Gamification of risk management learning material in the ESF-funded Kompassi project

Report on case “Riskivirasto”

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Abstract

The Kompassi project, funded by the European Social Fund (ESF) and coordinated by the University of Vaasa, aimed to improve through a digital learning environment the competencies of Finnish South Ostrobothnian companies and unemployed young adults under the age of 25. One of the main activities of the project was to create a digital learning game focused on digital risk management skills to stimulate learning and interest in this important area of competence. The Riskivirasto ("Risk Agency") learning game, which was brainstormed during a storytelling workshop in Seinäjoki, Finland, utilised a wide range of skills and ideas from the participants. The purpose of this report is to provide a perspective on the process of how gamified solutions can be used to support the goals of educational projects. This report describes the whole gamification design process and the results of related tests, surveys and statistics on the implemented learning game. Overall, the project succeeded in creating a gamified learning environment, emphasised collaboration and involvement of the target group, and contributed to the understanding of effective gamification in education. This report has been written with the intent for giving input to future European Social Fund projects involving online learning environments and gamification.

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1 INTRODUCTION

The Kompassi project was funded by the European Social Fund (ESF) from 2021 to 2023. One of the activities of the Kompassi project was to **design and implement a learning game on risk management to stimulate learning and interest in risk management in digital environments**. The target groups of the Kompassi project were employees of enterprises and other organisations in South Ostrobothnia and young adults under the age of 25 who are unemployed. The purpose of this report is to provide a perspective on the process of how gamified solutions such as learning games can be used to support the goals of educational risk management projects like the Kompassi project. The findings of this report can be used as basis for planning future ESF-projects that aim to offer novel, engaging digital learning environments.

In order to avoid stagnation, it is important to look for new ways to utilise and test the functionality of different approaches. One such approach is offered by gamification and by means of it promoting the development of new skills. In this report, the topic of **gamification is examined especially from the point of view of risk management** and how gamification can be used to promote learning within this topic. The thematic areas of this report also aims to address especially in accordance with the emphasis of the European Social Fund (ESF), purpose: "*[…] to encourage employees to improve their ability to adapt to different ways of working with the help of new skills*" and to "*focus on facilitating access to work*" by means of young people's transition to working life and raising their level of education ('Euroopan sosiaalirahasto', 2023).

To achieve the broadest possible view of the ways in which digital risk management skills can be developed through gamification, the topic is approached in this report by deconstructing and explaining the approach used in the Kompassi project to develop a learning game. The first section of the report discusses previous research on gamification supported by learning. It reviews basic theories and concepts related to games, gamification and storytelling. It also discusses the specificities of risk management and introduces gamified solutions implemented in the past.

The second section of the report focuses on the storytelling workshop and the related questionnaire that was organised for the design of the learning game. As part of the design of the learning game, a targeted gamified storytelling workshop was organised in May 2022 in Seinäjoki, Finland, for all those interested in game learning and gamification. The workshop was attended by, among others, members of the local Game Developers' Association, Seinäjoen pelikehittäjät, Sepeli ry. Based on the results of the workshop, a learning game called *Riskivirasto* ("*Risk Agency*") was developed to complement the

learning material developed in the Kompassi project, but also to act as a stand-alone game and a stimulating introduction to the topic of digital risk management.

The third key section of the report focuses on reporting on the testing process of the Riskivirasto game in different contexts and with different target groups, and the results of the tests and feedback. Finally, the report ends with conclusions.

The Kompassi project (full name: "Online learning environment for risk management and complementary digital skills") was a collaboration project between University of Vaasa and Tampere University. The project was funded from the European Union's response to the COVID-19 pandemic. A specific objective (#12.3) of certain REACT-EU -funded projects is to improve the digital skills of the participants.

Currently, digitalisation is driving ongoing transformations in various spheres. The Kompassi project's goal was to establish a digital learning environment that fosters competencies in risk management and complementary digital skills. These skills encompass areas such as lifecycle assessment, continuity management, and cybersecurity—all critical proficiencies for operating in business and other environments affected by digitalisation. The project promotes the policy of supporting continuous learning in online environments, facilitated by, for example, gamification.

