

**THE MAKING OF A SERIOUS GAME: PERSPECTIVES  
FROM STAKEHOLDERS**

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Abstract <p>This paper treats serious, educational, and learning games as games that aim to teach content like how vaccines work or skills like early reading.</p> <p>This paper found that at the core of the process of making serious games sits participatory design, where the game development team makes decisions together with clients, partners, and experts to address the purpose of the game, tackle a plethora of challenges, and balance learning and fun. Various stakeholders from Finland participated in five semi-structured interviews and the findings were examined through qualitative content analysis.</p> <p>This paper is a good starting point for educators and game developers who are interested in learning how the process of making a serious game goes and what roles various stakeholders have in this process.</p> <p>This paper provides further evidence that educational experts, other subject matter experts and game designers should work together throughout the whole lifecycle of a serious game, and not just in the conception phase.</p>	
Keywords: serious games, game development, educational technology, game-based learning, game design process, learning games, educational games	
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# 1 INTRODUCTION

This study investigates the process of creating a serious game, briefly defined as a digital game meant to teach skills and subject knowledge, and the challenges educational experts, topic experts and game designers face as they combine pedagogy, content knowledge and game development in the process of creating a serious game.

In an ever-digitizing world, teachers find themselves battling smartphone use that distracts their pupils (Green, 2019; Flanigan & Babchuk, 2022), who spend more and more time using technology. This has made it necessary for teachers to be able to engage students in interesting and innovative ways, including digital environments and games (Finnish National Board of Education, 2016), and prepare pupils for a work life that requires a plethora of 21<sup>st</sup> century skills, including digital skills (Kahila et al., 2020; European Commission, n.d.; United Nations, n.d.). A lot of these can nowadays be practiced and experienced through the smartphones that live in our pockets. There is a suggestion that supervised use of mobile devices increases student performance in all subjects in comparison to traditional teaching (Tingir et al., 2017); however, there is also evidence of association between lower school performance and smartphone addiction (Chang et al., 2019). While smartphones inherited and expanded on the communicative function of their predecessors, they are also capable of delivering digital environments like games. Despite video games in general having some drawbacks like lowering emotional creativity (Čábelková et al., 2020), they have had positive effects in subjects like history (Watson et al., 2011), geography (De Sena & Stachoň, 2023), and science (Tsai & Tsai, 2020); and have also improved early reading skills (Mehringner et al., 2020; Patel P. et al., 2022), as well as provided learners with enjoyable and interesting experiences that promote positive changes in attitudes and performance (Garneli et al., 2017).

While a lot of the studies of serious games in education focus on the effects on students (Garneli et al., 2017; Kahila et al., 2020; Mehringner et al., 2020; Patel P. et al., 2022), and some look into teacher attitudes towards serious games and their use in teaching practice (Hsu et al., 2017; Avidov-Ungar & Hayak, 2021), there is little research into the process of making a serious game from the perspective of educators (Dimitriadou et al., 2021) and/or game designers and developers (Linderoth &

Sjöblom, 2019). As adding educational aims complicates the game development process by adding an additional layer of requirements the game needs to meet like addressing curriculum or subject- or age-specific pedagogical approaches, it is important to learn more about this process. On the one hand, it can involve limitations due to the use of industry standard agile development models that educators might not be aware of. On the other hand, game designers and developers might not know about different pedagogical approaches, age-appropriate activities, subject-specific learning goals and assessment of learning.

This paper addresses the added complexity of creating serious games by examining what kinds of challenges various stakeholders face as they plan, create, and publish serious games; how decisions are made throughout this process and what dictates these decisions; how and to what extent these stakeholders interact with each other as work is being done on the game; and how learning can be integrated into a serious game. Overall, the paper finds that an involved participatory design process is required to address the needs of all stakeholders and manage the complexity of the process in order to make a high-quality serious game.

## 2 LITERATURE REVIEW

This chapter reviews previous research, defines the key concepts that are relevant to this study, and extracts from the literature what needs to be considered when developing a serious game. This includes:

- pedagogical approaches and theories relating to game-based learning;
- a review of serious games in education and what models have been used to design and develop them, including commentary on where educators and game designers fit in, and what challenges there are;
- a brief look at the design and development of commercial video games, and the challenges it faces.

The following sections aim to give enough information to understand where the research questions of this paper come from and how this literature review guided the use of methodology and methods described in the next chapter, as well as the formulation of the interview questions included in the Appendix.

When selecting articles to include in the review, Heck's (2011) advice to examine what has been done within the last 5 years was followed. As collection of sources started in the autumn of 2022, most of the included articles are from 2017 onwards. There are exceptions when it comes to research methodology and methods, and in rare cases relevant secondary sources.

Kelley's (2011) approach to formulating a literature review was followed – examining and comparing various published works, looking at the methodologies they used and what limitations they had; getting acquainted with common terms in the literature and repeating database searches with any new terms; and structuring the literature review in a way that would provide enough concise information about key findings on the topic to understand how the study was framed and why these specific research questions were asked.



## 2.1 Review of previous research

This section gives background information on the topic to frame the current study's research questions and how existing research helped guide the study. First, research regarding digital game-based learning from a pedagogical perspective is presented – what makes game-based learning useful and pedagogically appropriate. Second, serious games are presented – how they have been used in education so far, what teachers think about using them, and what their effects on students are. Third, how commercial games are designed and developed is examined – how that differs from serious games, and what crossover possibilities there are. Last, games this study's participants worked on are presented.

Before diving into the research on digital games, the TPACK (technology, pedagogy, and content knowledge) model is examined. This is because digital games are a form of technology, and as such there are pedagogical considerations when implementing these games in the context of learning. Therefore, digital game-based learning models and considerations are closely related to TPACK principles. Koehler and colleagues (2013) state that:

... TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies, pedagogical techniques that use technologies in constructive ways to teach content, knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face, knowledge of students' prior knowledge and theories of epistemology, and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (p. 16)

This complex relationship between TPACK components is the reason to look at the pedagogical perspectives on digital games, their technological affordances and limitations, and their relationship to content knowledge, while also looking at the people involved in the conception of digital games.

The definitions of some of the terms mentioned in the previous paragraphs are introduced here, as they will be encountered throughout this paper. Digital game-based learning (DGBL) builds on the idea that “game-based learning involves using games to execute learning content” (Govender & Arnedo-Moreno, 2021), with the addition that the games are digital. A subset of DGBL are serious games (SG), also referred to as learning or educational games which games made to teach a skill or content knowledge (Dimitriadou et al., 2021). Usually, they are less common than entertainment games, also referred to as commercial games, which are readily available games that are made specifically for entertainment (Govender & Arnedo-Moreno, 2021). These commercial games can easily be found on distribution platforms like Steam, Xbox Live, PlayStation Store, Google Play Store, Apple App Store, and others.

### 2.1.1 Pedagogical perspectives on digital game-based learning

Before presenting the literature on digital game-based learning (DGBL), it is important to distinguish between gamification and game-based learning. “Game-based learning involves using games to execute learning content” while gamification “uses game elements as a method to augment lessons for engagement and motivation” (Govender & Arnedo-Moreno, 2021, p. 3). The context of DGBL involves games that are made or used for learning, and not digital tools that gamify learning. For example, Class Dojo can be used to gamify and reinforce classroom rules and behaviors, allowing children to earn points for participation, being on time or doing their homework. In turn, DGBL would be using the Pokémon games to learn about ecological interactions (Rangel et al., 2022). Some research seems to treat the two terms interchangeably; however, there are crucial differences between the two and this paper uses the former meaning – using games to learn.

According to the elementary school teachers that Avidov-Ungar and Hayak interviewed, DGBL is useful because it “enables meaningful learning and the implementation of advanced teaching models, such as inquiry-based learning, active learning, the flipped classroom, etc.” (2021, p. 21). Also, a meta-analysis of the effects of DGBL on mathematics achievement (Tokac et al., 2019) found that games contributed to increased learning gains, however, the authors also criticized existing literature for missing detailed descriptions explaining how the games reflect curriculum, how trained teachers are to use these games, and what skills these games are supposed to teach.

To understand what contributes to the learning benefits of games, it is important to look at the design of DGBL. An analysis of 114 papers on DGBL within language education found that the most common design elements were: feedback, theme and narrative, (experience) points, and a progression system (Govender & Arnedo-Moreno, 2021). These make pedagogical sense as teachers are required to give various feedback to students to help them learn (National core curriculum for general upper secondary education, 2019). Themes and narratives can be found throughout different subjects: historical periods like the Renaissance or the Industrial Age; art themes like Cubism or Brutalism; narratives in language books like *Suomen Mestari*. In teaching there are narrative methods and theories that use storytelling in forming and transforming identities, empowering student agency (Huber & Yeom, 2017). Point systems are evident in the way the education system is set up – students get grades on their tests, projects, and finally for each subject every year; some teachers also employ point systems for younger kids, like Class Dojo, to regulate behaviors. Progression systems also naturally exist within the education system – students progress through books, lessons, terms, grades, and levels of education.

Tokac and colleagues’ (2019) aforementioned criticism of the existing literature on DGBL in mathematics brings up the need to examine how DGBL and serious games

have been implemented in education, and in particular if there is a way to combine design elements with curriculum while also addressing if, how, and why teachers use these games.

### **2.1.2 Serious games and their use in education**

This section examines how serious games have been used in education and what has affected their use, including teachers' attitudes towards gaming, and barriers to implementation in the classroom.

As teachers are the ones to decide whether to use serious games in their practice, it is important to examine their attitudes and views. This could also provide insight into what could be done during game development to make it easier for teachers to use the game. Kaimara et al. (2021) surveyed pre-service teachers and found the following barriers to using DGBL in the classroom: "the lack of financial resources, the preference for traditional teaching methods and stereotypes about the value of digital games, the lack of ICT training, the lack of infrastructure and the lack of educational policy" (p. 838).

A study in Israel (Avidov-Ungar & Hayak, 2021) categorized teachers' responses regarding DGBL adoption into two categories: innovative adopters, who are highly self-motivated, actively adopt and implement DGBL as a pedagogical choice and an instructional method, and share their activities and ideas with others; and traditional adopters, who use DGBL to practice already studied material or as a discipline tool. The study also looked at teachers' perceptions of the extent to which they implemented DGBL and why, and found three categories: large extent, because it was challenging, interesting, pedagogically advantageous, and effective; moderate extent, because while they saw DGBL as effective, there were surmountable difficulties and it was time-consuming to implement in the classroom; and limited extent, because of insurmountable difficulties related to concepts, management support and incompatibility with curriculum.

While these studies look at the relationship between teachers and DGBL, not every game needs to be used in the classroom or to involve the schoolteacher at all. There are games that students can play on their own, however, in this case the games need to have an effective feedback system so children do not get discouraged if they get stuck (Kankaanranta et al., 2017). An interesting example is Minecraft Education, not only because it is possible to create standalone games that can be played outside of the classroom, but also because of the free resources and support that teachers have access to, including ready-made lessons that they can use or recommend to their students for home practice (Minecraft Education, n.d.). While Minecraft is famous for its entertainment version of the game that revolves around exploration, crafting, and

customization of the game world, the Education version, which adds additional functionality and control, is a serious game.

