun.

An important principle of gamification is to adjust the level of challenge as the player's skill develops, in order to keep their attention. Csikszentmihalyi (2017) argues that working through a set of tasks at the right level can help a learner complete the task without frustration. Game designers should provide challenges that match a particular level of skills at the right time.

Successful gamification catches, retains, engages and challenges the attention of learners, and provides a foundation for teaching them. Phelps (2017) notes that gamification is in its early days and, "We still do not know why and how it works".

However, looking at examples of current games, it can be seen that most record and announce levels of achievement using badges and points. Gamification offers these metrics, and the success of a participant can be easily seen. This provides immediate feedback to the player. Students have various levels / channels of input from the classroom, learning and assignments, and other activities, so that they know what they know and what they will learn.

By mixing fun with learning throughout the game, a better learning experience is achieved. A good gamification strategy will increase the engagement of participants, increase feedback, and improve retention to high levels. The learning experience can be personalized and the students can develop at their own pace.

Gamification is not a panacea. Making play mandatory sounds like an oxymoron, and may remove some of the element of fun. Care must be taken to ensure that what is being rewarded is clear to the learner; effort should be rewarded, not superiority, and the students must learn to see failure as an opportunity. It is critical that activities are planned to encourage students in the event of an unsuccessful attempt to replicate these activities (Kiryakova, Angelova & Yordanova, 2014). It may be particularly important if the motivation system is not well designed, or motivation is given for the wrong things. For example, sometimes a trivial method can be used to reach the highest level. This is a question with the wrong course of motivation.

Computer-based Gaming, Skills and Learning for the 21st century

For the last two decades, Computer-Based-Gamification (CBG) has helped learners with its advanced technology. CBG is widely used in e-learning. The current pandemic has enhanced its importance in virtual learning. Computer-based games have dual benefits: they are fun and enhance IT skills. Gaming can help people to understand the complex ideas and can be used as training tools instead of conventional learning methods (Zirawaga, Olusanya, & Maduku, 2017).

When a learner plays a game, they may directly or indirectly learn technology skills. The game provides an opportunity to gain knowledge and enhanced skills. The exciting aspect of the game increases the desire of a learner to play the game frequently, which affects the effectiveness of their learning (Westera, 2019). For example, a fun game will inspire a learner to interact more with the game, thus increasing their desire to play more and to learn more. So these motives (intrinsic and extrinsic) are associated with academic achievement (Buzdar, Mohsin, Akbar, & Mohammad, 2017). The development of games helps to improve knowledge retention, the ability to compare and contrast information received, the use of more and different types of testing resources such as digital devices, computer language/programming learning, and the development of an insight into questioning skills (Owston, Wideman, Ronda, & Brown, 2009).

Many computer scientists and educators claim that it is a universally applicable knowledge that should be taught more widely (Bers, 2019). During the current pandemic, virtual education has been widely adopted, but a high drop-out rate has been observed, due to weak computational knowledge and skills (Lehtonen, Aho, Isohanni, & Mikkonen, 2015). Learning through CBG may help beginners, and, as a result, the drop-out rate will reduce.

Gamification has had a significant effect on traditional education. Elementary students can learn counting, and differentiate colours. Every game has different levels, and each level has a different offer for the users. These offers motivate the users intrinsically to achieve a high level. Reward system-based learning in education should stimulate students and can affect their behaviour. It is good practice to enhance a weak student's motivation towards learning.

There are many different games which aim to improve the students' learning abilities. Learning through gamification has been shown to be effective and easier than the traditional educational system. There are several games available that could enhance the education of children. Basic games help the beginners where English used as a second language (ESL) (Hashim, Rafiq, & Md Yunus, 2019; Homer, Hew, & Tan, 2018).

For example, there are numbers games which develop counting, addition, and subtraction, and language games which test grammar. Figure 7 shows a spin wheel game where students can learn the use of prepositions (for example, in, to, from) in the sentences.



Figure 7: Spin wheel game

Figure 8 shows a Jeopardy game that helps beginners to learn the basic rules of tenses used in English grammar.



Figure 8: ESL Jeopardy game

Brainscape is a simple game in which learners have some flashcards. This game helps beginners to create their own flashcards, and learn the ideas most comprehensively, by experiential learning.

