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# Giving virtual worlds a pedagogical boost with gamified authentic learning design

## Abstract

Gamification is one of today's hot topics in education. However, the concept is new and sometimes gets mixed up with others, such as virtual worlds or game-based learning. Understanding of what gamification actually is and what the educational benefits are is also diverse. The nDiVE research team explores how learning work related skills in supply chain management with the help of immersive virtual worlds can be supported with a learning design building on elements of gamification and the pedagogical framework of authentic learning. The complexity of supply chains and the related skills cannot be fully acquired from textbooks or other traditional ways of teaching and learning. There is also an identified gap in graduate skills and organisational expectations. While immersive virtual worlds can be extremely useful in that they can take students to learning situations that otherwise would not be safe, feasible or cost-effective, it is important not to let cutting edge technology steal the show. Instead, a pedagogically sound learning design should be employed to ensure a beneficial learning experience. Authentic learning provides a useful design framework for gamified learning experiences in a virtual world.

## 1. Introduction

Gamification is a phenomenon that is very much in the spotlight in education related discussion of today. While it is gaining increasing attention in research and practice, it is still an emerging concept and its potential has not yet been fully realised. Moreover, the myriad of terms and ideas may be somewhat confusing. What is the difference between game-based learning and gamification? Are virtual worlds the same thing as game-based learning? Is learning that takes place in virtual worlds always authentic? What do all these terms mean, how do they relate to each other, and how can they benefit learning? Why should we even care - are gamification and virtual worlds interesting because they are new and entertaining, or is there a deeper pedagogical value to be found?

The international research project *nDiVE* examines immersive virtual worlds enriched with learning design utilising elements of gamification and the pedagogical framework of authentic learning. The goal is to provide learners with authentic situations and opportunities to develop relevant targeted skills required in real-world applications of logistics and supply chain management. This paper concentrates on examining the relationship of the two learning design frameworks; gamification and authentic learning. We explore how these models can support

each other and how they can be used for a learning design in a virtual world in a way that promotes learning engagement, supports skills acquisition and facilitates transfer of learning.

**The nDiVE learning environment**

The context and motivation of the research project arises from skills acquisition and workplace readiness in the field of logistics and supply chain management. Supply chains can be extremely complex and acquiring the relevant skill set is challenging due to geographically distributed facilities, long lead-times between stages of production and manifold production systems. Errors at one stage of the chain may cause damages of millions of dollars or have disastrous effects on health and safety of humans or the environment at a later stage. Textbooks and lectures may introduce real-life case studies and site-visits offer a glimpse of the actual context, but the student experience remains theoretical and the readiness of the students to use the knowledge in the actual workplace situations may remain weak. Virtual worlds and simulations offer a promising alternative to the traditional teaching methods. nDiVE uses a virtual world where different stages of the supply chain are modelled (e.g. warehouse, container terminal). To enhance immersion and the sense of actually being in a physical place, technologies such as the Oculus Rift head mounted display are used. However, a virtual world alone, no matter how realistic and detailed, will not automatically result in a high quality learning experience. While the environment can be quite captivating, it is important not to get carried away with novel and cutting edge technology at the expense of pedagogically solid learning design.

**Skills gap**

Leberman, McDonald and Doyle draw our attention to course design when tackling issues such as retention and transfer of learning. They point out that courses may be preparing students for examinations or essay writing instead of preparing them for future workplace situations. The problem of traditional assessment methods is that they tend to direct students to store and encode information for short-term retrieval in composing essays or sitting exams. Although the student may perform well in these assessment tasks, this does not automatically mean that they would be able to transfer their learning to a workplace situation. In fact, a report of Australian Chamber of Commerce and Industry (2010) reveals a significant gap in graduate skills and organisational expectations, and others indicate similar industry concerns such as graduates possessing wrong or insufficient skills (Ferguson, 2012). Leberman et al emphasise that in order to reach better transfer of learning, "the learner needs to be prepared to draw on a range of resources and to adapt learning to complex and ill-structured workplace problems" (p.117). Knowledge must be encoded for use in authentic problem solving and the task of the educator is to facilitate this process. (Leberman et al). Kapp (2012) refers to the same idea when he points out that learners need more than abstract concepts and isolated, self-contained examples –

instead, they "need to be exposed to the use of the information and cognitive tools in an authentic activity" (p. 69).