In the Czech Republic, a pilot study investigated the possibility of using the entertainment version of Minecraft to learn more about climate zones and students responded positively and successfully completed the game (De Sena & Stachoň, 2023), and while the researchers modified the game themselves, this is not the only option. An alternative could be Cambridge's Adventures in English that is built on Minecraft Education. The game was made with the following in mind: "an engaging narrative, purposeful interactions, emotional engagement, freedom to fail, and learner autonomy" (Kozlova, 2021), reflecting crucial pedagogical needs. Alas, at this time there are no full text, peer-reviewed research articles that use this game as a subject of study, perhaps because it came out in 2021, and it might take a while to design, fund, conduct and report on a study that uses this game.

### 2.1.3 Criticism

It is also important to look at the criticism towards serious and entertainment games. Govender and Arnedo-Moreno (2021) found that amongst the games used in language learning, entertainment games used a lot more game elements like points, levels, narrative, feedback, etc. than serious games; and the games used in research on students conducted in secondary school included entertainment games more than in studies in primary school. This would imply that serious games tend to be simpler and are used less often with older children. This is expanded by Kankaanranta and colleagues' criticism that learning games in early childhood tend to be less attractive than entertainment games (2017).

The use of entertainment games in educational contexts also brings the question of the game's Pan European Game Information (PEGI) rating. The rating system looks at categories like references to alcohol, drugs, sex, violence, gambling, etc., and recommends the age restrictions: 3, 7, 12, 16, and 18 (What do the labels mean?, n.d.). Azam (2023) looked into the extent to which parents in Norway understand and use the PEGI rating system and found that: some parents treated the ratings as recommendations while others trusted them implicitly; most parents tended to briefly investigate games by looking them up online while a small number also played the games to make sure they were suitable for their kids; and there was also a confusion between PEGI, its American counterpart ESRB (Entertainment Software Ratings Board), and other rating systems.

As all games published in Europe need to have the PEGI rating, this existing divide in how parents understand and use the rating system is further complicated in the case of serious games because the age rating does not tell anything about the educational content. For example, the original Minecraft is rated for ages 7 and up by PEGI,

but there is no rating for the Education version. This could be because the Education version allows customization by the teacher, permitting the introduction of more mature themes, and the lessons available on the website for educators do list age ranges on every lesson instead. But outside of this particular case with Minecraft, it is difficult for a parent or a teacher to assess the educational content of a game.

It is also important to point out a recent negative trend – gaming addiction. Gaming addiction, or gaming disorder, is defined as online and/or offline gaming, which is difficult to control, takes precedence over other aspects of life, and gets worse despite the negative effects it has on a person’s life (World Health Organization, 2019).

A meta-analytic review on the prevalence of internet addiction and gaming disorders in Southeast Asia found that internet addiction is more than three times more prevalent in Southeast Asia than on a global level, and that gaming disorders are at 10.1% in Southeast Asia compared to 1.6% in Europe and 8.5% in the United States (Chia et al., 2020). The authors suggest that the result could be because of the more collectivist nature of Southeast Asian countries compared to the more individualistic Western countries, leading people to seek connections online. Their findings also show that older individuals, including adolescents, are at a higher risk for gaming disorders, especially those battling loneliness and wishing to increase their social contact. Of course, the heterogeneous findings of this meta-analysis are nuanced as representation of countries, population, and assessment tools varied.

Alok Kanojia, an addiction psychiatrist, says that fMRI (functional magnetic resonance imaging) scans show that gaming suppresses the negative emotional circuitry in the brain, thereby impairing learning (2019). This is because negative emotions make us learn to never repeat detrimental behavior, and if we don’t process these emotions and instead escape into games, we become unable to learn from our mistakes. This emotional suppression is also evident in the loss of emotional creativity, which is associated with extended time playing video games (Čábelková et al., 2020). While Čábelková and colleagues’ paper is based on a self-reported survey and cannot conclude why that happens, Kanojia’s explanations of fMRI scans seem to provide the reason.

In addition, there is a gender bias, even discrimination when it comes to gaming – which may affect how games are designed and what is assumed about the target audience. A study on the stereotypes in gaming culture presented gamers’ familiarity with stereotypical claims like men playing games more; men being better than women at video games; women not playing video games; men and women having different interests; etc. (Robinson, 2023, p. 864). This paints gaming as a male-dominated space that is uninviting to female players and should be considered in the case of serious games to make sure all students feel welcome to play them. Additionally, the field of education is female-dominated, in particular in Finland, where the proportion of

female teachers varies between 57% and 79% across different levels of education (Finnish National Agency for Education, 2019), and this could be a potential barrier to using SG in teaching as teachers may hold similar beliefs to the ones described by Robinson.

In addition to the sexist views and attitudes within the gaming community, similar stereotypes are also found in the industry itself. A study on the Swedish game industry, where about 16 percent of the workers are female, found that while sexist attitudes are present and seen as a hurdle preventing the industry from growing, they are also on an extinction path, albeit slow (Styhre et al., 2018). This could be a promising sign that with more female game developers, the needs and interests of female gamers would be better addressed in both commercial and serious games.

To sum up this section, if a serious game is to be used in education, it would have to compete for attention with commercial games; navigate a rating system that does not consider educational content; make sure it is not contributing to the rising gaming addiction problem; and also consider the impact of gender stereotypes in gaming affecting how the SG is used.

#### **2.1.4 Serious or entertainment - Similarities and differences**

This section reviews existing DGBL models, compares them to the models for developing entertainment games, and discusses some of the problems in the gaming industry and how they may relate to the development of serious games.

##### **2.1.4.1 Gaming industry standards and challenges**

This section reviews game development processes and methods in order to both familiarize the reader with the industry standards and give enough background for the following subsection which looks at DGBL development processes and models, which are built on these industry standards.

Aleem and colleagues (2016) reviewed 148 studies on the game development software engineering process and showcased a plethora of proposed models and methods they use. They sum them up as containing 3 major phases: pre-production, where the project is planned, feasibility studies conducted, major documentation prepared; production, where code is written, storyboard produced, visuals drawn, sounds recorded and composed, and everything is put together and tested; and post-production, where external testing is conducted, bugfixes implemented, and finally the game is released. The authors conclude that a lot of research focuses on the production stage (focus on development platform, programming, and implementation), followed by the pre-production stage (focus on management). However, research in the post-production phase, which includes validation, testing and marketing, is lacking. Aleem and colleagues also define a game engine as “a kind of special software

framework that is used in the production phase for creating and developing games. Game engines consist mainly of a combination of core functionalities such as sound, a physics engine or collision detection, AI, scripting, animation, networking, memory management, and scene graphs.” (p. 22-23).

The people behind GameMaker, a 2D game engine, say that some accept 3 stages of game development, but argue that is too simplistic and instead outline 7 separate stages: “planning, pre-production, production, testing, pre-launch, launch, post-launch” (Bramble, 2023). The first two, planning and pre-production, correspond to the pre-production stage summed up by Aleem and colleagues. In the planning phase, the genre, style, mechanics, characters, and engine of the game are decided, and a comprehensive proof of concept is drawn up – it includes the cost estimates, funding plan, timeline for development, human resources and hiring plans, monetization, and publishing. In the pre-production phase, artists, developers, engineers, project leads, and writers work together on a blueprint of the game, setting limitations, making sacrifices, and balancing all these separate aspects of the game before starting the production process. In the production phase, the blueprint comes to life – sounds are recorded, stories are written, models are rendered, and code is compiled. The testing phase goes over everything created during the production phase and checks it for errors, assuring a certain level of quality. Pre-launch covers marketing and making sure as many people as possible hear about the game. Launch covers finishing touches and fixing of any leftover problems. Post-launch covers more fixing of bugs and working on quality-of-life improvements and potentially adding content to the game.

It is important to also examine some of the problems in the industry as they may also apply to the development of serious games. According to Giri and Stolterman (2022), some of the issues in the game development world include the need for:

- better management training,
- a cohesive vision and culture to dictate better hiring decisions,
- tools, models, and frameworks to facilitate communication between the creative design team and the development team,
- more academic training and standardization of game design language,
- seeing the game as a successful product that people want to buy,
- business metrics and data-driven decisions to improve player experience,
- more research into player communities and interactions with the game.

These findings resonate with Ishak and colleagues’ (2021) criticism of agile game development that it may result in poor quality games. For example, *Fallout 76* (Jiang, 2022) and *Cyberpunk 2077* (Isaac & Browning, 2020) faced backlash for having been

released unfinished and full of bugs. The opposite happens less often – in March 2022 the developers of *Legend of Zelda: Tears of the Kingdom* apologized for delaying the game (Nintendo of America), and released it about a year later in May 2023. Perhaps the extra time they took to polish the game and ensure a pleasant experience explains why it sold 10 million copies in just 3 days (Nintendo of America, 2023) and has had overwhelmingly positive reviews.

#### **2.1.4.2 Models for DGBL and serious games**

A study by Ishak and colleagues (2021) analyzed different existing models for DGBL, compared them to an industry game development process, and proposed a framework for DGBL specifically in STEM learning. The authors are critical of the typical agile development style of entertainment games that may lead to lower quality games and state that instead development should consist of “5 main phases: conception phase, design phase, prototyping phase, analyzing phase, and evaluation phase” (p. 6), where the middle 3 stages repeat to modify the design, the prototype, and then redo the analysis. In their model pedagogical input is only explicitly present in the conception phase.

However, according to Dimitradou and colleagues, the educators are the only ones who are in contact with the students that the game targets and “are involved in the user-centered design phases” (2021, p. 135), and as such need to be involved in more than the conception phase. In fact, the authors also found that existing literature barely looks at the role of subject matter experts in the design and development process of serious games, and because of that they suggested another framework. In their framework, they involve the educator in every single stage:

In the preparation stage, the educator occasionally collaborates with the instructional designer, depending on availability and resources. In the stages of concept development, pre-production and production, the educator must find effective ways to communicate, often highly complex content, to the multidisciplinary team, ensuring that learning and game objectives are effectively integrated into a game. Most interestingly, the multidisciplinary team is not involved in the implementation stage, and the educator is tasked with finding effective strategies to overcome implementation challenges through effective strategies for SG promotion, adoption, and curriculum integration. (p. 137)

Being in touch with the target audience makes sense as a lot of games have large communities and companies invest in engaging with them – for example, Steam, the biggest distributor of digital video games on PC, shows not only user reviews that other players can engage with, but also curated community pages where players can post guides, fan art, ask for help, report bugs, interact with the developers, etc. In the same way, in an educational game it would make sense to involve people who are in direct contact with the learners and gather feedback from them.



A more hands-on perspective on the development process is presented by Linderoth and Sjöblom (2019), who conducted two case studies on the role of pedagogical content knowledge in game development. In the first case study, they examined university courses on educational game development and found that the educational goal of the game either became more of an afterthought, or the educational goal had to compromise and fit within the constraints of the game. In the second case study, they examined how a defense college approached making a game – they started with the learning objectives in mind and created the game as an environment where problems emerge naturally, and learners solve them as part of the gameplay.

Linderoth and Sjöblom (2019) also point out that educational games can and should break some traditional design heuristics. For example, they need not have a low barrier to entry like visually highlighting key elements to ensure the player sees and interacts with them, and in turn keeps progressing through the game. The point of the educational game is to present the learner with a certain level and type of difficulty to overcome and learn from. The authors also add that serious games need not necessarily be fun and conclude that the field of game-based learning would benefit from people who have knowledge about both game development and pedagogy.