The project team developed comprehensive learning materials, including the mentioned Riskivirasto risk management learning game and Riskioppi learning environment. These environments were accessible at free of charge and in Finnish language. The Kompassi project also produced this report on the use of educational games and the development needs for a low-threshold introduction to the topic of gamification, and how it was implemented in this case. In addition to previous academic knowledge, the report uses material produced and collected during the project, statistical data and user test results.

2 BACKGROUND

Previous research has shown that more research on gamification, utility games and learning is needed to clarify this multidisciplinary and multi-concept subject. Despite its popularity, the field of research on learning, gamification and utility games appears to be rather fragmented. Research in this area has been seen as challenging because of its difficult-to-measure features and its focus on narrow silos, such as eye-hand coordination of simple things (Van Eck, 2006, p. 18, 2015, p. 26). According to Charsky (2010, p. 178), for example while many games for teaching and training may not be the best possible games in terms of, for example, challenge and entertainment, or depth of learning, or playability, games still need to be analysed for the purpose of designing better utility games.

According to Van Eck (2006, p. 6), there are three approaches to the use of games in education: 1. getting students to come up with games, 2. developing educational games specifically for particular purpose, or 3. integrating a commercial off-the-shelf game for educational purposes. In the Kompassi project, it was decided to approach the learning game to be built specifically in line with points 1 and 2 by involving the target group in the development of the game and by developing the game for specific purpose to teach digital risk management. This was done in order to be able to design the game from the beginning exactly as it could take shape in the workshop. For these reasons, the use of ready-made commercial game mentioned in Van Eck's approach 3 was not considered.

In addition, according to Egenfeldt-Nielsen, Smith & Tosca (2016, p. 3), the drawbacks of using commercial off-the-shelf games for educational purposes, include the strong association of digital games with popular culture and, in particular, justifying their use to non-gamers. They argue that it is therefore difficult for such a person to justify in educational terms, for example, how killing game monsters could be educational. On the other hand, as noted by Kalmpourtzis (2018, p. 20), learning can also occur in unexpected, informal contexts, even in situations not originally designed for instruction by the game's creator. He cites as an example learning history from games like Tomb Raider with a theme of archaeology. Although we did not use a ready-made game in this context, it is worth bearing in mind what could be the features that make games such a tool in which learning seems to take place even semi-accidentally.

The Kompassi project aimed to make the most of these key elements in order to make the game it develops as attractive as possible. Following these guidelines, the project team set out to build a workshop to develop a learning game for the project. The development work was approached in an open way, starting with an exploration of key concepts related to gamification and how they relate to learning. It was also explored what learning games

consist of and whether the topic of risk management brought any particular characteristics to it, as detailed in the next chapter.

3 LEARNING SUPPORTED BY GAMIFICATION

What does gamification actually mean? We can start by looking first at how we define a game. By **game** we can generally refer to traditional games such as board or card games. In the case of **digital games**, the computer is responsible for following the rules of the game (Egenfeldt-Nielsen et al., 2016, p. 38).

Speaking of gamification, Deterding, Dixon, Khaled and Nacke (2011) define **gamification** as the application of game-like elements to non-game contexts. They argue that gamification is usually used to make something feel like a game, using techniques such as scoring, rewarding and tokenisation. Gamification is a broad concept, and digital games are often mentioned in this context. For example, Dorling and McCaffery (2012) point out that gamification is not a game per se. It is, in their view, more a set of tools related to game mechanics, game psychology and game design that use behaviours typical of games, such as competition, cooperation, engagement, dependency and learning to help achieve goals. The key to gamification is that it helps people to do things they might not normally do (Egenfeldt-Nielsen et al., 2016, p. 263).

