Chapter 6
AI-Enabled Gamification in Education

6.1 What Is Gamification?

Focus and concentration can profoundly affect the quality of the learning experience. With gamification, classes can become more exciting and engaging, leading to better student results.

The term "gamification" needs to be defined first. "Gamification" refers to "a strategy that implements game-like elements into non-gaming activities to enhance engagement and motivation" (FutureLearn 2021).

The designers of video games strive to create experiences that are both immersive and enjoyable. It is not unusual to get so engrossed in a game that you cannot stop playing until you have unlocked every possible level.

However, what about video games draw us in and keep us returning for more? Dopamine, also known as the "feel-good chemical," has been related to playing video games (Koepp et al. 1998), which can cause addiction.

This is because games' elements like points, rankings, and rewards all work to keep players engaged. The gamification approach uses game mechanics to improve non-game contexts, such as learning environments.

Intrinsic Motivation . Gamification fosters intrinsic motivation, defined as "the want to accomplish something due to one's interest in the work" (FutureLearn 2021). Thanks to this enticement, students will be interested in their study material.

On the other hand, extrinsic motivation refers to the desire to act in response to an external incentive or factor, such as a command from an authority figure. Learners should be careful not to rely too heavily on extrinsic motivation, even though most people will have a healthy balance of the two types.

A student who relies solely on external incentives to drive their work will do so for the wrong reasons. Educators should emphasize to their students that learning is rewarding, and they can do so by offering various incentives for successful academic performance.

M. Kurni et al., *A Beginner's Guide to Introduce Artificial Intelligence in Teaching and Learning*, https://doi.org/10.1007/978-3-031-32653-0_6

6.2 Reasons to Implement Gamification

Engagement, or how much interest and effort a person puts into anything, is the best predictor of success in learning. Students are more likely to remember what they have learned if they are actively involved in learning. According to research on gamification, including gaming elements in the classroom can enhance participation and interest. Keeping students interested is paramount, so here are some things to consider (Solanki 2022) when deciding whether to introduce gaming into your classroom.

- Gamification boosts competition, which can boost engagement.
- With gamification, students are more invested since they have more agency in their learning.
- Students may easily keep track of their progress toward academic goals with the help of gamification, which provides instant feedback (via peer comments, progress bars, badges, teacher responses, etc.).

Because of these benefits, gamification can be a powerful technique for enhancing the educational process for students.

6.3 Gamification in an Educational Context

Games encourage problem-solving, an increasingly important ability in the modern world. Several components of games make them effective tools for teaching and learning. Depending on the game, players may be encouraged to share information, work together, or even compete against one another. The most engrossing games are in-depth stories that inspire players to use their imaginations (TeachThought Staff 2017). Last but not least, games can function as both a learning tool and an assessment tool for their players depending on their structure. They are fantastic pedagogical, instructional, and evaluative bundles.

Additionally, the games' frameworks suit today's students' needs. The practice of incorporating game elements like story-telling, puzzle-solving, aesthetics, rules, collaboration, competition, rewards, feedback, and trial-and-error learning into non-game contexts has been called gamification (or gameful design, in Jane McGonigal's terminology) and has seen widespread adoption in fields like marketing, training, and consumerism with runaway success (TeachThought Staff 2017).

The use of gamification in the classroom is gaining popularity. Game-based learning has the potential to extend to more schools, especially with pioneers like Classcraft, Class Dojo, and Rezzly paving the way (TeachThought Staff 2017). A subset of the education community also creates its own "gameful-designed" classrooms.

6.4 How Can Gamification Benefit Education?

Adding games and incentives to the classroom can radically improve student engagement and retention. Now, the question becomes, "How can we use gamification to improve education?"

Many of us have developed an expectation of instant gratification due to the frequent use of social media, mobile apps, and video games (FutureLearn 2021). Because of the habitual dopamine release from destructive behaviors, it might be challenging to maintain concentration on something constructive.