Another paper detailing the creation of a biodiversity offsetting game, involved stakeholders, students and researchers in an iterative participatory design process and tested how important framing is during the design process (Nygren et al., 2022). The game puts the players in a developer or conservationist role, the former aiming to build on the available land and the latter aiming to slow down land development and preserve biodiversity. The researchers debated what they wanted the players to learn from the game and tested how changing the framing of the problems, mechanics, and roles in the game changed the outcome of what was learned. Nygren and colleagues concluded that the design choices they made affected the message of the game on many levels and that sometimes compromises need to be made between realistically representing the issues in the game and following established game design practices.

## **2.2 Research questions**

To sum up, the literature review of this paper goes over: pedagogical considerations and benefits of DGBL; how serious games have been used in education and what factors may prevent this use; potential issues with negative effects on players, gender bias, and too simple learning games; what DGBL models exist and how they relate to traditional game development and its own challenges; and a bit on the involvement of the educator in the process of making SG.

With all this in mind, this paper aims to uncover more about the process of making a serious game by examining the perspectives of various stakeholders from design and research to business development and operations. This paper aims to answer the following research questions:

1. What are the roles and levels of involvement of different stakeholders in the process of making a serious game?
2. What are some of the challenges that the development of serious games faces?

### **3 DESIGN, METHODOLOGY AND METHODS OF THE CURRENT STUDY**

This chapter reviews the research design of the current study and the justifications for it; the research methodology used and why it was chosen; and how data was generated, managed, and analyzed.

The stance here is constructionist-interpretivist – reality is not an immutable part of the individual, rather it is defined and described through the social and cultural interactions of the individual with others; knowledge is also created through how humans interpret their mutual experiences and construct meaning through them (Howell, 2013). Moon and Blackman (2014) also point out that constructionist research creates understanding of a phenomenon in context; and that interpretivist research looks into particular cases to track how a phenomenon has developed while also making clear the researcher’s presumptions or biases that may impact how data is generated and then analyzed.

In the context of this study, this means that serious games are created through the interactions between all stakeholders involved in making SG and how their own experiences and backgrounds affect what is important to them in the game. A game designer may prioritize visual appeal and gameplay, an educational expert may prioritize learning outcomes, and an organization paying for the development of the game may prioritize reaching as many people as possible – these all need to come together into a cohesive meaningful whole created through the interactions of all parties involved.

In addition, the perspectives of these stakeholders are interpreted through the lens of a novice researcher who has a positive view of video games and has experience as a teacher. These interpretations are further checked by the participants over multiple interactions to ensure correct representation.

### 3.1 Research methodology

Initially, this study aimed to examine how educators and game developers interact with each other and view the process of creating a serious game. Throughout building the literature review and acquiring participants, the focus shifted towards the process of creating a serious game rather than the interactions between stakeholders. Qualitative research methods were chosen not only because they fit a constructionist-interpretivist paradigm, but also because they “focus on discovering and understanding the experiences, perspectives, and thoughts of participants” (Harwell, 2011, p. 148). Ercikan and Roth (2011) substitute the word ‘qualitative’ with ‘low-inference’ research that is conducted to:

... find out how people [...] in a very specific situation make sense in and of their life-worlds, how their everyday ways of acting are patterned (the structures of their practices), and why they do what they do (the grounds for their actions). In new kinds of situations not (or seldom) studied before, this requires researchers to collect materials from which the sensemaking of research participants can be inferred. What is relevant or interesting emerges from a dialectic tension between the materials at hand and the researchers' interest. (p. 233)

Of course, there are drawbacks to qualitative methods, as Harwell (2011) continues to add, because the researcher is taking part in the interaction with the participants and affecting the data generation. This is evident in the choice of topic and the examples given in the literature review – I, the author of this study, am a gamer. I have learned a lot from games, and not just when it comes to the English language – I like games with rich storytelling, life-like characters, and believable worlds. Game series like Mass Effect, Dragon Age, Fallout, The Witcher, Life is Strange, which explore very human topics about hardship, friendship, survival, morality, and more. Playing them is like when I was little and reading books, but I can see the world and ‘live and breathe’ in it instead of just imagining it. Online games have offered me real world friendships and the joy of overcoming obstacles, working together, and achieving victories with my friends. All this made me want to show that games can and do help people grow, learn, and develop.

### 3.2 Data generation

Before going into what data this study aims to generate, what ‘data’ are must be defined. Flick (2018) says there is a debate in the academic community about elicited and naturally occurring data, or between constructing and finding data. This makes sense as in qualitative research it is often difficult to separate the researcher and the research,

and it would be nigh impossible to just find naturally occurring data. The researcher makes a choice where, when, and how to look and that already alters what data is 'found'. Hence, a more guided approach was chosen – triangulate data by having multidisciplinary expert participants and triangulate methodologically by combining semi-structured interviews and member checks.

Originally, observations were planned as well, however, the recruited participants could only talk about games that were already completed. Additionally, some had business partnerships that would not have allowed observation or did not have the time to accommodate multiple or lengthy interactions. To still try to triangulate, the option to play the games they had produced and treat them as documents and artifacts that can be analyzed was explored. This, however, was also not ideal as only one game was in English. Three of the other games were in Finnish, which limited my ability to immerse in the experience. Moreover, the finished product might not be able to tell how decisions about creating it were made. In the end, I did play the games to the extent that I could ask questions about design choices like gameplay, visual style, genre, etc.

### **3.2.1 Research participants**

Some of the people contacted for this study were recommended by teachers from the University of Jyväskylä who were familiar with the study's topic. Others were contacted through the university personnel list if their publications and research interests were related to the topic. Then other universities in Finland and the programs they offered were examined and faculty members working in gaming-related fields whose publications included serious, educational, or learning games were contacted. In this way game studios, individual researchers, designers, and educators from all over the country were contacted. Once interviews started, some of the interviewees suggested others to contact. A total of sixteen companies, organizations or individuals working either directly with serious games, or in the field of game design were contacted. Six either did not answer at all or stopped answering; one declined; four redirected to other people; and five agreed to an interview.

The study's consent form included a questionnaire where demographic data like gender and age was collected because in the process of compiling the literature review it was found that there is a gender bias and even discrimination when it comes to both playing and designing games (Robinson, 2023; Styhre et al., 2018). Out of the sixteen contacts reached out to, only two are female (based on their name and appearance). Out of the five participants who filled out the consent form with its questionnaire and were later interviewed, four identified as male, one as other. The options they could pick from were: male, female, other, prefer not to say. Regarding age, the options in the questionnaire were split by decades – twenties, thirties, forties, fifties, sixties or

older. One participant was in their twenties, one in their thirties, two were in their forties, and one was sixty or older. Answering the open-ended question, *In what role are you involved with serious games?*, the participants described their roles as: developer, researcher, author, educator, designer, executive producer, operative lead, or a combination of these.

The following paragraphs describe each participant in more detail and provide examples of the games they have worked on to provide more context for this study.

Ville Kankainen, a researcher and game designer, has worked on three serious games that were discussed - two digital games and one board game. Frankly (EHYTY, n.d.) is a point-and-click adventure where you can play different characters in order to find Frank, the grandson of the head of the mafia. The game aims at addressing issues like substance abuse, addiction, and interpersonal relationships. Another game, Reptilian Overlords (Tuohimaa et al., 2016; Zet-hanke, n.d.), aims to increase well-being among youth and familiarize them with working life by playing as a recruiter for an international corporation. The gameplay is similar to Frankly in its point-and-click adventure style. The board game, Offsetting Game (Nygren et al., 2022; Tampere University, 2022), aims to start a discussion among the players about land development, nature conservation, and offsetting efforts, which are difficult, if not impossible to balance.

Psyon Games is a game studio specializing in applied games, or games with purpose other than pure entertainment (Lahti, 2023). Their work includes mobile games like FULL ADHD (n.d.), which allows the player to experience life with ADHD through a visual novel with multiple choices, while also learning more about the disorder from the medically accurate information in the game. Another game that is also built on medically accurate information, is Antidote COVID-19 (n.d.), a tower defense style game which teaches the player how the immune system works to defend against bacteria and viruses, including the COVID-19 virus. Two people from Psyon Games were interviewed - Niko Pyrhönen, the Executive Producer, and Valtteri Lahti, the COO.

Lauri Järvilehto, a researcher, developer and author, worked on Big Bang Legends, a game which aimed to teach children particle physics and the basics of the elements. He also worked on Angry Birds Space Solar System. The games are no longer available; however, the focus was on having fun and learning as a byproduct of playing.

Heikki Lyytinen, a researcher in education and psychology, and reading expert, has worked on many games that teach reading skills - Ekapeli (meaning "first game") for Finnish speakers, GraphoLearn, GraphoGame, and currently a game focusing on full literacy. The Grapho series were originally designed to help children with dyslexia, but studies have shown it helps all children improve their reading skills: learning

English in India (Patel P. et al., 2022); reading skills in German for children with dyslexia in Switzerland (Mehringer et al., 2020). Heikki Lyytinen is currently working on games which aim to improve reading comprehension (Lyytinen & Louleli, 2023).

### **3.2.2 Semi-structured interviews**

Semi-structured interviews are an established form of data generation – they have set topics of interest but are not strictly formatted, tend to follow the participants’ responses, and allow for unscripted questions that the researcher may ask based on the participant's responses (Roulston & Choi, 2018). Semi-structured interviews fit the study’s vision well as they allow to focus on specifics and explore further, and to gain a better understanding of how a multidisciplinary team works together and what it means to them to create serious games.

Roulston and Choi (2018) also caution of researcher bias when it comes to what questions are asked and how. Ideas for questions were noted down during the compilation of the literature review, and once the bulk of it was ready, the questions were re-evaluated to keep them grounded in the literature.

The interviews were planned to last between forty and sixty minutes, depending on the participant’s availability and disposition. Five people were interviewed via Microsoft Teams, which was also used to record the interviews, and each lasted between twenty-five and fifty-eight minutes, on average around forty-five minutes. The shortest interview skipped some questions as the participant had to leave early. Additionally, the interviews were conducted in English, which is not native to the participants or the author of this study.

The list of interview questions is available in appendix 1.

### **3.2.3 Transcribing the interviews**

The interviews were not only recorded, but also transcribed by Microsoft Teams, in accordance with university policy (University of Jyväskylä, 2023a). According to Kowal and O’Connell (2014), there are difficulties in translating audio-visual data into written data, and the transcription always reduces the original data, which is why researchers must keep reviewing the audio or video recordings as they do analysis. This is why the interviews were played multiple times: initially to recollect the conversations; then to correct the auto-generated transcripts that Microsoft Teams created and fix misinterpreted words like “value apple” when what was said was “valuable”; then to mark the pauses and segment spoken speech into written sentences; and then multiple times during the analysis.

Kowal and O’Connell (2014) advise to thoroughly consider what is expected out of the data when choosing how to record, organize and analyze it. The focus of this

study is to find out what themes, topics and ideas came up as participants shared their experiences and perspectives. This meant that a very detailed transcription with many layers of information like intonation, notation of interruptions and non-verbal expressions was not needed, but a simpler transcript would suffice to focus on what was said instead of how it was said. The HIAT transcription standards (Schmidt, 2008) were used to keep the data coherent. HIAT denotes short pauses as such: a single bullet point • means less than half a second, •• is about half a second, and ••• means up to a second. Longer pauses, unintelligible speech, and non-phonological phenomena are denoted with double brackets as: ((2s)); ((unintelligible)); ((coughs, 2s)). Uncertainties are denoted with single brackets as: (He) said that. Repairs are denoted with a forward slash: I wanted to do/ to go there.