A **learning game** is a game that is specifically designed for a particular learning purpose and aims to teach something (Singh, Wei, Shanmugam, Gunasekaran and Dorairaj 2008, p. 643). Games and their link to **learning** have a long history together. Games in their various forms have been used as learning tools for thousands of years, from games teaching war tactics in ancient times, through the development of information technology, to business educational games in the 1950s, for example (Keys & Wolfe, 1990, pp. 307, 309–310). In the context of learning, for example, **utility games** aim to train and fill gaps (in skills or knowledge) while building on one's own strengths (Iuppa & Borst, 2006, p. 99). Utility games are often defined as games with a main purpose something other than pure entertainment (Bonnechère, 2018, p. 34). Their purpose may be to change behaviour (Schuller, Dunwell, Weninger & Paletta 2013), deepen understanding (Destyanto, Putri & Hidayatno 2017, pp. 3–4) or increase knowledge (Wouters, van Nimwegen, van Oostendorp & van der Spek, 2013, p. 258).

We can see that the key issues related to game-based solutions in the context of learning are not only concrete things like scoring and rewarding, but also more general things like collaboration, engagement and clear goal setting for the action. Another key aspect is that the game-based solution is seen as a way of meeting knowledge or skill needs and deepening understanding.

Although utility games, and especially those strongly linked to learning, are not as entertaining as they could be, they do not need to be seen as a purely non-entertaining form of play. Already decades ago, Abt (1987, p. 9) noted that utility game can still be entertaining, even if their ultimate purpose is not to entertain. For example, how can

storytelling be a part of the entertainment? This is discussed in more detail in the next subsection.

3.1 Storytelling as part of gamification

When we are dealing with gamification, it is important to remember that digital games are generally thought of as a form of entertainment. Games allow us to experiment and learn things that would not necessarily be possible in real life. Entertainment is also closely linked to storytelling. Understanding the basics of good storytelling is often seen as an essential part of good digital game design (Skolnick, 2014, p. 145). This is the case especially in games that present characters doing things.

Starting with Aristotle's *Poetics*, a few basic elements are generally considered to be involved in creating a good story. Iuppa and Borst (2006, p. 39) define a good story as one where the hero, with a goal, faces obstacles on the path to achieving it; the more obstacles on the way, the better the story can be. Skolnick (2014, p. 14), on the other hand, defines a key requirement of a story as always having at least one conflict. He defines *conflict* as an issue that prevents someone from achieving what they want. For a good story, it is not enough to have a single hero, but other characters can be expected to be involved. A memorable story should be filled with interesting events and characters that as a whole convey the desired message (Iuppa & Borst, 2006, p. 48).

Stott and Neustaedter (2013, p. 1), for example, also argue that storytelling is an important factor for successful gamification in education. Other factors, according to them, include the possibility of failure, feedback and progress monitoring. In the context of learning, the importance of storytelling increases when considering, for example, Abt's (1987, p. 34) finding that gamification can contribute to inventing new solutions to problems presented in educational situations.

Compared to previous definitions of gamification and related concepts, storytelling in the context of gamification includes elements of an engaging story, such as different characters (and hero) to drive the story forward, obstacles and conflicts to be encountered along the way, interesting events, and the possibility of failure, feedback and progress tracking. It was decided to further exploit these findings in the Riskivirasto game to be developed in the project.

3.2 Gamifying risk management

Facing problems and tackling how to solve them are intrinsically linked to risk management. It is the subject of the gamified learning material of Kompassi project as well

as the topic of the Riskioppi learning environment, which has been developed in parallel with the Riskivirasto learning game discussed in this report.

Risk management is the activity of dealing skilfully with uncertainty in order to achieve set objectives. Balancing resources and choosing strategies to deal with the threats that are considered to be the most serious are key skills. Ilmonen, Kallio, Koskinen and Rajamäki (2016, p. 16) define risk management broadly as the protection against various risks, their impacts and the ability to identify and respond to events. According to them, understanding the threats related to the subject being studied also helps to find new opportunities, as risks are often associated with a crisis or disruption such as an accident, crime, threat of war, strike or production interruptions (ibid. 2016, pp. 17, 79). Risk can have both negative and positive effects for achieving objectives, that is, risk can be both a threat and an opportunity (ibid. 2016, pp. 33–34).