Playing chess has also been used a lot in educational settings. Chess is a powerful tool for strengthening a child's mind and his/her IQ levels (Dauvergne, 2000). It is part of the curriculum in many Western institutions, and enhances concentration and the ability to think on a specific point (Jankovic & Novak, 2019). Students who play chess do well in the examinations due to their special ability. When students play a game, they can enhance their self-esteem and confidence for better learning. Chess also places growing demands on the complexities of problem-solving. It is helpful for the students during their education to teach the importance of chess and how it can be effective for problem-solving during situations where there is a lot of pressure.

Many pupils in developing countries underachieve in mathematics. There is evidence of a link between chess and mathematics with physical and visual understanding (Sala & Gobet, 2017; Sala, Gorini, & Pravettoni, 2015).

Learning Computer Skills through the Hour of Code

Learning to program computers is very difficult. The Hour of Code (HOC) helps students to learn computer basics. It is a mathematical and algorithmic problem formulation, converted to code, that the computer can interpret and execute. By 2015, nearly one hundred million students had had access to the HOC in over 150 countries. HOC is designed to achieve diversity in computer science education. It is a source of learning the initial language of computer science for the students with the motivation of a game (Majumdar, 2018). It started as a one-hour introduction to computer science, designed to clarify code, and to show that anybody can learn the basics.

HOC uses a block-based visual programming language, where students simply drag and drop visual blocks to write code. Visual programming is fun and easily understandable. During the game, the instructor gives rewards in the form of a completion certificate that affects the student’s motivation.

Figure 9 shows the basic elements of the game. Moana is standing at the starting point and assigned the task to cut the rope shown in the figure. So, Moana makes a plan or flowchart to cut the rope as shown on the right.



Figure 9: Moana’s path to the rope

This is a mental challenge (like chess) and involves describing Moans’s path, using loops and decisions (Repeat..., and If... Then...).

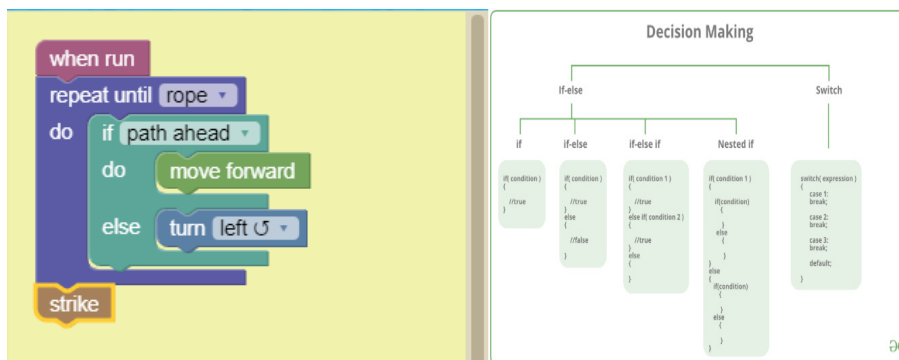


Figure 10: (a) Moana Code Gamification Decision Making Skills, and (b) Decision Making Programming Skills

Students can enhance their programming skills using HOC. It is a decision-making game, and can help students to see how we make decisions to achieve our target.

21st-century education can develop students' IT skills and enhance their knowledge by playing different games. As the computer is involved in every field of education, whether social or applied science, learners can learn concepts through gaming. Learning through the HOC is an excellent way for art students to learn programming skills and knowledge. (Liu, Wimmer, & Rada, 2016).

Technological learning has become very important to enhance the students' IT skills at all levels of education, and various computer games can be used in educational institutions. To receive an award certificate for playing a game can have a positive effect on the student and increase their involvement in learning initial computer skills. If game-based learning is applied to the education of children, and it then could be helpful during their later education.

Computer based gamification may help students progress in education in an easy way. The literature suggests that it can improve the sharpness, thinking ability, decision making, risk taking, and a number of related skills, which can result in a deep understanding of certain complex ideas.

Gamification and Citizenship Education

With a focus on the local, national and global, and above that on a sense of action, citizenship is one of the most challenging of 21st century skills to incorporate into a curriculum. Citizenship, if it is to be taught, needs to be experienced, and this is the crucial intersection between educational games, technology and citizenship education. It is through technology, in particular gamification, that students can experience more avenues to becoming an active citizen.