Here is an example from one of the interviews that includes a repair, a very short pause, and an uncertain word that was not clearly audible in the recording but was referring to the subject matter experts, hence *their* role:

Uh yeah wha-/ yeah it depends of course like uh • what is (their) role in the project?

After this was done, the transcripts were segmented whenever there was a change in the topic with square brackets denoting the start and the end of each segment. A further, more detailed transcription like rise and fall of intonation or comments about the participant's facial expressions or actions was not done.

### 3.3 Ethics and data management

The study's design elements were checked against the requirements for an ethical review set by the Finnish National Board on Research Integrity (TENK) (2019, p. 19) and none of these requirements were met, resulting in ethical review not being necessary. Participants filled out an online consent form which included links to this study's research notification and privacy policy, and a short demographic questionnaire – all written in English. The consent form used the standard template provided by the University of Jyväskylä (2023b). The research notification used the template provided by the University of Jyväskylä (2023c) which detailed the aim of the study and the data generation method in simple, easy to understand language and let participants know that:

- the study is voluntary;
- should consent be withdrawn, already generated data will be used based on public interest;



- the study would consist of recorded interviews lasting between forty and sixty minutes that will take place between August 2023 and March 2024;
- the participants will be contacted again during the data analysis;
- the study could bring benefits to the participants' professional life through insights into working processes;
- the participants will not receive any compensation for their participation;
- the study is not expected to cause any harm or inconvenience;
- the study will result in a master thesis that will be published in the University of Jyväskylä depository;
- and that personal data will not be published unless explicitly agreed to.

The privacy notice used the University of Jyväskylä template (2023d) and detailed that:

- the author of the study was the sole data controller;
- Microsoft services would be used to process the data for the questionnaire, recording and transcription of interviews, and storage of data;
- data would not be disclosed to any outsiders;
- data would not include any special categories;
- personal data would be processed on the basis of public interest;
- personal data would not be transferred outside of the EU/EEA area;
- if explicit consent is given, direct identification will be used as participants are interviewed about their professional work which is already public;
- data will be protected by means of university login ID that requires password and two-factor authentication, and will be accessed via password-protected devices;
- data will comply with GDPR (European Parliament and Council of the EU, 2016);
- research data will not be archived and will be deleted by May 2024.

All five participants agreed to the above and agreed to be named in the study and relevant references to their work be shared.

In addition, prior to his interview, one participant requested a list of the interview questions and received them with the caveat that I may ask additional questions. Then, at the beginning of each interview, participants were asked whether they had any questions about the study or the documentation they received and were reassured that they could withdraw consent at any time. Any questions that came up were answered. Also, one participant had given a public lecture that was uploaded to a video streaming platform and during the interview I asked for permission to refer to that

recording, letting the participant know that even though the recording is publicly available, I cannot refer to it in the study without asking for consent.

Later, when information about the findings was sent to the participants as part of the member checks, it was anonymized and names were replaced with generic descriptors like 'city', 'participant', 'organization', 'game', etc. Additionally, viewing these anonymized findings required email authorization – participants had to log in to view it. Also, through the member checks, participants made clarifications to what they said, and some requested minor alterations be made to their own direct quotes that I had planned to use in the study. I made alterations and added clarifications to the participants' words in the final version of the thesis, just as they had requested.

When it comes to other ethical considerations of the study, there was no prior relationship between the researcher and the participants; all participants are adults; and as far as the researcher is aware, none of the participants are with limited capacity. Furthermore, in one interview one participant said something and immediately asked that it not be quoted and discussed, and it was redacted from the transcript. Tracy (2013) recommends considering how readers would interpret the study and form opinions of the participants. This is why when summing up participants' experiences, and especially when using direct quotes, care was taken to omit any accidentally shared personal data or anything else that could negatively affect the participants.

Regarding the personal information that is published in this study – names, roles, relevant work and places of employment – the decision to offer participants the option to consent to be named in the study was made on the basis that their work is already public. Some have published research articles related to serious games and others appear in popular or news articles about serious games. Additionally, while the data used in the study will not be archived, the references to the work of the participants, including links to articles and websites, remain as public sources that can be used in future research as well as to corroborate this study's findings.

### **3.4 Data analysis**

Qualitative content analysis was used because it is a flexible method, which describes a phenomenon in a succinct, focused way (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005; Schreier, 2014). In addition, the focus is on what is being said and interview transcripts need not include paralinguistic features (Schreier, 2014), which fit the way HIAT was used to transcribe the interviews. The inductive (Elo & Kyngäs, 2008), also called conventional (Hsieh & Shannon, 2005), variant of qualitative content analysis is generally used when the existing literature is sparse and fragmented. The deductive (Elo & Kyngäs, 2008), also called directed (Hsieh & Shannon, 2005), variant uses existing

theory and/or research to formulate coding categories and then fit the data in them. From the discoveries in the literature review, there were a couple of studies investigating a similar topic, but nothing with the exact same focus as this study, and that fit the inductive approach. At the same time, the literature review guided the formulation of the interview questions and could guide initial coding categories like 'platform', 'gameplay', 'age rating', 'subject matter expert', 'challenges' from these interview questions, which fit the deductive approach. In the end, both approaches were used because of Schrier's (2014) description of the coding frame being generated through input from both theory and research, and being complemented by data-driven categories as well, which results in no data being left out because it doesn't fit pre-defined categories.

### **3.4.1 Qualitative content analysis**

This section describes the analysis process and how different approaches to analyzing the data were implemented. The final results will be discussed in the Results section further below.

Following Scheier's steps (2014), the material was segmented thematically, each new segment starting whenever the topic changed. Then the coding frame was made deductively by creating categories from the interview questions. The following main categories were established: participant background; decision-making in the design process; client/expert involvement; challenges; learning objectives; and fun. Some also had sub-categories like 'pedagogical experience' and 'work on games' as part of 'participant background'. Other main categories like 'challenges' were left blank with the idea to populate them with what participants said.

Once this preliminary categorical frame was done, one of the interview transcripts was examined and used to fill in the frame, mapping as many of the answers as possible to these categories. The data that did not fit was left for a second pass to either create new categories or be added to summed up categories. As the categories are mostly level one and two, every piece of data from the first categorized interview was reexamined and checked if it can be combined with another one into a level two or three category. This resulted in new subcategories added under 'challenges' like 'communication' and 'complexity of the process'. Then descriptions of each of these categories were written to be referred to when categorizing the rest of the data or verifying already categorized data.

The creation of a preliminary coding frame concluded by rereading each category and subcategory, their descriptions, and all the sentences that had been assigned to each one. This was done to make sure that the subcategories were mutually exclusive and there was no data in multiple subcategories of one main category.

Then the frame was tested with the remaining interviews, adding new subcategories. The deductive approach ended up with a map that looked like this:



Figure 1 A diagram of the categories resulting from the deductive approach to analysis.

While these categories described the data, they did not show the connections between the categories and how important they were to understand the process of making a serious game. Consequently, inductive analysis started by rereading the first interview and summing up each segment into a couple of words or a short sentence. All these summaries were then copied into a spreadsheet, grouped together, and summarized further. The context of each one and the connections to other categories were noted. For example, how participatory design meant that working with the client/expert was challenging, but how it was also crucial to making sure the content of the game was appropriate for the target audience and that the game did what it was supposed to do. The initial coding frame from the inductive process ended up being more complex than the deducted one and was further expanded by repeating the same process for the remaining interviews, adding details and connections. The inducted coding frame ended up looking like this:

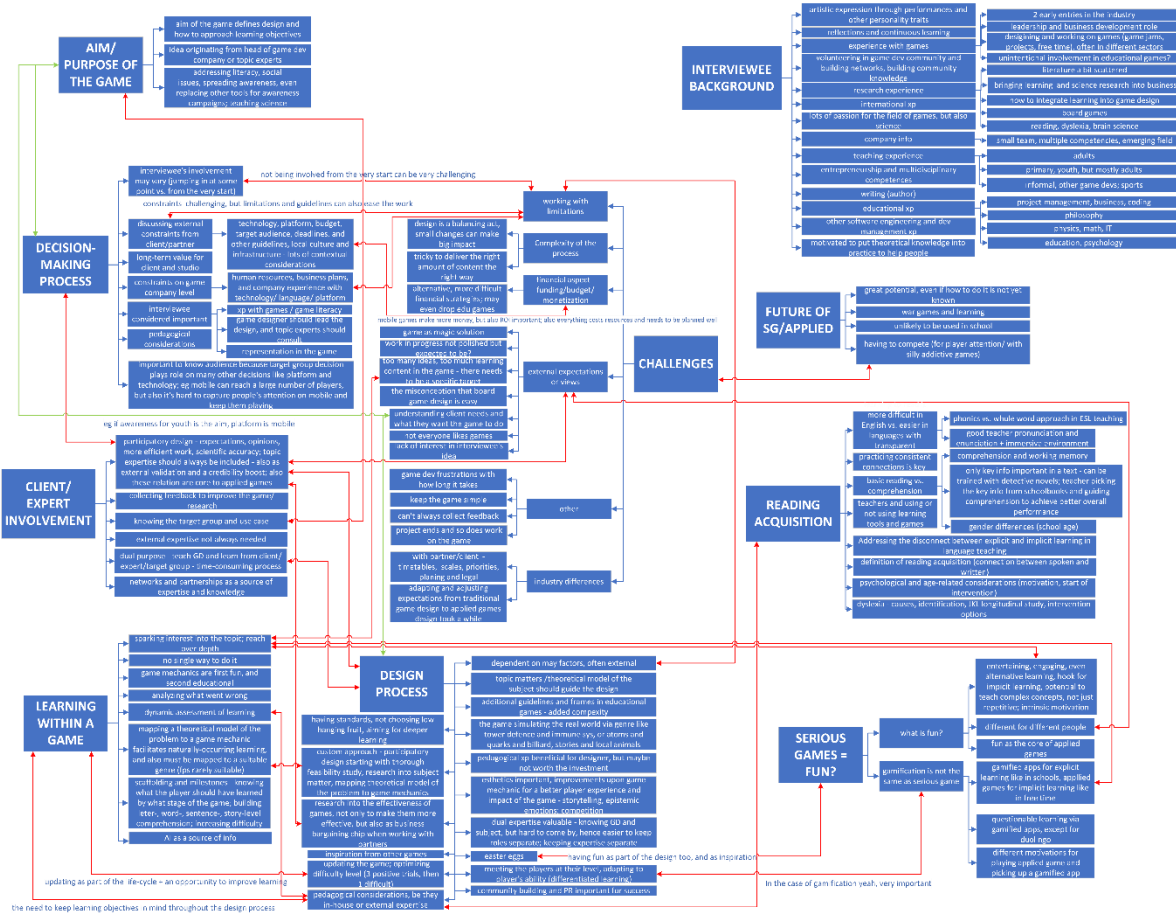


Figure 2 A diagram of the categories resulting from the inductive approach to analysis.

This had gone into too much detail and work started on a categorical map that would be simpler and easier to understand but would still show the connections between categories. The final categories will be presented in the Results section.

