



Games-based Learning & Gamification: The Future of Industry Training?

Summary

In today's technology-driven world, traditional classroom learning is often seen as inefficient. Game-based learning (GBL) and gamification have emerged as innovative techniques to enhance education and workforce training. These approaches provide engaging and effective learning experiences through problem-solving and motivation. GBL involves using games designed specifically for educational purposes, while gamification applies game elements to non-game contexts to boost engagement. Both methods offer distinct advantages, such as improved skill acquisition and better performance through immediate feedback and interactive experiences. However, challenges like cost and complexity exist. By integrating these methods, particularly in industries like forestry, we can harness their potential to prepare workers for volatile and complex environments, fostering creativity and innovation.

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Introduction

As part of the Primary Growth Partnership (PGP) programme, 'Te Mahi Ngahere i te Ao Hurihuri – Forestry Work in the Modern Age' (FGR, 2018), the objective of the Human Factors theme is to prepare people for tomorrow. We aim to identify the skills and knowledge required for the forestry industry of the future and develop training to address those needs. Furthermore, we intend to augment the ongoing introduction of operational and systemic innovations. This knowledge will guide the uptake and integration of new technologies using the latest knowledge transfer techniques (FGR, 2019).

Increasingly, the challenge is not just providing more training but better targeted education considering timing, location, and format. In the technology-driven, digital world of today, traditional classroom-based learning is often considered inefficient in terms of knowledge provision, skill transfer and learner preparedness. Game-based learning and gamification have emerged as effective techniques to educate, upskill and train our future workforce. Such modern approaches offer engaging training that consistently delivers desirable learning outcomes through problem solving and individualised competency development. The benefits of using well-designed games for on-the-job learning purposes have been brought into sharper focus with generational shifts at work, as younger workers enter the industry. The predominantly unconscious learning occurring during play positively affects performance metrics and acts as a gateway for us to explore training approaches around unconsciously processed information.

Ultimately, the utility of such approaches is based in the feasibility and likelihood of achieving the desired outcome of an upskilled industry.

Gamification vs Game-based Learning

Gamification is the application of game design elements and techniques into non-game contexts to improve user engagement and drive motivation. It essentially turns the entire learning process into a game. Game mechanics, such as achievement badges, points, rewards, leader boards, and progress bars, help to encourage participation and learning. Gameplay design elements might involve narratives and characters, player control, immediate feedback, scaffolded learning with increasing challenges, and opportunities for mastery and levelling up.



Figure 1. Farming Simulator 22

Where gamification is taking a learning process and applying game principles to it, Game-based Learning (GBL) is taking a game and using it for learning. GBL is aimed at teaching a discrete skill or learning outcome, rather than being a complete pedagogical system. It involves creating games specifically designed to teach and impart knowledge in a fun,

engaging way. GBL may employ elements of gamification, but the focus is education and facilitating learning.

While the overall objectives of the two approaches are similar – seeking to understand and influence human behaviour through strategic rules and incentives – applicability depends on specific training needs and goals. Both gamification and GBL have their own disadvantages and advantages, with effectiveness determined by target audience, the content being taught and the desired outcomes. Gamification can reinforce desired behaviours, as well as be a useful tool for tracking progress and providing feedback to learners. GBL is an effective means of providing

interactive learning experiences that allow participants to practice and apply their knowledge in a safe environment. The best approach may be a combination of both gamification and GBL.

Aligned to this topic, it is important to distinguish between simulator-based training and GBL/gamification techniques. Simulator training uses computer-based simulations to imitate real-life scenarios with the goal of providing hands-on experience in a safe environment. In contrast, games facilitate learning by employing game elements such as competition, rewards, and rules. The primary objective is to engage learners and make the learning process more enjoyable and interactive.

Gaming in Industry Settings

Table 1. Examples of gaming and gamification applications in industry settings.

<i>Industry</i>	<i>Applications</i>
Defence	'VBS4' provides a comprehensive virtual desktop training environment that allows the user to create and run any imaginable military training scenario for tactical training, experimentation, and mission rehearsal (1).
First Responders	Current technology allows for the simulation of fire spread and smoke movement along with training certain firefighting skills and incident command co-ordination (2).
Business	Game-based learning has proven to be an effective teaching method in a variety of fields, including supply chain management (3). Game-based learning used for circular business model innovation (CBMI), the complex, dynamic process of designing business models according to the circular economy principles (4).
Agriculture	'Riceville' is a game used to simulate a virtual farming environment promoting the use of effective best-practices introduced by leading rice organisations like the International Rice Research Institute (5). 'AgVenture' is a computer programme designed to teach risk management strategies and reinforce traditional farming management principles. Students choose the crops they would like to produce, determine profit-maximizing fertilizer applications, make machinery buy-sell-trade decisions, and manage their land and irrigation resources (6).
Manufacturing	A highly interactive and immersive Virtual Reality Training System (VRTS) simulates in real-time the cooperation between industrial robotic manipulators and humans, executing simple manufacturing tasks (7).
Medicine	Competitive game-based learning is an effective and well-accepted means of teaching core radiological anatomy and radiological signs content to medical students (8).
Health & Wellbeing	Gamification is finding growing application in the field of physical activity, promising engaging and motivating experiences that foster behavioural change (9).
Education	Education 4.0 is a new educational paradigm that intends to address the needs and potentialities of the fourth industrial revolution. Education 4.0 builds on the concept of learning by doing, using game-based learning and gamification technologies (10, 11).