As adjectival citizenships are numerous, so there is a wide range of game-based learning and gamification matched to those types of citizenship. Students can learn how to be a 'sustainable citizen' from mobile apps, such as JouleBug 1, that incorporate classic gamification concepts, like virtual trophies and monthly challenges. Players to try their hand at sustainable living through green assignments (Vanolo, 2018).

Indiana University's Quest Atlantis, was developed to progress a player's sense of civic engagement and ecological stewardship through students encountering a virtual world in which they must solve environmental and social issues mirroring those of our own world (Anderson, 2010). Marino and Hayes (2012), discuss how science videogames (not necessarily gamification), by covering global scientific concerns, such as pollution, biological diversity, scientific discovery and disease, encompass more than the just encouraging civic scientific literacy skills, but also dive into the realm of global citizenship; global citizenship does not exclude the scientific and environmental citizenships.

River City is one of the science games that connects the world of students with the world of the school-based science curriculum, and it has been extensively studied (Marino & Hayes, 2012). Transporting students to a virtual 19th century industrial city, the mayor of River City assigns students the mission to discover why the population of the city is facing escalating levels of illness. By interacting with the city's virtual residents and digital objects, the students' progress on their own scientific inquiry process, but they are also able to make correlations between science and their lives, as the knowledge gained through such games is more accessible than through a textbook (Marino & Hayes, 2012), possibly as a result of the students experiencing, engaging and participating with the knowledge.

Kafei et al. (2010), utilizing the game, Whyville, a game that allows the Avatar's of players to become affected by epidemics, found that through playing the game, the scientific arguments of students increased in terms of the student being able to discuss these scientific issues with more proficient vocabulary words (for example contamination) than they had prior to playing the game. These results, of students knowing more after playing the game than before it, have also been found with Quest Atlantis. By playing the game, students, through conversation with researchers, were able to make a link between the virtual problems and those of their own community, such as student's contemplating the long-term effects of pollution on their local community or seeing themselves as possible change agents (Anderson, 2010). These students, began to understand the actions associated and needed with citizenship at the local level and beyond.

Civic engagement is another area where gamification can help. Students develop new citizenship skills. Two prominent examples are "Statecraft X" and "Act Now!". "Statecraft X", a digital game, was designed as a tool to allow 15-year-old Singaporean students to directly experience governance through being assigned the role of a governor and having to find ways to expand their influence over citizens beyond their initially assigned territory (Chee et al., 2013). These students must compete with other students to turn their governorship into eventual leadership of the whole kingdom (Chee et al., 2013). Similarly, civic engagement in terms of civic identities of Finnish, Norwegian and Swedish youth was explored by Eränpalo (2014) through "Act Now!". "Act Now!", an example of gamification, is modelled on a "deliberative polling-like learning situation", in which students acquaint themselves with key information and facts and engage in civic debate. The game was designed as a mechanism in which students could distance themselves from matters that are too personal or difficult (DeLeon, 2008), express themselves without the external authority in a school setting (Eränpalo & Karhuvirta, 2012, 2013), and identify issues in the everyday life and the local community, but beyond that at the national and global level. They enhance their understanding of their role in society and their personal and group identities (Eränpalo, 2014). Both of these games have helped to advance civic engagement in terms of being able to experience governance and explore various civic identities.

The use of gamification in teaching future citizenship skills is one of the most exciting aspects of gaming in education, as it provides new avenues for students to engage with the learning material in a way that is impossible with textbooks and even general video games. As in the case of games such as Quest Atlantis and Whyville, in their study of Statecraft X, Chee et al. (2013) noted a difference, not only in the student performance before and after playing the game, but also between those who did not play the game (who learned solely from textbooks) and those who played the game. They noted that those who played were able to communicate "a strong sense of personal voice, awareness about current global and local issues, and an agency to act to achieve changes sought by the students" (p. 24), thus identifying a sense of action in terms of citizenship. Good citizenship cannot be taught but is formed from thinking over it, practicing it and experiencing it (Sim & Print, 2005). Schools and books, while teaching about the diverse types of citizenship, can find difficulties in translating that knowledge into either skills or competencies (Selwyn, 2006).

Although there are numerous other opportunities that schools offer for experiencing citizenship through both academic and extracurricular endeavours, for example clubs aimed at volunteering or Model United Nations, the students who are most likely to engage with these activities would be the students who would already

are socially engaged. The new avenues offered by gamification may encourage a larger variety of students to ponder, experience and practice citizenship, understand it on its local, national and global levels, and thereby translate their augmented knowledge into skills and competencies. This is an important aspect of the idea of 21st century skills or competences.