### 3.4.2 Member checks

Member checks, also known as respondent validation, aim to improve the credibility of a study's results by asking the participants to give feedback on whether the results represent their own experiences accurately (Birt et al., 2016; Kornbluh, 2015). Member checks, however, cannot ensure absolute representation and therefore need to be used carefully and as openly as possible, accounting for differences in how the researcher and the participants interpret the data (DeCino & Waalkes, 2019). In addition, Kornbluh (2015) has compiled a list of how to tackle potential barriers, mainly: "anticipating potential barriers, conveying the data analysis process with transparency, reconstructing data collection memories & identifying prominent themes, establishing guidelines for theme comparisons, incorporating member checks into data analysis" (pp. 401-402). Some of these were pertinent to the study, but others were not. On the one hand, there was no issue with power dynamics between the participants and me, or between the two participants from the same company as the interviews were about professional work only, did not cover any special data, participation was voluntary,

and in the case of the two coworkers, their roles are on a similar level. On the other hand, it was anticipated it would be challenging to present the findings to the participants, hence detailed logs of what had been changed in the categorization process were kept to explain how the process went and why data was re-categorized, or categories merged.

In the first half of January 2024, the preliminary analysis of the data was completed, and the findings were sent to the participants. The email to each participant included a link to a video where the data analysis process was explained alongside how the two coding frames were created and combined to make sure all data is categorized and represented. A coded transcript of the interview was also sent along with the final diagram of the categories and a set of instructions on how to complete the participant validation. Participants were asked to complete the member check by mid-February.

One participant met up with me shortly after and said the visual map I created gave a good overview of the process but thought that at the core should be the work between a good subject expert who knows the problem well and can explain it in detail, and a good programmer who can implement the subject knowledge into the form of a game. The participant also expressed desire to keep things as simple and affordable as possible, hence relying on the mobile platform and keeping the team as small as possible, ideally just a subject expert and a programmer.

Another participant said things looked good and requested that I send him the final citations I wished to use from our conversation. I complied with that request, sending a draft of the results, discussion, and conclusion sections so that he can see the quotes in context. Based on that, he made some clarifications to the citations, and I reflected them in the final version of this paper.

A third participant returned the annotated transcript with clarifications and additional information and said that the map of the data and the conclusions looked good. Based on these clarifications and additional information, minor additions were made to the findings.

The remaining two participants did not respond by mid-February. However, when all participants were sent a final draft of the Results section in early March, one briefly replied that it looked good, and others requested minor alterations to some of their direct quotes to give more context and clarify the meaning of what was said. I made all the requested changes and clarifications to the final version of this text before the end of March 2024.

## 4 RESULTS

This section describes the final categories of the data in detail and gives examples both as summaries and citations. Any citations used here have been edited for readability by removing repeated words, notations for pauses and non-phonological phenomena. Words put in brackets like (this) mean that it was not clear if that is exactly what the participant said, while words bracketed like [this] provide context.

Here is what the final categories look like:

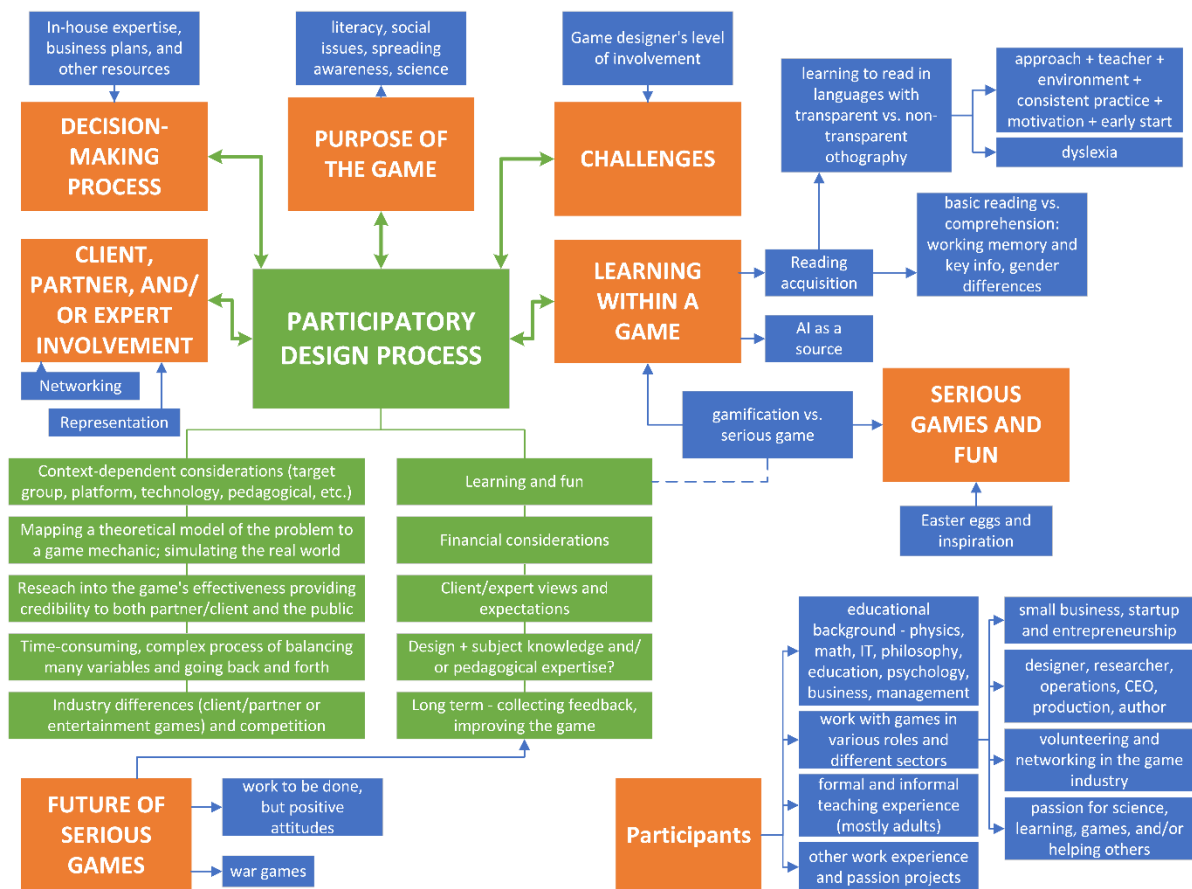


Figure 3 A diagram of the final categories.

There are eight main categories which are represented in orange. How these main categories interact with each other is shown in green. The blue boxes represent either unique cases or very detailed information related to the main categories which was either too general or didn't interact with other categories.

The presentation of findings starts with a description of each main category, including mostly summaries of what participants said, and then goes into detail how these main categories interact with each other in the design process.

The answer to the first research question, what are the roles and levels of involvement of different stakeholders in the process of making a serious game, can be summed in the following way:

Stakeholders can play the role of a client or a partner, an expert, a game designer, or a game developer, and different projects can involve varying number of roles. A client or a partner is often an entity from outside of the gaming industry that is looking for a serious game that could be utilized to serve a purpose in their own field. An expert is someone with subject knowledge directly related to the topic of the game. A game designer is part of the game development team and is responsible for conceptualizing the game, designing the game mechanics (how the game works) and what the player experiences. A game developer is usually a game development studio which transforms the game designer's work into a playable game through various tasks like programming, testing, and sometimes even publishing. The levels of involvement of each of these roles can vary depending on the project – only during conceptualization, consulting at different stages, or throughout the whole process. More details on roles and involvement are available in sections 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.8, 4.2.9.

The answer to the second research question, what are some of the challenges that the development of serious games faces, is that the majority of challenges revolve around the added difficulty of the serious element in the game and how to balance them with the fun engaging experience of a game, and how complex and time-consuming that process is. More details on the challenges can be found in section 4.1.6 in brief, and in the whole second half of the findings, section 4.2, which goes into more details and links how challenges relate to the different roles and levels of involvement.

## **4.1 Main categories**

### **4.1.1 Participants**

This category describes what participants shared about their educational and professional background.



Their educational backgrounds are quite varied and include physics, mathematics, IT, philosophy, education, psychology, business, and management. Some have formal teaching experience, primarily teaching adults in university, but also younger groups in project work. Some have informal teaching experience, mostly relating to supporting peers throughout their studies or volunteer work.

Regarding their work with games, they have done research on games, both as testing the games they have created, but also looking into how learning, fun, and game design come together. Some have done volunteer work in the game development industry, supporting local developers, or working on socially significant projects.

One common thread was that all shared a passion for science, learning, games and helping others. Another common thread was that the businesses they started and/or work for are of small size and required a wide range of skills.

#### **4.1.2 Purpose of the game**

This category describes how important it is to understand what the game aims to do because that would also affect design decisions. Here participants talked about understanding the needs of their clients or partners, or the aim of the project – raise awareness, teach a skill, act as a source of information. The purpose of the game was often described as the starting point, and as one participant said,

I think that is maybe the key issue for games like this. Trying to figure out what we want the game to achieve. Is it to teach something or is it to convey some message or opinion about something... (Ville Kankainen)

A key aspect of understanding what the game has to do is related to the target group that it is trying to reach. A game like *Ekapeli* that aims to improve the literacy skills of early readers is very different from a game like *Frankly* that is trying to address issues like addiction and gambling that youth face. Talking about *FULL ADHD*, Niko Pyrhönen described how the team first explored the topic in close collaboration with Takeda Finland and then grounded it to the context where the game would be applied, “The first market was targeted in Finland. So, what's the situation in Finland? What do we need to know more about ADHD in Finland? What kind of awareness do we want to spread inside Finland?”

The answer to these questions also tied the purpose of the game closely to the target group as it was middle aged people in Finland who needed to be made more aware of what ADHD is and how its symptoms manifest.

#### **4.1.3 Decision-making process**

This category describes how and why decisions were made and who made them. Often some decisions had already been made by the client or partner, like the aim of the

game and the target group, and that would in turn decide what platform or game mechanics to use. For example, two separate mobile games had set audiences that the client/partner wanted to reach to increase awareness about the topic of the game: one targeting adolescents and youth, and the other targeting a middle-aged audience. But the game mechanics and gameplay were different – the younger audience played a real time strategy, while the middle-aged audience played a visual novel. In addition, sometimes decisions were made directly with the target group, often during different stages development like:

... if you have this starting workshop or meeting or at the beginning of the project (to) conceptualize the idea together with the target audience. [The game] is then developed to a certain point and when there are these big decision points so to speak [...] then you can have a workshop or discussion with the target audiences and (ask) should we do this kind of decision or that kind of decision? (Ville Kankainen)

Other decisions were made because of what experience and resources the company had, be that expertise in certain programming languages, an already tried and tested business model, or available staff and time. For example, in the development of *Big Bang Legends*, the team toyed with the idea of including more elements from the periodic table but realized that "... just the artistic resourcing we would have needed to be able to design three versions of 110 or so characters would have been just impossible for us early-stage startup" (Lauri Järvillehto). In the end, only the first ten elements of the periodic table were designed and implemented into the game.

As one participant put it, "depending on the goal of the design and the problem at hand, it always varies what needs to be taken into account." (Valtteri Lahti)

Overall, the participants reported a thorough and involved decision-making process, often discussing with the partner or client, and in some cases organizing workshops to involve the target group in some decisions.