Gaming Advantages & Disadvantages

Advantages

Games are inherently engaging, making learning more enjoyable for employees. Such an active form of skill acquisition requires participation and decision-making which can lead to better information retention. Games with rewards and incentives for completing tasks and reaching goals can lead to better performance. This is further enhanced by immediate feedback on that performance, allowing workers to quickly identify areas for improvement. Additionally, games can simulate real-world situations giving individual learners and teams opportunity to practice skills and collaboration in a controlled setting. Thus, gamified activities provide learners with meaningful experiences that allow them to understand and internalize the material in a way that is not possible with traditional learning methods. This type of learning is particularly effective for developing critical thinking and problem-solving skills, as learners must use their knowledge and skills to solve complex challenges and overcome obstacles. Games offer quantitative learner data collection and analysis options, where traditional classroom-based approaches are almost wholly reliant on subjective teacher assessments. Finally, GBL and gamification offer accessibility advantages. With the rise of digital technologies, digital games and gamified activities can be delivered online, making them accessible to learners who may not be able to attend in-person training sessions. This accessibility advantage makes games particularly suitable for educating and training the future workforce, which is likely to be increasingly distributed and diverse.

Disadvantages

The main disadvantage of educational games is cost. Investment in production, purchase or licensing of games can be expensive with potential added costs associated with specialised software and/or hardware. Finding a commercial game that accurately represents real-world scenarios or creating the necessary level of detail, information and applicable skills required for a specific industry or task can be both difficult and pricey. There are implementation challenges as games can be complex to apply, with the need for careful design and testing to ensure learning outcomes are valid and reliable. Finally, games may not be effective for everyone. Some individuals may resist the use of games due to a preference for traditional training or a lack of familiarity with gaming technology.

Gamification has several drawbacks unique to its distinct format. While being a powerful motivator, it can lead to an over-reliance on rewards and an increased focus on external drivers. Gamification can also be addictive in similar ways social media can, and over time, learner well-being and productivity may be impacted negatively.

Implicit Learning

Implicit and explicit learning are two different types of learning that refer to how information is acquired, processed, and retained. Implicit Learning refers to non-conscious acquisition of knowledge and skills, which occurs naturally through repeated exposure to a task or activity. This type of learning does not require much conscious effort and is often automatic. It can result in the development of highly skilled behaviours. For example, most people learn to drive a car implicitly through repeated practice, without consciously thinking about the mechanics of the task. Explicit learning, on the other hand, refers to the conscious, intentional acquisition of information, often through conscious effort and attention. This type of learning can be slower and more labour-intensive than implicit learning. It is often taught through instructional methods such as lectures, textbooks, or structured training programs.

While there is no definitive answer as to whether implicit or explicit learning is 'better', the efficacy of each style is dependent on several factors like individual preferences and task type. In general, implicit learning is often seen as a complementary process to explicit learning, as both types of learning can work together to help individuals acquire and retain information in different ways. Game design can successfully achieve such a balanced amalgamation of the two learning types.

Forestry work lends itself to implicit learning methods with current training predominantly completed via an on-the-job apprenticeship model. This provides opportunities for practical learning typically with expert supervisors where workers can practice and develop their skills through observation, repeated exposure, and natural exploration.

Forestry Applications

Game-based training can provide hands-on experience and immediate feedback, helping to improve learning outcomes and increase retention of information. This can be especially useful in industries where it may be difficult or dangerous to gain real-world experience, like forestry. Such gamified activities could provide an engaging and interactive way to teach forestry workers about key forestry business principles, machine operation and maintenance, sustainable practices, and forest management. The benefits that a cultivated and holistic understanding of forestry harvesting operations are wide ranging.

New Zealand Example

Safetree SIM is a forestry game-based training tool that was developed to help tree fallers prepare for the competency assessment. The game is available online and as a mobile app. It comprises four levels, each more challenging than the last. Starting with the basics like tailgate meetings, planning, PPE, tools and equipment, to best practice guidelines, site

assessment, 5-step felling process, felling cuts and causes of harm.