Larsen-Freeman (2013) discusses transfer of learning in language education where traditional teaching methods include behaviourist approaches such as drilling. Although this paper is not about language education, similar practices – and thus similar problems with transfer of learning – are not absent in professional skills acquisition. Larsen-Freeman's discussion on successful transfer is also highly relevant also in this context: successful transfer occurs when the retrieval conditions are matching with the conditions of learning. In other words, we can better remember what we have learned if the cognitive processes we employ during learning are similar to those that we employ during retrieval (Larsen-Freeman, 2013). An important advantage that games have in comparison to many classroom-based learning situations is that games have a strong potential to create episodic memory. Kapp (2012) points out that often immersive 3D games "have the visual and temporal-spatial relations to provide a strong, rich association between what you are doing in the event and your long-term memory" (p. 68).

**Gamification**

Gamification is one of the current hot topics in education and as a field of research it is still new and emerging. There are still various views whether gamification is a distinctive phenomenon by its own right, compared to e.g. pervasive and serious games, and what its true definition might denote (e.g. Deterding, Dixon, Khaled & Nacke, 2011; Hamari, Koivisto & Sarsa, 2014). After reviewing the existing research and literature on games and gamification, Deterding et al. (2011) conclude that it indeed differs from other similar concepts revolving around the design of games and play, defining gamification as "the use of game design elements in non-game contexts" (p. 10). Examinations by Huotari & Hamari (2012) support their argument that there is indeed a call for new definition for a new distinct concept, but instead of systemic conditions, they emphasise the experience of games. Building their definition from connecting service marketing perspective to game studies, they describe gamification as "a process of enhancing a service with affordances for gameful experiences in order to support user's overall value creation" (p. 19). Detering et al. (2011) argue their definition addresses different dimensions from the one by Huotari & Hamari (2012) in three ways: Definition by Huotari & Hamari could basically be applied to any interactive system even beyond games and gamified services, examining it through service marketing context diminishes the "constitutive social and experiential dimension of games", and that it "excludes all systems where the provision of game mechanics (tailored to a specific context) is the core service itself, or at least an essential part of it" (p. 13) (see also Hamari, Koivisto & Sarsa, 2014). Kapp (2012) defines gamification as "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" (p. 10). Gamification should not be confused with games or serious games.

Gamification adapts elements of games (for example achievements and rewards) in non-game situations, whereas gaming and also serious games deal with actual games. (E.g. Prince, 2013)

When considering gamification for education, the crucial question that the nDiVE research team also had to ask itself is what the learning benefits would be and what it is that gamification sets to achieve. It is often claimed that gamification should be adopted because the new generation of learners has grown up with technology and they are bored with PowerPoint presentations and other content-driven teaching methods. Deterding et al. (2011) describe one reason video games seem interesting in the industry, is the possibility to transfer the entertainment and motivational aspects from commercial video games in order to improve engagement in non-game events. Uram, Wilcox and Thall (2010) suggest that today's students "expect teachers and trainers to deliver curricula in an innovative and creative way" (p.2) because they have grown up with computers. While these things may be true in many cases, we could not accept student preferences and expectations of being entertained as a sufficient driver for gamification. We dare guess that most people in the world have always found games more captivating than textbooks, but is this a solid enough reason to adopt gamification in education? Engaging in learning and motivation are important factors but the underlying reason and thus the ultimate goal of gamification should not be merely entertainment or appearing "cool" in the eyes of the learners. Instead, the reasons for nDiVE to explore gamification in the learning design is finding ways to improve learning results with regard to retention and transfer to actual workplace situations.