#### **4.1.4 Client, partner and/or expert involvement**

This category describes how and to what extent clients, partners and experts work together with the game developers on a product. Clients and partners could be private or public companies from other industries, and experts may come from these clients and partners, but may also be external. For example, a client could be a public healthcare provider who hires the game developer. A partner could be a university which conducts studies on the game that the game developer then presents to the client. Expertise on the healthcare topic that the game addresses could come from the client and/or partner, but it could also come in the form of an external consultant.

This was where networking and having connection within and outside of the game industry came in. As one participant put it,

We collaborate with people that have come along our way in the past or we make use of the relations of the client/partner organization. They usually have good, very good relations and it's then a process of finding suitable experts; first identifying what expertise we need and then finding people who (fit) that profile. (Valtteri Lahti)

The levels of involvement also varied. Sometimes a lot of the blueprinting work for the game was done together and then the development team and the experts continued checking in as development progressed. Sometimes, like in the case of the *Off-setting Game* ideation workshops were done at the start with everyone, then the designers worked on the game, and later everyone reconnected to test and get feedback on a prototype. What varied was the involvement after the game was out. In some project-based cases once the game was out involvement ceased, but in other cases exchange of metrics data and feedback continued after the game's release.

In addition, the importance of representation in the game also came up in the form of experts by experience:

Do we need subject matter expertise possibly? Possibly experts by experience, like in the case of the ADHD game which is based very largely on actual tales of people living with ADHD. So that we really try to speak in their voice. Representation – it's very important when we are talking about experiences that belong to a certain group of people. (Valtteri Lahti)

While representation came up directly only in one interview, Ville Kankainen said that in the making of *Reptilian Overlords*, workshops with youth that the game was targeting were held, because the design team wanted to find out what kind of a game the youth would like to play so they could customize it for them. During the member checks he clarified further that the point of having the participatory design was to indeed represent these young people as best as possible.

#### 4.1.5 Learning within a game

This category describes what was said in relation to the learning objectives of the game – how to integrate learning into the mechanics and gameplay, what pedagogical considerations there would be for the chosen target group, the motivations behind playing a serious game compared to using a gamified application to learn, etc.

One of the subcategories here, reading acquisition, focuses on the specifics of learning to read that Heikki Lyytinen pointed out:

- The difference between basic reading skills and reading comprehension – the need to focus on the key information in a text in order to understand it, and differences between reading habits of boys and girls and how they affect comprehension.
- The difference between transparent orthography like in Finnish and opaque orthography like in English and how that affects learning to read. In English, letter combinations can have multiple different pronunciations, and sometimes different letter combinations are pronounced the same way. There is no such phenomenon in Finnish – letters and letter combinations are always pronounced the same way.

- The importance of the teacher in supporting the pupil in an immersive learning environment with consistent practice and motivation.
- Additional considerations to all of the above when it comes to dyslexia.

Another subcategory relates to the mention of AI as a source of information when trying to learn new things. The example given in the interview was that improved literacy skills would help the population in rural areas to access AI services like ChatGPT to get new information that is not as easily accessible in their location.

A third subcategory deals with the differences between gamification and serious games. The topic did not come up in one interview, but the other four participants made a clear distinction between the two: in gamification, the focus is on learning and motivation comes from wanting to learn, while fun is secondary; in serious games, the focus is on having fun and that is also where the motivation comes from, and learning is part of the process of playing and progressing through the game. In addition, participants said gamification may be more suitable for structured learning like in schools, while serious games would work better outside of school.

#### 4.1.6 Challenges

This category deals with the various challenges that the creation of a serious game faces – from communicating with the client, partner, or expert, through balancing learning and fun, all the way to financial and business decisions. This is very interconnected with other categories and the challenges depend on a multitude of factors like target group, in-house expertise, budget, purpose of the game, various limitations and constraints, etc. Most of these challenges will be revealed in section 4.2, however, one thing that came up in only one conversation was the level of involvement of the game designer and how he was not involved in some of the decision-making process. He saw that as both challenging and positive:

It wasn't my decision to decide what to use. But I think that is typical. As a designer you jump in at some point, and you don't get to make that decision of technology. There (are) always these structures and things that define it and... But I feel that (is) actually a good thing for the design process because it gives you certain design constraints that you have to use to figure out what kind of game you make. And that actually I think helped making more interesting games than if you would have completely free hands to do whatever you want. (Ville Kankainen)

While this challenge was uniquely related to the level of involvement of the game designer, the overall attitude towards challenges was similar. Challenges were seen as par for the course and as something that can be worked through in due time.

#### 4.1.7 Serious games and fun

This category describes the relationship between serious games and fun and connects to the category 'learning within a game'. However, it is different from it because the focus is on fun, and the link to learning is through the discussion on gamification, serious games, and motivation. In essence, it addresses definitions of fun and the elements of design that contribute to engagement and fun – aesthetics, customization and player choice, and other ways to appeal to the player.

Something that came up in one of the interviews was the addition of easter eggs to *Big Bang Legends* as inspiration and having fun during the design process. Lauri Järvillehto said “whenever we visited CERN, [the lead designer] would take photos of all the kind of funny buckets in the yard there and stuff like that. And then he would use those as grounds for making the enemies.” An easter egg is “a hidden surprise or extra feature that is included in something such as a computer game” (Cambridge Dictionary, n.d.) and can serve as motivation to explore the game.

Another consideration that came up was the importance of knowing the target group well because different people have different ideas of what fun is and it is difficult to match everyone’s expectations.

Everyone agreed that serious games should be fun, however, Ville Kankainen made an interesting comment that was later followed up on in the member checks, “Definitely, educational games should be fun- / well, engaging. I'm not saying fun.” He clarified that fun is subjective and difficult to define, but also that people do not always play games for fun, for example sad games that address war, depression, or other similar topics that can be engaging without being fun.

#### 4.1.8 The future of serious games

This category describes the future of serious games and how this niche of the gaming industry could be explored further. All participants unanimously agreed that there is a future for these kinds of games and different applications, be it in or outside of school, and despite the challenges of figuring out a working business model and balancing learning, game design and the needs of all stakeholders.

With Ville Kankainen we discussed the idea to research war games further, specifically from the point of combining design and learning in board games. He said:

...we should actually look more into military universities because they've been using games in their education since the Kriegsspiel back in the early nineteenth century. [...] I've been working a little bit with my friend (who) is war researcher. We wrote an article about this because these tabletop war games also have lots of potential for education and lots of these educators actually play them. And many people who are doing entertainment board games, their background can be in the military or intelligence agencies.

Kriegsspiel is referring to a training exercise that the Prussian Army created that simulates the fog of war where only the game master knows everything that is happening, but not the players (International Kriegsspiel Society, n.d.). This both simulates the real world and forces players to rely on known strategies, critical thinking and available information to make decisions and improvise – skills that education also aims to promote and develop.

## **4.2 Interconnected categories**

This section goes over the participatory design process where a lot of the main categories intersect in such a way that it is difficult to separate them without losing contextual information. A lot of these are challenging, not just because of the combination of factors that need to come together in a good way, but also because they take time, have to be negotiated, and need to work within various limitations and constraints.

### **4.2.1 Context-dependent considerations**

This category describes what needs to be considered when talking about: the target group and the pedagogical needs or approaches specific to that target group and the problem or topic at hand; the choice of platform; the aim of the game and how that works on the chosen platform for the chosen target group in the context of the country where the target group is located. These considerations change depending on the game that is being made, who it has to reach and how.

Ville Kankainen described having participatory design workshops with the target group, which the researchers used to both teach game design to the youth and get ideas about what kind of game they would like to play, especially when it came to “the aesthetics because that also matters. We wanted to do something like that. And in that project, we discussed that with the youth in the workshops – discussing and deciding what kind of aesthetics we are going for.” During the member check, Ville also added that the desired aesthetics, gameplay, sound design and more would also influence the choice of platform and game engine that can support them.

Pedagogical considerations regarding the target group include matching the seriousness of topic to the age of the students, understanding the local school system, and working within these limitations:

For example, our goal in this project, if we ever get funded, is to develop it for upper secondary level of students because the topic is probably a bit difficult to grasp for younger kids and also because it's for the Finnish school system and schools so that again constrains this. (Ville Kankainen)

The above example also features an interjection about the financial challenges in such projects that concern game development in academia.

Another example shows pedagogical considerations for young learners who are just starting to learn to read – building on what they already know, gradually increasing the difficulty from letters to words to sentences to whole stories, building connections in the readers’ minds, and constantly assessing learning in order to make corrections as early as possible:

We need only 10 animals which they know. And we use animal names. And we teach each of the letter sounds using these animals. And then, when they have learned this basic reading skill, they start to listen to stories. And when they listen to the stories, they see the story written down at the bottom and read going from one word to the next, always showing the word which was just sounded out. [...] For (complex) games the most important concept after connection building concept is dynamic assessment. Because if we wanted to teach something well enough, we have to open any bottleneck they find immediately after it has been observed (so) that this connection has not been stored yet. (Heikki Lyytinen)

A third example showcases using levels and chapters of the game to increase difficulty and tier the knowledge that the player attains. And while assessment of learning was not discussed, not passing a level could imply not having learned enough to pass it and could push the player to review how different immune cells work together and devise a better tactic to beat the level.

With *Antidote COVID-19*, if the player plays through the campaign, then we can say that the player knows how COVID-19 works really well, but if the player plays for X chapters of the game or X levels of the game, then the player should know basics of COVID-19 and what a vaccine is and how it affects COVID-19. (Niko Pyrhönen)

Regarding the choice of platform and technology, Ville Kankainen said it sometimes came from the in-house expertise and experience, “because it was a small company and they had expertise in this kind of technologies and platforms. They had already done some games using similar technologies.” However, when it came to making mobile games, there were other factors like the aim of the game:

...our mobile games so far, they have been all about some kind of health awareness topic. And when you are doing awareness, it's really, really much about how many people you can reach and how long you can engage them in the topic. So, mobile is really kind of your ultimate tool for maximum reach. So, it's kind of a simple decision there. (Valtteri Lahti)

Lauri Järvilehto also noted that, “Finland is kind of the world capital of mobile game design. And as a business case all the other platforms are nowhere near,” adding that compared to PC games, “a leading global free-to-play mobile game can clock even two to three billion in terms of annual revenue.” In this sense, not only country-wide experience with mobile games, but also the financial affordances of mobile games play a role in choosing the platform.

### 4.2.2 Theoretical model to game mechanic

This category describes the idea of researching the problem that the game is aiming to address, finding a theoretical model of that problem, and then mapping that theoretical model to a suitable game mechanic. This strengthens the connection between learning and play, and also simulates the real-world problem that the game is addressing.

In *Antidote COVID-19*, a tower defense real time strategy was employed to imitate how bacteria and viruses attack and how the immune system would react and defend, and how different immune cells work together to fight off the invaders.

The process was similar in another one of Psyon Games' products, *FULL ADHD*, where Niko:

...tried to find some theoretical model of ADHD. After hours of searching, I found Dr. Brown's model, which is an expanded model to describe the complex cognitive functions impaired in ADHD. This model described executive functions, the cognitive management system of the human brain. The expert psychiatrist involved in the project, Dr. Asko Niemelä guided us in the process, validated the proposal for a theoretical framework and provided us with valuable literature sources that helped us come up with suggestions that would gamify Brown's model in an easily understandable yet meaningful way. (Niko Pyrhönen)

Lauri Järvillehto also described a similar process for the game *Big Bang Legends* which is about elementary particles:

We took the whole game team, so the designers, artists, and everybody, to CERN. We had this one-day workshop with CERN experts, they were sharing just current understanding about how elementary particles function and what they're composed of. And then we drew elements from that and then the game designer started looking for ways to employ the learnings from CERN as game mechanics. And then that led to the idea that the game would be about collecting quarks and then building products out of the quarks.