Because they spend so much time online, this is especially important for the younger generations. According to studies, more than half of all members of Gen Z use their smartphones for more than 5 hours daily (Vuleta 2022).

When we apply the same gamification principles to education, we may help students develop a similar addiction to success in their studies.

Gamified learning has been demonstrated to improve academic performance (Smiderle et al. 2020). Though gamification has been shown to boost student performance in the classroom (Legaki et al. 2020), this has not been linked to increased student engagement.

Motivation The introduction of progress indicators may greatly inspire students. When used in the classroom, gamification can help keep students motivated by rewarding them for incremental progress toward a larger goal (FutureLearn 2021). Motivating yourself is far more straightforward if you work toward something you can achieve.

Social learning, which may be a powerful motivator, is greatly enhanced by gamification in education. To encourage maximum growth in knowledge, certain apps and websites let users connect with their social networks and compete against one another.

Fun Learning Aiming for a higher level or a specific accomplishment can motivate you to put more effort into your studies. By incorporating game mechanics, gamification transforms learning from a chore to a pleasure (FutureLearn 2021).

Like any good video game, pursuing a higher score or a more challenging objective may be much more fun. With the help of gamification, students can shift their perspective on school from drudgery to anticipation.

Teachers are always looking for new methods to capture the attention of their young students. It is no secret that today's classrooms use technology and other innovative techniques. However, outside of school, many members of Gen Z enjoy playing video games. Designing a curriculum based on what they already know and are familiar with makes perfect sense.

Control and Encouragement Students can familiarly and enjoyably achieve their objectives using motivators such as point systems and levels. Using gamified learning materials can help students and learners feel more responsible for their education (FutureLearn 2021).

Gamified learning makes students feel more in charge of their own learning experience and motivates them to keep trying even if they first fail. Traditional education approaches can be very discouraging for students who do not achieve their goals.

Because of the playful character of the gamification model, it can be simpler for students to see how to try again and progress toward their goals. Points encourage progress toward a level rather than working toward a grade or result that can be failed. Taking this constructive tack results in a more encouraging atmosphere in the classroom.

E-Learning Business in the field of providing education online is booming. Additionally, gamification complements online education. Online learning platforms are the best places to implement gamified education.

Due to the pandemic and the demand for online education options, the popularity of e-learning has exploded in recent years (FutureLearn 2021). Software and the web are well-suited to house gamification elements like leaderboards and point systems.

When compared to traditional classroom settings, learning online has its drawbacks. Younger students may find it challenging to focus and pay attention during online lectures and lessons due to the abundance of distractions. Using game mechanics, online education may be just as engaging as classroom instruction.

Disadvantages of Gamification in Learning Apps and websites rely on technology and are frequently used in gamification strategies. By emphasizing technology so heavily in the classroom, we risk isolating some pupils who are not adept with it. Gamification is a great educational tool but comes with challenges (FutureLearn 2021).

Students' attention spans can decrease if gamification is introduced into the classroom. Today's youth crave immediate satisfaction; gamifying education could appeal to this need. Combining game elements with more conventional forms of education could help us fight this problem. This will ensure pupils have access to more solemn settings conducive to learning and work.

6.5 How Can Gamification Transform Education?

The motivation to study is essential to academic success and long-term retention of lessons learned. However, the conventional classroom environment undermines this goal by emphasizing memorization over critical thinking and discussion.

A person's professors and books were once the primary means of gaining information. These days, it is the online world with countless courses and a global community of peers. Even so, the trend toward the homogenization of all educational materials persists. New ways of teaching and learning, like game-based instruction, are desperately needed (Agrawal 2021).