After the question "why", the question of "how" arises. What is it that makes a game engaging? Deterding reminds us that games are not fun merely because they are games but because they are well designed. The nDiVE team agrees with Kapp (2012) and many others in that the current trend of adding badges and leaderboards to courses, units and learning activities is not yet good design of gamification. Kapp (2012) warns designers who wish to embrace gamification that simply adding game mechanics into boring content is not going to make a good gamified learning experience - indeed, Kapp goes as far as to state that mechanics such as badges and rewards are the least useful and least interesting elements of games and yet they have become "the face" of gamification. Prince (2013) also points out that paradoxically one of the elements that tend to be left out from half-hearted gamification designs is the element of play; if one is forced to "play", one is not actually playing at all. On the other hand, it is also important to ensure that engagement and fun also leads to high quality learning. Kapp (2012) suggests that game elements such as interactivity, storytelling and problem-solving are the right foundation for gamification of learning.


**Authentic learning and gamification**

Like gamification, authentic learning is also a concept that has been interpreted in many different ways. When thinking of authenticity in education, it is easy to think about work integrated learning or other learning methods that take place in the physical setting where the knowledge would be used. However, being situated in the actual physical setting of the workplace or other relevant

environment does not necessarily lead to authentic learning. For example in the case of logistics and supply chain management, students may have a field tour but typically they would get a predefined, guided tour with very restricted access to where the work actually takes place, let alone be offered the opportunity to engage in an authentic task on the site. We use the authentic learning environment model developed by Herrington and Oliver (2000) and extended to online learning environments by Herrington, Reeves and Oliver (2010).

The framework of authentic learning provides a practical and comprehensive model of operationalising pedagogical ideas deriving from situated cognition and cognitive apprenticeship. It identifies nine elements that characterise an authentic technology-based learning environment (Herrington, Reeves & Oliver, 2014). These elements can be used directly to support gamification in the learning design.

**Authentic context** reflects the context where the knowledge is used in real life. Case examples are not enough, but the context must provide the motivation and purpose for learning. The learning environment must be sustained and complex. (Herrington, Reeves, & Oliver, 2010). Gamification embedded in a virtual world provides the opportunity for operating in a simulated environment that replicates the complexity of the real thing. Moreover, the realism is enhanced by the use of the Oculus Rift, which gives the student a strong feeling of "being there" (Reiners et al., 2014). However, compared to for example a real container terminal, the gamified simulation has a major advantage: it allows students to safely learn through trial and error.

**Authentic tasks** are ill-defined and have real-world relevance. They are complex, not simplified or broken into small manageable chunks. An authentic task requires a sustained period of time for investigation. (Herrington, Reeves, & Oliver, 2010). Authentic tasks are very much about solving complex and realistic problems, instead of learning "the right answers". This is also true of a good game design, and, according to Kapp (2012), one of the fundamental elements of gamification. A gamified simulation allows for task design that mimics complex real-world tasks that would not otherwise be available for students due to danger, cost or accessibility.

**Access to expert performances and modelling of processes** replicate the forms of support that is available in the real-life context. There must be access to expert thinking and learners with various levels of expertise. (Herrington, Reeves, & Oliver, 2010). In a gamified 3D environment, expert performance can be captured and students can practice their skills and improve their performance. For example the slo-mo and ghost functions that are often seen in games allow the students to replay their own performance, or the performance of a fellow student, and see where they can improve. Leaderboards and high scores help identify the best performances and these can be used for group reflection.

**Multiple roles and perspectives.** Students must have the ability to investigate the task from various perspectives and explore the learning environment in a non-linear way. (Herrington, Reeves & Oliver, 2010). In nDiVE the learning material is presented in the form of an interactive story broken into "chapters" while allowing to learner also to explore the environment and form their own perspectives and experiences. (Reiners et al., 2013). Some ideas familiar from

games, such as different character classes with different skills and abilities may also be worth considering.

**Collaborative construction of knowledge.** The task design should require collaboration rather than presenting it as an optional extra. Few real world problems can be solved independently, therefore students' work should also be designed to be interdependent. As Kapp (2012) remarks, gamification has significant potential in collaborative problem solving. Online collaborative learning is often easier said than done, and often students resort to simple cooperation rather than achieving true collaboration. Often collaboration is not an inherent part of the task but it is possible for the students to delegate individual tasks to each other, or for someone to take over the responsibility. Every educator has run into a situation where students complain about a group member who has not pulled their weight in a collaborative effort. Gamification offers opportunities for learning tasks that genuinely rely on collaboration. Anyone who has played the co-op campaigns in games such as Gears of War or Army of Two will know that the input of the fellow player is absolutely crucial in completing the missions. This aspect of gamification offers huge potential that is well worth investigating further.