Having such a strong relationship between the theoretical model of the problem and the gameplay was seen as an important way to have the learning come in implicitly as the rules of the play and allow players to focus on having fun without realizing that they are also learning.

### 4.2.3 Research on the game

This category describes the importance of doing research on how effectively players learn through the game, not just as part of the development process, but also as a necessary part of negotiating with clients and partners, in addition to gaining public approval and confidence.

As is typical in the field of education, what children learned from playing the game was studied. Lauri Järvillehto said that:

... with *Big Bang Legends* what we would see in game testing, and we tested it in dozens of schools in Finland, Slovakia, even Cambodia and Uganda, and what we found out is



that because you have to very quickly learn to understand that you need to have three quarks to make a proton and that you needed to have a set amount of protons to be able to make a particular atom. So then even after like 15-20 minutes of gameplay, the students will be able to answer questions like how many quarks does it take to make a proton or how many protons do you need to make something like a carbon atom.

Assessment of learning via scientific study is valuable to teachers and parents who would like to use the game. In addition, such a study can be “the most important validation that we are currently using in partner and client negotiations because we need to prove that games can work well for information delivery and it's not only for boosting marketing performance of the campaign or similar KPIs” (Niko Pyrhönen). KPIs refer to key performance indicators, which is a metric that measures the progress a certain business has made to achieving its goals (Cambridge Dictionary, KPI, n.d.).

Often such research can be conducted in-house as development teams that work on serious games tend to have pedagogical expertise and sometimes even subject matter expertise, however, sometimes it is better to have someone else conduct such studies. Valtteri Lahti stressed that “having an external expert who does not have vested interests in your company comes out more credible for the audience outside.” In addition, such impartiality would improve the credibility of the claim that the game really does serve its applied function, be that to raise awareness or educate.

#### **4.2.4 Complex and time-consuming process**

This category describes the complexity of making a serious game – creating a detailed plan, making various business decisions, negotiations with the client and partners about what to include, how much and in what way, and trying out different design ideas to find out what fits the budget and other constraints.

When asked how he approaches the design process, Ville Kankainen said, “... in educational games there are, of course, some kind of frames, design guidelines, like what is the topic and so on and... So, I think that is... kind of difficult to say.” During the member checks he elaborated that when working on educational games, there is a set of frames:

First, there are the frames of education, then there are the frames of the topic that is being educated about, and finally there are the frames of practice, which includes the scarcity of resources, what part of the project you jump in, etc. (Ville Kankainen)

Ville further added that each of these frames can be seen as design constraints that can be rigid or flexible to different extents, and it would be good for him as a designer to know what is set in stone and what is not.

In a different take, Lauri Järvilehto had this to say about the complexity:

...it's really, really hard to make a good game that converts well in terms of a business. Supercell [a big mobile game studio from Finland], for example, they've launched five

games up to date and they've developed dozens or even hundreds of games that just don't perform well enough. So that gives you an understanding of the order of magnitude of the challenge. And then if you throw in addition to this also the pedagogical content and the subject matter, it becomes an order of magnitude higher in terms of complexity. [...] finding the balance between the gameplay and the subject matter is already one massive challenge and then balancing all of the above with financial conversions, becomes economically or mathematically, just really, really challenging.

Communication between the development team and the client, partner, or expert, was described as a time-consuming process when it came to understanding what the game has to do and what is the best way to do it. In a sense, the most time-consuming parts of the process are the planning and pre-production phases, and after describing that process to me, Valtteri Lahti ended with, "Usually, it takes over a year even for a simple game just because of the rigidity of getting your facts, representation and cross-industry compliance correct."

Additionally, Lauri Järvilletho described having a few different ideas for *Big Bang Legends* like making the game multiplayer or having a Pokémon-like system of collecting items and using them to level up but discarding these ideas due to complexity and high development costs. While it was not specified in the interview, this would take place during the pre-production phase.

#### **4.2.5 Industry differences and competition**

This category describes the need to navigate how the clients' or partners' industry operates and how that affects business plans, contracts, and even legal considerations from the point of view of a game studio. In addition, compared to traditional game development, competition is complicated by the different way serious games are developed, and there needs to be careful planning when it comes to reaching and retaining players as people might give the game just one chance or just a few minutes.

Niko Pyrhönen gave this overview when asked about the challenges in his line of work:

The nature of different kinds of industry. The game industry is really agile and fast working and of course, we, as a small company, need to have our product pipelines designed or planned beforehand. And we really need to know things as soon as possible and we can work really fast and agile with the design, for example. But then with life-science and healthcare industry, with big NGOs and big clients, they are really slow with their decisions and budgeting and everything. [...] But it's been how [partners] work is so different and that causes big, big problems in production and planning. And when we sign papers, for example, and on the legal side as well, and analytics and data collections. There's a lot of things that we need to do really carefully compared to traditional game development.

Lauri Järvilletho spoke about children playing mostly entertainment games and shared his dream to:

...create a learning game that would become a massive hit and clock in the billions. It would also redefine the mobile game market so that more companies could be incentivized to build these types of games rather than just silly games.

I interpreted the above as there not being a lot of incentive to make more meaningful games that add value to the player rather than being something to just pass the time, especially in the mobile market which was the focus of the interview. This lack of incentive could be partly because of all the additional challenges, but also because serious games would inevitably compete with silly games made for the sole purpose of having fun.

#### **4.2.6 Learning and fun**

This category describes the challenges of balancing learning and fun, as well as using fun in order to hook the player into learning. In addition, it was said that fun is different for different people, requiring good knowledge of the target group. The term serious games and how that relates to what fun is was discussed with some participants.

When it came to balancing learning and fun, Lauri Järvillehto had this to say:

There was constant tension with the designers with respect to ((unintelligible)) how much learning can we actually incorporate in the game so that we don't lose the fun aspect of the game. And I think that's the holy grail question of creating compelling learning games.

In addition, Niko Pyrhönen also talked about looking for ways to improve both the learning and fun aspects of the game once they had chosen a suitable game mechanic, and added that:

If it's not fun, you don't want to play it. Applied games should always be fun and the motivation does not come from that you want to learn something. It comes from wanting to have fun and while you are having fun, you are learning something, and you might not even know that you are learning something. Purely educational games are different. Those can be built so that the player's motivation comes from wanting to learn about the topic. Then it's possible to make the game perform better for education and less for entertainment.

Psyon Games defines applied games as having “a purpose beyond entertainment” including educational purpose, process gamification, professional tools, lifestyle goals and more (Lahti, 2023). This paper's definition of serious games as games that teach a skill or content knowledge fits within Psyon Games' broader definition of applied games.

#### **4.2.7 Financial considerations**

This category presents some of the financial considerations that need to be made when creating a serious game, including the difficulties of securing funding, different ways

of monetizing the game, and even having to make business changes because of financial reasons.

While describing one of his current projects, Ville Kankainen casually mentioned “if we ever get funded” and during the member check elaborated that it is always challenging to secure project funding for academic game development.

Lauri Järvillehto also gave a good overview of the financial challenges the company he started, Lightneer, faced, and different ways of monetizing *Big Bang Legends*:

...throwing the financial, the business conversion into that process and that was really what caused the most trouble - that we couldn't come up with the strategy of how to employ... We ended up making a free-to-play with them there, but we were all a bit uncomfortable about this idea, especially because we wanted this to be available and fun for very young kids, and having a free-to-play earning mechanism for kids - that has all kinds of ethical pitfalls that we weren't very happy about. [...] And eventually, if I had continued as the CEO, I actually would have launched the game. We already set it up in that way before I stepped down as the CEO. I would have launched the game with no conversion mechanism at all, which is like this - I would have just made it a free game and then built merchandising and stuff like that. That was the last strategy that we're looking into.

After *Big Bang Legends* was pulled off the market, Lightneer changed their business to hypercasual games, which have a low barrier to entry and are easy and simple to play.

In a talk at Aalto University, Valtteri Lahti (2023) goes into further detail about different funding and monetization options on a business level: public projects are often not monetizable and difficult to scale as a business; while in private projects there are more flexible options, but it takes a lot of iteration back and forth, and monetizing end-users may still not be an option.

As the topic of how games make money came up a couple of times, I am including Klimas' (2019) investigation of revenue streams that Polish video game developers use and the explanations of how each of them works. Klimas described three main categories: selling paid games, where the game has a fixed price to pay before the player can play it; selling free games, where the player can play without paying; and selling licenses, where the game engine or game assets are available to other developers or the public for a fee. The mobile market (smartphones and tablets) is primarily using a free-to-pay model in which “the game developer generates revenue either from micropayments or from advertisements embedded inside the game” (p. 129), and which also generates the majority of the revenue in the industry. In addition, Klimas points out that gamification and serious games tend to fit a made-for-order model where small and medium enterprises make these products for companies from other industries (p. 133).

In that sense, the ethical pitfalls that Lauri Järvillehto referred to when talking about *Big Bang Legends* could be related to the idea of having an educational game where kids are served advertisements or have the option to make small payments. In

turn, Psyon Games' model fits the made-for-order description where they make their games in partnerships with other industries.

#### **4.2.8 Client, partner and expert views and expectations**

This category describes the challenges of managing expectations from clients, partners, and experts about what can be done in a game and what the process entails.

One participant described facing the misconception that it is easy to make board games, another spoke of government officials not believing the game he was making was needed, and a third described facing 'games are just for kids' views.

Ville Kankainen said the following about how much educational content was expected to be put in the game:

I think that the main challenge is that [the experts] have very huge ideas for everything. Everything is important for them in the topic so they would like everything to be in there, and to realize that games can only teach that much.

This notion that a game cannot have vast swaths of knowledge came up in other interviews too, specifically in the idea that a serious or an applied game would invite the player to explore a bit of the subject and spark interest in it in a playful, enticing way, and as an invitation or a hook, it cannot overwhelm the player with subject matter. The challenge there also lies in explaining this to the client, partner, or expert, and working together to prioritize what is an absolute must-have, and what can be forgone, because everything takes resources and time and adds complexity.

#### **4.2.9 Dual expertise**

This category describes the different opinions on whether it would be necessary to have a person who is an expert in both game design and the subject the game is addressing, or perhaps game design and pedagogy.

One participant saw pedagogical expertise as a way to understand the target group and the context where the game would be used:

I definitely think [pedagogical expertise] will be valuable, especially when doing a game for younger kids and when doing an educational game, for example, for a school environment. That is of course important, to know the learning objectives or pedagogical goals there to make the game as usable tool for the educators as well, so it aligns with the goals that they have there. (Ville Kankainen)

Lauri Järvillehto felt strongly about expertise in both game design and the subject matter:

... I think it may even be the case that in order to make the game like we tried to build work, the lead designer would also need to have a pretty deep understanding of the

subject matter. This idea that we would have the experts separate and designers separate – it worked, but it could have worked better.

Whatever the preference or the ideal scenario, Valtteri Lahti summed it up like this:

Small / early stage studios don't have the luxury of choosing that. You work with the people you meet and come along (your way). And if you were able to recruit to your team people who have lots of subject expertise about both your core business and the stuff that you are making games for, great. But these people are rare.