Problems with Gamification

Much of the literature that focuses on the concept of gamification presents the view that gamification should be promoted as part of learning, and is much more needed in the 21st century. For that reason, it is important to make a special effort to examine the criticisms of gamification that have been put forward. Conway (2014) argues that gamification usually “invokes organisation-centred design, treating users as zombies: senseless mechanisms urged onwards by a desire for extrinsic rewards”. It does so by failing “to acknowledge the user’s context and innate psychological needs”. Conway emphasised the difference between gamification based on “a user-centred initiative, engaging and motivating the alienated masses” and those that are organization-centred. He did this through theoretical frameworks that involve social, cultural and psychological effects of the design features of games. He proposed the use of motivational psychology to shift gamification towards a user-centred design which does “not only transform the way the user is evaluated and rewarded but also the activity the subject is tasked with performing”.

Woodcock and Johnson (2018) took a fairly similar stance, arguing that gamification, applying game systems consisting of competition and rewards in non-game domains, are “deeply problematic”. Their focus is on showing how the concept of “play” became heavily influenced by neoliberalism, to the point that it became a regularity and a standardization of everyday behaviour. They talk about two types of gamification: “gamification-from-above” involving the optimization and rationalizing of work practices by management; and “gamification-from-below”, a form of active resistance against control at work. The authors present the arguments from a work/productivity rather than a school/learning perspective. From the work perspective, they argue that the concept of gamification ought to be one that “supports workers, rather than one used to adapt behaviour to capital;” the call for gamification-from-below rather than gamification-from-above.

Conclusion

The challenges presented by gamification, as presented by Conway, Woodcock and Johnson, need to be taken seriously. To avoid what Conway (2014) has identified as ‘zombification’, parents, teachers, and educational policy makers need to be careful in defining the purpose of learning and ensuring that gamification is only used where that purpose aligns with before the purpose of games. Learning is about empowering students, and not only making them play while learning. Teachers know that the purpose of games is mainly to attract those alienated students to the main purpose of learning. Teachers need to realize that a game is not an end of itself, and should not be what drives teachers and students. Games should be seen as tools, and should not be developed based on commercial drives, but according to the human needs of the 21st century.

All stakeholders in education have witnessed many playful and gaming activities both in and out of school. Many, including teachers, know that games can enhance global citizenship and cultural attributes, promote global social activities,

and enhance social unity. In this article, we have examined how games have a substantial influence on education and vice versa. In that we have identified some shortcomings of gamification, noting that gamification must be the servant of learning, and not the other way around. Games have a firm foundation in traditional education, and this will continue into the future, and possibly change with the introduction and development of new technology. But the literature may present an overoptimistic view of what gamification can offer, and some advocates are only concerned with the pleasure and enjoyment that games can enhance, and not with seriously evaluating the benefits and shortcomings of gamification. Examining various examples of gamification, there are certainly benefits to be gained from this development, for learners, tutors, schools, and the society, but there are also some limitations. We should not expect that gamification can replace more traditional approaches to education. What is needed is a workable theory and policy that will effectively enhance gamification in the 21st-century curriculum to improve learners' skills and training for the present age.

On the other hand, the discussion of the relationship between gamification and citizenship education indicates that moving toward gamification might not only affect how learners learn, but might also affect who learns and how they engage with the educational material. The evidence from the literature shows that students and tutors could also articulate some attributes of citizenship skills that could enhance them some virtue to becoming global citizens, civil engagement, and techniques for teaching and learning in the 21st century. These opportunities for doing new things that have not been possible with traditional methods may turn out to be more important than using gamification for things that we could already do rather well anyway. But identifying those opportunities may be more difficult. There may be a need for global curriculum reform with a collective role of all stakeholders to ensure that gamification is utilized effectively in the school system. As technology has advanced, interest in gaming and gamification has also increased. If policymakers and stakeholders in education do not take care, education may be swept along with an unwarranted enthusiasm for gamification. In this article we suggest a path of curriculum reform, effective use of gamification, and the use of gaming to enhance the 21st-century skills, while being alert to possible difficulties in such an approach.

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