**Reflection** is required in solving authentic tasks. Students must be able to compare themselves to expert performances, self-evaluate and return to elements of the learning environment if needed. Often instructors are eager to promote reflection and students may be encouraged to reflect with prompts and questions. Herrington, Reeves, & Oliver (2010) see this as insufficient, instead, true reflection takes place when the situation genuinely requires reflection and it is very important to stop and think of how we act. Schon (1983) makes a distinction between "reflection on action" and "reflection in action". The first takes place when we contemplate on our performance afterwards, whereas the latter refers to reflecting while performing a task. Schon (1983) recommends making this type of reflection an integral part of professional development. This type of reflection does not typically occur when performing isolated, short-term tasks but it requires an authentic task. As Schon (1983) points out, there is enough time for reflection when the activity is a process rather than a single operation. This type of reflection would probably be familiar to anyone who has ever played video game campaigns and struggled with a task or with completing a level. Authentic, collaborative tasks in a gamified virtual world should naturally provide plenty of opportunity for reflection in action.

**Articulation** strengthens students' reasoning and allows them to negotiate meaning and word their growing understanding. The learning task needs to provide inherent opportunities for articulation, as well as collaborative groups to enable articulation. (Herrington, Reeves, & Oliver, 2010, p. 32). Collaborative gaming and gamified simulations have plenty of potential in this area. When playing together and solving a complex problem, groups of players need to constantly negotiate meaning and strategy. Moreover, in a gamified simulation, situations for naturally occurring articulation may easily be built in the storyline, e.g. running into a supervisor or fellow worker and having to explain to them what you are doing and why.

**Scaffolding and coaching** should be provided for learning support. Immersive 3D games provide a model for cognitive apprenticeship. Kapp (2012) compares traditional apprenticeship to the way cognitive apprenticeship can be created in games to immerse the learner in an authentic

learning experience. Instead of working with a mentor or teacher who models the relevant behaviours and is observed and imitated by the learner, in a game you learn by operating a character, serving as an apprentice to the game environment that patiently teaches you to function in the environment and solve increasingly complex problems. The game environment provides feedback, coaching and tips (Kapp, 2012).

**Authentic assessment** is directly integrated with the task. The learning environment must allow for students to demonstrate their performance with the newly acquired knowledge. (Herrington, Reeves, & Oliver, 2010). Gamified environments provide versatile opportunities for providing formative assessment and feedback on the task. Game elements, for example save points and multiple lives, can be used to facilitate learners progression through scenarios that become gradually increasingly difficult. The gamified environment allows for multiple tries and improvement through reflection and trial and error. (Woods, Teräs Reiners & Gregory, 2013). Moreover, assessment can be built in through storytelling which allows for assessment that replicates workplace situations and the ways employee performance is assessed in real life.

**Conclusion**

In this paper we have explored how pedagogically meaningful authentic learning can be supported by incorporating elements of gamification into skills acquisition in a 3D virtual world. We argue that while virtual worlds and gamification carry significant potential in engaging learners and allowing for learning situations that would be too dangerous, expensive or impractical to conduct in real life, the best learning benefits can be achieved with pedagogically solid learning design. The pedagogical approach of authentic learning provides a useful design framework for gamified learning experiences in virtual worlds. The model aligns with our definition of gamification which goes well beyond badges and leaderboards.

The nDiVE project is at the stage of implementing the learning design, which means that the research on the actual impact of authentic gamified learning in a virtual world environment is still ongoing. Basing on literature we hypothesize that such a learning design has a positive impact on the transfer of learning and retention. We are undergoing development and implementation of the described learning design in a supply chain management unit and will be collecting both quantitative and qualitative data to determine its suitability and to inform further development.

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