By definition, risk management could even be interpreted as a gamified activity, as it itself deals with many of the issues that digital games address. These include, for example, conflicts or various challenges to the player (Chou, 2016, p. 66; Skolnick, 2014, p. 16). In many games, the player deals with obstacles and uncertainties hindering the player from achieving the set objectives. Although many games deal with these, it is still worth looking at the subject a little more closely, specifically narrowing it down to the subject of risk management. So, what are some examples of gamified solutions related to risk management? We will first look at the issue at a slightly more general level, before moving on to more specific details.

Various risk management games seem to be largely based on collaboration. The idea of cooperation is also approached by Griffiths (2012) who studied risk management games, focusing on collaborative games. He states that collaboration also involves the collection of individual ideas and validation by the group. So collaborative games allow risk management processes to be recreated as visual, team-based activities, also enabling a creation of database of stories related to the mitigation and avoidance of various risks. Griffiths also stresses that forgetting various risks can be fatal, so visual representations allow us to use our spatial awareness and memory to better remember the risks.

Another consideration related to the topic of risk management is that the games are also often based on the use of note-taking, notepads or post-it notes, at least in a non-digital environment. At a very basic level, games could be about, for example, risk identification, risk categorisation and risk addressing, illustrated by a series of notes to be written down and discussed. This is exactly how, for example, the variant of the "*Risk Management Game*" presented by McDonald (2016) operates. The game is intended to be played, for example, at the beginning of a project to identify the risks and help in the planning process. In the next subsection, we will look in more detail at some more or less similar examples.

3.3 Examples of gamified solutions

Various gamified solutions have been developed to exploit gamified elements in risk management. This does not necessarily always mean that digitalisation is at the centre. This subsection presents nine examples of gamified solutions already implemented in the field of risk management. We start with cases where the focus is on working together and the game is played like a board game.

One example is Risktec (*Game Based Learning in Risk Management*, n.d.), which among other things offers a range of RDI services on security, health, environment and business risks, among others. Risktec has developed a series of games to deliver practical training in a fun and game-based learning process. The games are board game-style games of around 30—60 minutes in length, covering a range of risks and safety topics.

Some games developed by Risktec include *Tipping Point – Defence in Depth* which is tailored Jenga style game. It is played in groups and focuses on the prevention of major accidents by solving different scenarios given to players from a deck of cards and building an associated wooden block tower where blocks represent barriers that guarantee safety (Wolters Kluwer, 2021).

From the same company, another example, *Riskjet – Safety Critical Elements* also played in groups, illustrates the safety critical elements of aircraft systems. The game is presented in a light-hearted story where, in the aftermath of a lottery win, an aircraft is purchased and players decide what they want their private aircraft to contain, with choices ranging from disco ball to safety-critical items, as players try to identify the most safety-critical components. However, alongside the fun content, there are short, facilitated serious discussions on game topics and safety. (Wolters Kluwer, 2021.)

Similar game examples are also discussed by Griffiths (2012) in his conference paper. Paper discusses specifically about visual representation as a benefit of risk management. He gives the example of "*Plan your trip*" activity, where participants are put into groups to plan, write down and discuss, for example, what items to take on a fictious trip. To help identify risks, he also suggests "*Find Friends and Foes*" activity, where different risks are collected individually on a blackboard in the form of a clock, after which the group reflects together on the outputs in more detail and in deeper assessment. Using these tools, for example, a wall full of notepads relating to different risk situations etc. can be a useful visual way to illustrate the importance of risk management. (ibid. 2012.)

The "*Boat Game*", which deals with explaining risk management necessity and processes, also relies on sticky notes. This facilitated game for 3—15 people, lasting 1—2 hours, aims to find out what can go wrong on a transatlantic boat trip, guided by an opening story by a facilitator. The aim is to open up the need and process of risk management, assessment

and risk handling, for example by asking the players to write down a number of "what can go wrong?" situations within a time limit. Then the players assess the risk situations together, thinking about how to avoid risks and what the worst-case scenario could be, and finally, through a summary, to think about risk management. (Mňuková, 2018.)