How It Helps Gamification of learning" refers to utilizing game elements and dynamics to improve educational outcomes (Agrawal 2021). In the past, students were motivated to study because their teachers gave them high marks for their work. The goal of gamifying the educational process is to exchange traditional letter grades for numerical scores based on how well students do at various milestones in the learning process. When a student reaches a specific point total, a badge is awarded as a visible indication of achievement. When students complete a section of material, an assignment, or an exam and receive feedback about their performance, they are more likely to continue learning and improving.

Games are developed to have the same responsiveness and interactivity. The relevance and significance of the topic are brought home to players in a very tangible way. Students are given immediate feedback on their performance in gamified learning instead of in a traditional classroom setting. They can better correct their errors and learn from their explorations and discoveries of new knowledge and methods of approaching their objectives when they receive these when they make them. Students are pushed to learn and can retain more information when they use it in a dynamic, real-time environment.

Additionally, collaboration is boosted by gamification. Students are more likely to learn from each other and share their knowledge and ideas when placed in competitive groups.

With a gamified system, students may move through the material at their own pace, making it more effective and adaptable (Agrawal 2021). Each player can have an equal chance at learning a topic because games can be adapted to their native language, region, and age range. In addition, with the help of ed-tech-enabled competency-based learning, students can learn and acquire skills based on the demonstration of learning outcomes.

As a result of students' increased participation and enthusiasm for the material, teachers' workloads are reduced thanks to gamification. More than that, users are given multiple means of gauging their progress in a course rather than just one, thanks to the availability of alternative paths to completion. They will be able to tailor their instruction to the specific requirements of each learner.

It is expected that gamification will usher in a new era of education as it becomes more commonplace in K-12 classrooms, colleges, universities, and corporate training and development programs.

6.6 Gamification and Artificial Intelligence

The widespread application of games in education, as defined by and shown by game-based learning (Homer et al. 2020), has led to the creation (Dingli and Seychell 2015) and implementation (in schools) of educational video games (Panoutsopoulos and Sampson 2012), (Sykes 2018). Compared to traditional didactic teaching approaches, studies show that using games as a teaching tool might help

students learn more and be more enthusiastic about it (Posso 2016). Recently, a new conceptual layer has been added to using games in education (Bezzina et al. 2021).

The theory behind gamification, also known as the "use of game design elements in non-gaming contexts" (Deterding et al. 2011), shifts the emphasis from the use of actual games in educational settings to the use of specific design elements, such as game mechanics and thinking, to captivate and motivate learners and generate innovative solutions to challenges (Pfeiffer et al. 2020). Preliminary empirical research on gamification's use in the classroom indicates a favorable impact on students' interest and effort (Kingsley and Grabner-hagen 2015), (Leaning 2015).

Conversely, detractors of gamification point out that its primary motivators—such as points, badges, and leaderboards—are overly simplistic and exploitive of game design characteristics that lead to a phony sense of accomplishment (Woodcock and Johnson 2018). As there is currently only a small amount of scientific research about the use of gamification in education, most of it relates to the effects of gamification on students' motivation and engagement rather than on their cognitive development and learning (Alsawaier 2018) (Jayalath and Esichaikul 2020).

Artificial intelligence (AI) is an interdisciplinary topic with applications in many fields and disciplines, including medicine, law, linguistics, and education (Goksel-canbek and Mutlu 2016). Grading automation, adapting to students' needs, predictively analyzing their learning, differentiating and personalizing learning activities, real-time learning analytics, anytime, anywhere support from AI tutors, and targeted individualized feedback are just a few of the many advances made in the field of artificial intelligence in education (AIEd) over the past two decades (Bezzina et al. 2021). There has been a recent uptick in classroom implementations of AI-based algorithmic and systemic initiatives. Therefore, artificial intelligence has the potential to enhance the quality of instruction and learning as a leading-edge developing technology that is breaking new ground in the academic world (Chen et al. 2020). It is important to note that while many AIEd systems have been developed throughout the years, there is currently scant scientific evidence of their effect on student learning (Goksel-canbek and Mutlu 2016).