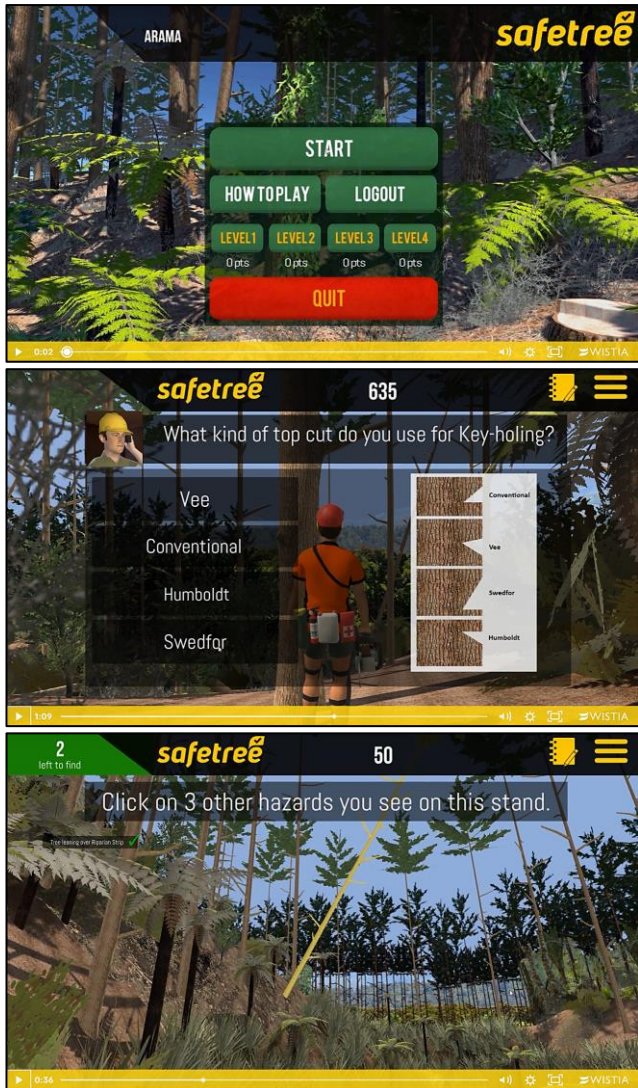


Figure 2. Safetree SIM Game-based Training Tool.

Farming Simulator 22/23

Given the time and resources required to develop a fully functional game, the easiest way to test gaming effectiveness in forestry may be a commercially available options from the established entertainment market.

Farming Simulator is a game available on multiple platforms where players take on the challenging, but important, career of a modern farmer. Giants Software is the developer and publisher of the Farming Simulator suite of games, offering a variety of farming operations focusing on agriculture, animal husbandry and, more recently, forestry. The game includes more than 500 authentic machines and tools from over 100 Brand name manufacturers worldwide, with near limitless Mod community additions available.

Forestry on Farming Simulator allows farmers to establish a flourishing business in harmony with nature, using renewable resources and state-of-the-art machinery from renowned manufacturers. The game incorporates all elements of the forestry supply chain, from silviculture (planting, pruning, thinning) to

harvesting (cable and ground-based) to transport and logistics to processing for different products (wood chip, logs, and furniture) to selling your product on the log market. It has forest design features, with fifteen different conifer and deciduous species of tree. Log sales on the in-game 'Wood Market' give players an appreciation of forestry-specific economics and log quality metrics.



Figure 3. Farming Simulator 23

There are limited tutorials, and ultimately the player must figure out what to do, and how to do it on their own. This is a perfect example of implicit learning.

GIANTS Software is expanding the Farming Simulator universe, with the upcoming Farming Simulator Kids game supported by John Deere. This new game is set to engage younger players to learn about the importance of agriculture.

With no strict gameplay goals limiting the journey, the game invites players to adventure through several lovingly designed scenes like a garden, the farmhouse, or the market, to discover many agricultural activities...Their simple, intuitive tasks teach logical thinking and making connections between the produce grown on fields and the everyday products available at the farm store(12).

Such an approach showcasing forestry activities could serve to introduce young children to our Sector in a playful and educational way, potentially cultivating an enduring interest in trees, climate, sustainability, and machinery.

Conclusions

The forest industry needs to train workers for a future characterised by volatility, uncertainty, complexity, and ambiguity. Over the next decade, skills gaps are

expected to increase across all industries. We believe an apprentice-based curriculum that combines timeless traditional learning styles with novel elements discussed in this Report will strengthen workers' forestry understanding and the decisions they make as a result. GBL and gamification affords the opportunity to refocus on uniquely human skills best suited to deal with high-risk workplaces, such as creativity, empathy, and innovation. This approach has the potential to generate curious employees and excellent collaborators who can successfully navigate increasingly complex multistakeholder industry ecosystems.

GBL and gamification offer a fresh, modern approach to education that is well-suited to preparing the future workforce for the challenges of the 21st century. Through an enhanced learning experience, improved knowledge retention, and increased accessibility, GBL and gamification have the potential to revolutionise the way we educate and train the future workforce. As technology continues to evolve and transform the way we live and work, these approaches are likely to become increasingly important tools for delivering effective learning capabilities.

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