In addition to calm board game-style solutions, risk management is also practised in more physical ways. Elite Training (2023) offers games for risk management, for example through the physically played "*Survival by Teamwork*" game, where team members have to support each other and get over an electric obstacle (a fence) without anyone touching it. The challenge is increased by raising the fence. In "*Minefield*", 42 mats representing a minefield are placed on the ground and players work in teams to cross the minefield while avoiding detonation of a simulated mine. The game relies on the condition that players cannot talk to each other and must find other means of communication to find a mine-free route of progress.

Naturally, there are also solutions for risk management training in digital environments. Taillandier & Adam (2018) introduce an agent-based serious game called *SPRITE* played through the open-source digital GAMA modelling and simulation environment. SPRITE uses concrete case studies and deals with coastal flooding risks based on a model from Oleron Island in France. In a simulated scenario, players are placed in the role of the island's local councillor and are presented with various objectives to be met within a budget. Players act as major players in various risk reduction activities, thus increasing knowledge to support different types of decision-making. In their research, the game showed positive results. For example, the game was open to all, although it was specifically aimed at students, decisions in the game were based on a number of criteria, the game was based on real terrain, the game's duration was kept short, the game was based on predefined pedagogical criteria, and the game's objectives were met.

Galvão, Neto, Bonates and Campos (2012) have examined the use of games in teaching and learning. In their study, they showcase a multiplayer, browser-based *eRiskGame* to simulate risk management experiences as a training aid for new project managers. The game simulates the management of software projects in a software house looking for new project managers in the midst of change. eRiskGame allows players to manage costs, meet targets, deadlines and monitor productivity, for example. During the game, the player receives instructions and other additional risk management material, with integrated scoring for the questionnaires presented. The player can run different scenarios with different features and the results can be viewed through different infographics to support decision making.

In their study, Galvão et al. (2012, p. 60) found eRiskGame to be an innovative and useful tool to reach different audiences and to build collaboration between students and teachers. As well as the flexibility of time and place, they identified the benefits of a fully web

browser-based game, including lower costs and the fact that no special software was required to use the game, which could be accessed regardless of the device. This observation about saving costs is in line with the view of Kulshrestha, Agrawal, Gaurav, Chaturvedi, Sharma and Bose (2021, p. 248) who state that the cost aspect should also be taken into account when implementing utility games. In specific sectors, they argue that traditional expert and coaching services are expensive, so utility games are seen as a cost-effective way to provide innovative, effective and engaging training.

3.4 Some caveats and considerations

The above examples of gamification of risk management were only part of what was available. However, they clearly show a pattern in which collaboration, different visualisation tools, activation and positive attitudes play an important role. Nevertheless, it's also worth paying attention to those points that, based on previous experience, may have been noticed as problematic in connection with gamified solutions.

Various risk management games have been surveyed by Taillandier and Adam (2018, p. 446), who have found some of the many aspects that can be associated with risk management games. In their literature review, they found that many games are aimed at children or are targeted at everyone rather than specifically at students. Secondly, they often deal with only one criterion, such as economics. Furthermore, games often use geographically general or imaginary areas or they do not consider spatial dimensions. Games are also often very long, with randomness playing a large role in the gaming experience, and often require someone to observe and control the game play. (ibid. 2018, p. 446.)

Practical applications over the decades have shown that successfully combining games and learning is not straightforward. With the proliferation of different gamification approaches, problems have arisen, for example, with poorly implemented (e.g. perceived as boring) gamification solutions (Chou, 2016, pp. 20–21) or with not properly taking into account the possible objective differences or preferences of their users with respect to tasks (Koivisto & Hamari, 2019, p. 206). Utility games have been criticised for a long time because too often, when game elements are combined with learning, a fun of playing may be forgotten (Alkhalifah, 2022, p. 112).