Students' cognitive learning, insight acquisition, and risk prediction can benefit from using AI-supported adaptive learning objectives, feedback, and rewards to foster intrinsic motivation (Bezzina et al. 2021). Access to a stimulating learning environment that allows for individualization and adaptation of instruction is even more critical in mobile learning and evaluation.

6.7 Educational Gamification Powered by AI

A fundamental requirement of Educational Gamification is a familiarity with digital games and gameplay. Imagine hiring a consultant with no background in gaming yet who gives you in-depth instructions on how to use gamification but has no idea what you are talking about because they have no experience with digital games. In most cases, gamification entails some metamorphosis, as seen in (Friedemann et al.

2015). It is grounded in students' prior learning, skills, and established pedagogical procedures (Jantke 2018).

Educational Gamification Beyond Game Elements and Mechanics People's interest in playing digital games is consistently high. After only a few years, the digital games industry has already shown to be more successful than the film industry. Furthermore, it cannot be denied that playing digital games might become a habit-forming behavior. Educational gamification seeks to maximize the potential of digital games for teaching and education by capitalizing on the entertainment value and the potential for addiction they present.

Video games are a form of popular entertainment that can give humans unique opportunities to engage in meaningful activities. A range of psychological aspects, such as the gratification of overcoming a challenge or difficulty or the relief of escaping a potentially dangerous situation, can set the stage for emotionally moving and fulfilling experiences. It could be exciting or surprising. Those working in the film industry are familiar with dramaturgical methods like Mitaffekt and Eigenaffekt, both famously used by Alfred Hitchcock.

Parasocial experiences, which are difficult to separate from social experiences in multiplayer games, may emerge through interactions with non-player characters (NPCs). Even a novice player in flow (Jantke 2018) does not control a digital system through an interface, nor does he or she have to work through technical difficulties to have fun while exploring a virtual world through touch. To "gamify" a classroom or other learning space means changing it into an atmosphere where students can have positive learning outcomes while having fun.

Whether instructive or not, various humans see gamification results differently due to the sheer nature of digital games and gameplay. In light of this, the teaching and instructing occasions may differ considerably.

The Need for Artificial Intelligence for Educational Gamification Educators, aware of the allure of digital games and eager to respond to the increasing digitization of society, seek to maximize their impact on as many students and trainees as possible. Results from gamification are often misinterpreted. Only by enhancing AI in educational gamification can this problem be solved. The key to making Educational Gamification flexible and, thus, more effective for varying human learners and trainers is artificial intelligence, which allows a digital system to learn about users. The ideas and procedures of AI make digital systems eminently edifying. A digital system based on AI might be able to pick up on the nuances of its user, such as the player's goals, the learner's misconceptions, or even the human's current emotional state (Jantke 2018).

As can be observed from case studies (Jantke 2018), gamified education has advantages over conventional approaches due to its personalized, adaptable nature and its attractiveness based on playfulness.

Concepts and Technologies of Artificial Intelligence Implementation One of the biggest challenges with gamification is that it is hard to predict how people will

react to it, which is true even outside the classroom. This dynamic planning challenge calls for the anticipation of future courses of action.

Storyboarding is essential for preparing for various user experiences (Jantke 2018). Digital storyboards are required for direct integration into the deployed system. Technically speaking, storyboards are graphs; more specifically, they are families of graphs with a hierarchical structure. The strategy works well for sophisticated, realistic training applications (Jantke 2018).

Scenes and episodes are typically represented as separate nodes in storyboard graphs. Scenes are fundamental nodes with application-specific meaning, such as a cutscene, downloadable file, text or audio file to be read or listened to, or menu options from which to choose. Each episode is a stand-in for a different subgraph. The various subgraphs have new substitution criteria introduced in each episode. Interaction history, the application's setting, and the user's role are all factors the conditions can influence. Through the use of the information implied by the substitution conditions, dynamic adaptation is achieved. What we now call "storyboard interpretation technology" has its syntactic foundation in storyboards. In technical parlance, this is the idea of reading and using storyboards during actual gameplay, practice, or instruction.