In the end, it may be best to source expertise from a business network and a client's or partner's business network, and, as mentioned alongside the importance of research, outside expertise would add credibility to a business' product and claim.

#### **4.2.10 Long-term thinking**

This category describes the long-term thinking of stakeholders and the desire to collect feedback and keep improving and updating the game in various ways. And sometimes that is also the issue – the lack of long-term involvement.

One participant who has worked on a number of projects had this to say:

When the game is done, then you need to collect feedback also from [the experts]. We did that in *Offsetting Game*. Certain projects that is the issue - that you maybe cannot do that. [...] But I think the problem with these kinds of projects often is that there is no extension to the project (so) that you could develop the game after it is ready or needs to be ready. (Ville Kankainen)

Long-term viability is also a shared goal between the studio and the investors:

We definitely think in terms of long-term value. We don't just put the product out there and leave it be. And that's also not the way of thinking for our clients and partners. It's a big investment for them as well to create the product and of course they want to make the most out of it. (Valtteri Lahti)

Talking about *Big Bang Legends*, Lauri Järvilehto also expressed intent for long-term support, “if we had kept on evolving the game, we would have been able to go even deeper with the learnings eventually.”

This long-term thinking is also present in education, where children spend a significant time of their lives and grow into adults. This is why researchers are constantly working on improving teaching practices, teacher training and educational policies.

## 5 DISCUSSION

This section connects this study's findings to existing literature on the topic of serious games and discusses common threads and points of divergence.

When it comes to pedagogical considerations, the use of design elements like a feedback system, theme and narrative, points and levels (Govender & Arnedo-Moreno, 2021) connects to what participants said about improving the game's appeal through enticing visuals and immersive storytelling, and also finding a way to map a theoretical model of the problem in the game to well-established game mechanics. In addition, the criticism that DGBL in language seems to test vocabulary, but not more complex skills (Govender & Arnedo-Moreno, 2021) and that literature lacks detailed descriptions of expected learning outcomes and how they are measured (Tokac et al., 2019) connect to both the limits of how much learning can be implemented in a game, as well as the idea of using serious games as an enticing tool spark interest to learn rather than using them for more focused learning.

The literature review brought up various barriers to using games in school (Avidov-Ungar & Hayak, 2021; Kaimara et al., 2021) and while this was not directly discussed in the interviews, the idea of having participatory design where teachers as experts are more involved in the design of serious games would help overcome some of these barriers and design the game with more tangible learning goals and outcomes in mind. This would also confirm the idea that the educational expert needs to be involved throughout the development process (Dimitriadou et al., 2021). The need for more pedagogical information was echoed by Ville Kankainen, and the very involved communication with the client, partner and/or expert in Psyon Games' business model demonstrates that participatory design is necessary.

This participatory design process, which also includes research into the effectiveness of learning through the final product, would help address some entertainment game industry challenges that Giri and Stolterman (2022) listed like player experience and dynamics research, content-specific analytical data, and process metrics. In

addition, further research into tying these with learning assessment and analytics would also improve the educational content and goals of serious games.

Other criticism like agile development sometimes resulting in poor quality games (Ishak et al., 2021) seem to not apply to serious games when stakeholders from other industries are involved and the game goes through a rigorous quality assurance process. The small size of game studios working specifically on serious games and the higher level of involvement of each member could help deliver a good product as well.

This study's findings also connect to Linderoth and Sjöblom's (2019) conclusions that serious game design has to do some compromises with established game design practices, and that dual expertise would be beneficial. What this study's participants disagreed with was the element of fun – most of them said it is a must and one pointed out that 'engaging' would be a more suitable term than 'fun', while Linderoth and Sjöblom stated that fun may not be necessary. That too would connect more to gamification, where fun is not a must, but engagement and enjoyment are often used as metrics.

Something that was not talked about in the interviews, but was confirmed when looking for participants, was that gender bias towards men in the entertainment game industry (Styhre et al., 2018) that also seems to exist in the serious games niche. As only two out of the sixteen people contacted are female, this raises the question how that affects the learning games that are being created, especially if they aim to be used in the classroom where there are more female teachers.

The other two topics addressed in the literature review, but not in the interviews, were gaming addiction and the rating system PEGI. While these are potential barriers to games in general, it remains to be investigated how they relate to serious games in particular.



## **6 CONCLUSION**

### **6.1 Summary**

To sum up, this study found that serious game development would greatly benefit from a participatory design process as there are various challenges on a business level, which are further complicated by having to incorporating learning into a game and balance the needs of other stakeholders.

While the data could be separated into eight main categories, five of them interact with each other in a way that is difficult to separate – the purpose of the game, which is often dictated by the client or partner, affects the decision-making process, and often defines what needs to be learned in the game. This makes the design and development process challenging in every stage. Which is why it is important to treat this study as further evidence of the need to involve the subject matter experts and the educational experts throughout the whole process of making a serious game.

### **6.2 Reflections on and assessment of research**

Tracy (2013, p. 230) details eight criteria for excellent qualitative research: worthy topic, rich rigor, sincerity, credibility, resonance with the reader(s), significant contribution, ethical, and meaningful coherence.

My topic was relevant not just to me and to the five wonderful participants who volunteered their time to explore it with me, but also to current research trends focusing on digital game-based learning. I chose to look at the process of making a serious game because I could only find two articles that examined and proposed frameworks

for how that process should take place (Dimitriadou et al., 2021; Ishak et al., 2021), and they proposed different levels of involvement for the educator. Also, as the topic crossed between two fields of study, I had to define and explain concepts from both fields in an accessible way and also connect them. I had considered it important to make a distinction between gamification and serious games in my literature review, and during the interviews, participants brought that same point up unprompted.

My study was rich in rigor to the extent of my knowledge and abilities, and while I could have gone deeper with the literature review and that could have resulted in different findings, I made sure that I did the best analysis I could with the data that was generated through this flawed literature review. In addition, the methods used fit the aims of the research and worked in tandem – semi-structured interviews allow exploration of participants' experiences (Roulston & Choi, 2018), qualitative content analysis then categorized these experiences (Schreier, 2014), and member checks ensured the analysis and interpretation of these experiences was consistent with the participants' own interpretations (Birt et al., 2016). Moreover, analysis was bidirectional to ensure that no data was missed and that pre-defined categories did not limit the interpretation of data.

Throughout this process I have been sincere and transparent, describing in detail my approach and considerations, and any changes in my course of action.

When it comes to whether my study is credible and constitutes a significant contribution, I can say I have been thorough, if a bit scattered, in providing enough context so that a reader with either educational or game design background can find something familiar and something new. In section 3.2 I explained my reasoning behind the way I have tried to triangulate my study to make it as credible as possible and the member checks have also helped make sense of the data and my interpretations. But most importantly, because all my participants agreed to be named, the results of my study and what I have said about my interactions with them and their work can be checked with relative ease.

Regarding the study's significance and impact – to me it was a significant eye-opening journey into the big unknown of academic research. The study has also impacted one of my participants, who had neither participated in, nor conducted member checks previously, and shared that the experience has been valuable, and he plans to use it in his future work. To other readers it can be a useful stepping stone in learning about the topic of serious games.

With all that said, there are also limitations to this study. It was conducted in a single country and had only five participants. The participant recruitment process was very specific – mainly targeting people my teachers knew of and looking up university teachers and researchers whose work involved serious games – and this is sure to have left out potential participants.

### 6.3 Further research

Recommendations for further research could include a case study of a game studio, where interviews and observations cover the whole lifecycle of a game and are able to go into more detail with every stakeholder and their level of involvement. Alternatively, it would be fruitful to investigate how to map a theoretical model of the problem the game addresses to game mechanics and how to have assessment of learning also incorporated into the mechanics and gameplay to make a cohesive whole. With this level of detail, it would be possible to improve previously suggested DGBL frameworks.

However, from both what my participants and the literature say, it seems that in education, the focus is more on gamification rather than serious games. This could be because of the challenges in both creating a bigger, more technically involved game and in pitching it to teachers to use in the classroom where curriculum, school infrastructure and teacher skills come into play as well. Or it could be because gamification provides a more structured approach to learning and makes it easier to assess what has been learned. For these reasons it may be practical to treat serious games as ICT and include them in studies assessing the relationships between teacher training, curriculum, ICT use and serious gaming in and outside of the classroom, and student performance.

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## APPENDICES

### APPENDIX 1 - INTERVIEW QUESTIONS

Interview questions:

Tell me a bit about yourself and what you do/did at [company].

- What kind of experience do you have with serious / entertainment games?
- Do you have any pedagogical experience?

How do you approach the design process [of specific game or in general]?

- Where does it start? (learning objective vs. technology/platform/gameplay)
- How do you decide on players' age? (PEGI/client/developmental stage)
- How did you decide to use a [specific game mechanic in the game - tower defense, pinball/billiard, puzzles]?
- How did you decide to use a [specific gameplay style - top-down, real time strategy, comic strip storytelling, platformer]?
- How did you decide to publish it as a [mobile, PC, web browser game]?

How often and in what way do you involve the client / subject matter expert?

- Does the client / subject matter expert actively participate in the main development stages (pre-production to testing)?
- What about after the game is out?
- What do you find challenging when discussing with the client / subject matter expert what the game has to do?
- Valtteri Lahti said at Aalto University's Games Now! that sometimes you have to teach the partner/client how a game is made. How do you do that? (P2 and P4)

How do you approach learning objectives in the design process?

- How do you integrate the learning element in a serious game?
- What do you think will help you incorporate learning objectives into gameplay?
  - o Could having pedagogical knowledge help you?
  - o Would you benefit from a crash course on the subject knowledge of the game that you are making (e.g. immune system)?
- Should serious games be fun? How would you define fun?

Is there anything else you would like to share about what we talked?

## APPENDIX 2 – DESCRIPTIONS OF CATEGORIES

Listed here are the descriptions of all categories that were used to create the coding frame and categorize the data.

Participants – Describes the background of the participants, including subcategories like educational background (university and other qualifications), work with games (in what role, what kind of games), teaching experience (formal and informal, age groups), and other work experience or passion projects they mentioned.

Purpose of the game – Describes what participants said when talking about what the game has to do, whether it is to raise awareness, explain a problem or simulate a process. The focus is on how they understand the requirements and interact with them to make a plan for game mechanics which address the aim of the game.

Decision-making process – Describes how decisions were made - how player age was decided, why they chose a particular platform like mobile or web, why they used certain technologies like Unity, etc. It differs from the next category, expert involvement, because it only looks at the decision and how/why they were made.

Client, partner and/or expert involvement – Describes what the client, partner or expert did in the design process of the game and what contributions they made towards creating the game. It differs from the previous category as it is not concerned with the decision-making process, rather with the content.

Learning within a game – Describes how learning objectives were incorporated in the game, especially when it came to pedagogical and subject-specific considerations and motivation to learn through a game or through gamification.

Challenges – Describes any issues, difficulties, and problems the participants encountered throughout their involvement in the creation of a serious game.

Serious games and fun – Describes the answers to the question, “Should serious games be fun?”, how participants understand the concept of fun, and what contributes to making a game fun.

The future of serious games – Describes participants thoughts on whether serious games are an avenue worth pursuing as a business model or an educational tool, and what needs to be researched and investigated further.