Another point of view is presented by Kalmpourtzis (2018, p. 128) when he highlights the concern of taking the learning material into the game environment. In this case, according to his view, the general situation is that the material is already complete in advance and only after that do you start adding game elements to it. So, when the planning starts to progress according to the learning material, there are fewer opportunities to make the "game structure" both fun and educational.

Indeed, there are many aspects that need to be considered and taken care of in gamification. Based on these findings and theories of gamification, the development process of the learning game for the Kompassi project was initiated.

4 RISKIVIRASTO LEARNING GAME DEVELOPMENT PROCESS

When starting development, the first concern was what kind of technical solution to find for the game platform. It should support both the game itself and the related Riskioppi learning environment. The latter would be developed separately from the game, but would contain the actual learning material, and the content of which the game would be partly based on. The starting point was that gamification would be a key part of the learning process. Ease of use was also kept in mind in both of these solutions.

With the above assumptions, together with previous research, the project team set out to find a suitable platform solution. Based on the preliminary study, the project team compared different learning platforms. Following a public invitation to tender organised by the project, **Seppo gamification platform** from Lentävä Liitutaulu Oy, was selected as the platform with the most versatile overall features. In addition to the overall price and content quality, the different platform solutions were evaluated by the project team, with particular emphasis on the functionality and versatility of the platform offered. The licence for the Seppo platform was acquired for the use of the project until August 2023.

The Seppo platform is a web-based platform that works on both computer and mobile devices, and allows you to create gamified solutions for different needs using a variety of tools. The Seppo platform is used in more than 50 countries, with over 4 million players and more than 1500 companies using the platform (*Seppo Gamification Platform*, 2023). In Seppo, you can add, for example, different scored tasks to the learning material or use different types of tasks (Figure 1).

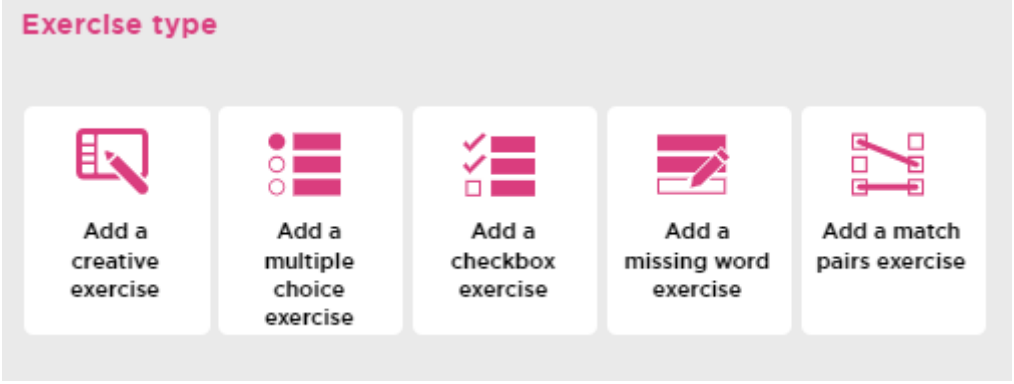

Figure 1. Different types of tasks on the Seppo platform

As shown in Figure 1, the types of tasks include multiple choice, matching pairs, searching for missing words and various creative tasks, where the answer can be given in the most appropriate form, either in writing or as a voice message. The platform makes it easy to import a variety of digital background material. For example, videos, photos or audio can

be added to the game board to enrich and diversify the learning experience. The platform also provides the possibility to give feedback on the performance of tasks.

These starting points provided a good framework for the kind of learning game that could be built in the project. After the procurement decision, work began on how to develop the game, taking advantage of a collaboration that had already proved effective in theory. Based on the discussions, it was decided to start the development work through a workshop of some kind. The workshop would be put together in collaboration with the Seppo platform developer's representative, a pedagogue, with whom the workshop programme was discussed and how it should be shaped in order to achieve the best possible outcome for the game ideation process. The planning and implementation of the workshop is discussed in more detail in the next subsections.