Graphs depict many instructional notions that can be interpreted as patterns (Jantke 2018). It is possible that changing out episodes for different graph nodes can stand in for entirely new pedagogical ideas. There is empirical evidence that this method works (Jantke 2018). Effective Educational Gamification is made possible by AI's storyboarding, storyboarding software, and storyboarding interpretation technologies.

6.8 Incorporating AI Into Educational Games

General education manager at Microsoft Dan Ayoub (Ayoub 2020) claims that the use of AI in education is not a new phenomenon but that the technology is set to change how teachers teach radically and students learn.

How can educational game makers apply machine learning to educational games, as artificial intelligence plays an increasingly important role in the status of education? Let us examine a few cases (Jantke 2018) in point:

Personalized Learning Adaptive learning, in which content is automatically and constantly adapted to the learner's competence and knowledge depending on their input, is one significant way artificial intelligence supplements game-based learning. This can be achieved in a game-based learning setting by collecting and analyzing information about the player's actions, skills, and preferred learning methods and then delivering tailored content to the player. It could be more complex game mechanics activated when the player progresses quickly through content and seeks a more significant challenge, or it could be the activation of supplementary aids if a student is having difficulty grasping a particular subject.

Task Automation Scholastic and the Bill and Melinda Gates Foundation polled teachers in 2013, finding that they spend an average of 53 hours per week on the job, with much of that time spent on things like home grading and staff meetings. However, by outsourcing all grading-related chores to artificial intelligence systems integrated within learning games, educators will have increased time and availability to engage directly with learners – especially 1-on-1 encounters with individuals who require additional attention and support. Learning games with added AI features can also help with task automation.

Support Beyond the Classroom Many parents nationwide struggle to provide enough at-home learning support for their children for various reasons, including a lack of financial resources or educational experience. The use of AI in games is one way to address this issue, as it can enable the game itself to provide individualized assistance to players, thus leveling the playing field and guaranteeing that student always have access to the guidance they require, regardless of the setting in which they are learning. Using AI in educational games makes them adequate resources for both in-class and at-home learning.

6.9 Conclusion

The purpose of the in-depth analysis and evaluation of the novel application of AI-powered gamification to the educational setting is to contribute to and shape the development of future thought and practice in the field of education. This chapter provided additional insight into how AI facilitates efficient educational gamification.

References

Agrawal, A. (2021, June 12). How gamification can transform education. *The Hindu*, 1–10. https://www.thehindu.com/education/how-gamification-can-transform-education/article34796220.ece

Alsawaier, R. (2018). The effect of gamification on motivation and engagement. *The International Journal of Information and Learning Technology*, *35*(1), 56–79. https://doi.org/10.1108/IJILT-02-2017-0009

Ayoub, D. (2020). *Unleashing the power of AI for education*. https://www.technologyreview.com/2020/03/04/905535/unleashing-the-power-of-ai-for-education/

Bezzina, S., Pfeiffer, A., & Dingli, A. (2021). AI-Enabled Gamification for Learning and Assessment. *International Conferences on Mobile Learning and Educational Technologies*, 189–193.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access*, *8*, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). Gamification: Using Game Design Elements in Non-Gaming Contexts. *CHI EA '11 Extended Abstracts on Human Factors in Computing Systems*, 2425–2428.

Dingli, A., & Seychell, D. (2015). *The New Digital Natives: Cutting the Chord*. Springer. https://doi.org/10.1007/978-3-662-46590-5

Friedemann, S., Baumbach, L., & Jantke, K. P. (2015). Textbook Gamification: Transforming Exercises into Playful Quests by Using Webble Technology. *7th International Conference on Computer Supported Education*, 116_126. https://doi.org/10.5220/0005489101160126

FutureLearn. (2021). *What is gamification in education?* FutureLearn. https://www.futurelearn.com/info/blog/general/gamification-in-education

Goksel-canbek, N., & Mutlu, M. E. (2016). On the track of Artificial Intelligence: Learning with Intelligent Personal Assistants. *Journal of Human Sciences*, *13*(1), 592–601. https://doi.org/10.14687/ijhs.v13i1.3549

Homer, B. D., Raffaele, C., & Henderson, H. (2020). Games as Playful Learning: Implications of Developmental Theory for Game-Based Learning. In *Handbook of Game-Based Learning* (pp. 25–52). MIT Press.

Jantke, K. P. (2018). *Educational Gamification & Artificial Intelligence*.

Jayalath, J., & Esichaikul, V. (2020). Gamification to Enhance Motivation and Engagement in Blended eLearning for Technical and Vocational Education and Training. *Technology, Knowledge and Learning*, *27*, 91–118. https://doi.org/10.1007/s10758-020-09466-2

Kingsley, T. L., & Grabner-hagen, M. M. (2015). Gamification: questing to integrate content, knowledge, literacy, and 21st-century learning. *Journal of Adolescent & Adult Literacy*, *59*(1), 51–61. https://doi.org/10.1002/jaal.426

Koepp, M. J., Gunn, R. N., Lawrence, A. D., Cunningham, V. J., Dagher, A., Jones, T., Brooks, D. J., Bench, C. J., & Grasby, P. M. (1998). Evidence for striatal dopamine release during a video game. *Nature*, *393*(May), 266–268.

Leaning, M. (2015). A study of the use of games and gamification to enhance student engagement, experience and achievement on a theory-based course of an undergraduate media degree. *Journal of Media Practice*, *16*(2), 155–170.

Legaki, N., Xi, N., Hamari, J., Karpouzis, K., & Assimakopoulos, V. (2020). The effect of challenge-based gamification on learning: An experiment in the context of statistics education. *International Journal of Human-Computer Studies*, *144*(November 2019), 1–14. https://doi.org/10.1016/j.ijhcs.2020.102496

Panoutsopoulos, H., & Sampson, D. G. (2012). A Study on Exploiting Commercial Digital Games into School Context. *Educational Technology & Society*, *15*(1), 15–27.

Pfeiffer, A., Bezzina, S., König, N., & Kriglstein, S. (2020). Beyond Classical Gamification: In-and Around-Game Gamification for Education. *19th European Conference on E-Learning*, *October*, 415–420. https://doi.org/10.34190/EEL.20.007

Posso, A. (2016). Internet Usage and Educational Outcomes Among 15-Year-Old Australian Students. *International Journal of Communication*, *10*, 3851–3876.

Smiderle, R., Rigo, S. J., Marques, L. B., Coelho, J. A. P. de M., & Jaques, P. A. (2020). The impact of gamification on students' learning, engagement and behavior based on their personality traits. *Smart Learning Environments*, *7*(3), 1–11. https://doi.org/10.1186/s40561-019-0098-x (2020)

Solanki, V. (2022). *Gamification in Education | Learning, Benefits & Strategies*. Study.Com. https://study.com/academy/lesson/what-is-gamification-in-education-definition-research-strategies.html

Sykes, J. M. (2018). Digital games and language teaching and learning. *Foreign Language Annals*, *51*(December), 219–224. https://doi.org/10.1111/flan.12325

TeachThought Staff. (2017). *12 Examples Of Gamification In The Classroom*. TeachThought. https://www.teachthought.com/the-future-of-learning/examples-gamification/

Vuleta, B. (2022). *Generation Z Statistics*. 99Firms. https://99firms.com/blog/generation-z-statistics/#gref

Woodcock, J., & Johnson, M. R. (2018). Gamification: what it is, and how to fight it. *Sociological Review*, *66*(3), 542–558. https://doi.org/10.1177/0038026117728620