4.1 Planning the workshop

The planning of the workshop started in early 2022 in cooperation with the project team and the Lentävä Liitutaulu Oy's Seppo platform expert *Anna Uusiniitty*. It was also requested that their representative introduces the Seppo platform and its potential at the workshop. The project team and the expert discussed the framework criteria for the game, such as who the game is aimed at, what the game is intended to teach and what limitations or strengths the target group has. There were some preliminary ideas for this, but it was noted that these could still change with the results of the workshop. Thus, it was decided that the project team will present the project and the learning material to be gamified at the event.

In terms of content, it was decided that the workshop aimed to find ideas and examples for gamification of risk management learning material on the Seppo platform. The aim was also to promote learning through storytelling. So, when planning the workshop further, the issue was how to bring both professional, amateur and end-user perspectives to the workshop. The project team came to the conclusion that it is essential to bring together representatives of all these groups and think together about potential solutions. A joint brainstorming workshop was considered to be the best way forward. As a result, work started on the final programme for the workshop in Seinäjoki.

Game designer and non-fiction writer *Juho Kuorikoski* agreed to be the keynote speaker of the event, talking about gamification, especially from a storytelling perspective. Also, representatives of Seinäjoki Game Developers Association, Sepeli Ry. were involved in the planning of the workshop. They were a natural partner because of their subject matter. In addition, there had already been successful cooperation with the association on previous occasions. Through the association, the event was likely to attract a number of participants. Through the cooperation with Sepeli Ry, researcher doctor *Jussi Rasku* from

University of Tampere / University Consortium of Seinäjoki was also invited to the workshop to talk about game mechanics design tools.

In addition, the workshop manager *Petteri Lehtola* of the Kulttuurityöpaja Preppaamo in Seinäjoki was also involved in the planning. Preppaamo is a place for young people where young jobseekers do work trials and rehabilitative work activities to learn the rules of working life and life management. The Preppamo team provided valuable young people's perspectives in the planning of the event. They also provided the facilities for the workshop and attracted some participants to the event.

After the joint planning sessions, the workshop was actively promoted through various channels. Finally, with this configuration, the workshop proceeded to its implementation, which will be described in more detail in the next subchapter.

4.2 Implementation of the gamified storytelling workshop

The workshop was held in the premises of the Seinäjoki Rytmikorjaamo (Figure 2), which made it perfectly suited for the event. A total of 29 participants registered for the workshop and a total of 24 people attended.

Figure 2. Storytelling workshop in Seinäjoki (Niemi, 2022b)

As planned, the programme of the event consisted of a project presentation by the project team and a presentation of the workshop task and related material. The programme included presentations on *game learning*, *storytelling in games* and *game mechanics design tools and other considerations*. In addition, the Preppamo team had prepared a relaxing and thought-provoking audio piece for the workshop, which was played to everyone during the workshop break just before the first idea creation session.

After the presentations and creative break, participants divided into four groups of 4—6 participants. Each group was given the task to come up with examples of gamification of risk management learning material and ways in which storytelling could be used to present this material. Participants were given printouts of a part of the learning material to be gamified. This material enabled them to familiarise themselves with the basic concepts and themes of risk management. The brainstorming process did not have to be locked into a specific learning platform, for example the features of the Seppo platform.

The following guidelines were given for brainstorming, based on the workshop objectives, on the effects that game ideas should have on the learner:

> *a.* ***Knowledge change:*** *'I know what the risks are, how to manage them and where I can get more information on how to manage them.' I learned how risk is not only a threat but also an opportunity."*
>
> *b.* ***Behavioural change:*** *"By anticipating risks - i.e. by being one step ahead of threats - I ensure that I achieve my goals."*
>
> *c.* ***Emotional change****: "I see risks as opportunities."*

The time spent on brainstorming was around two hours and time flew by. In general, there was a lot of discussion in the groups (Figure 3).

Figure 3. Development of game ideas in groups (Niemi, 2022a)

In this actual brainstorming part of the workshop, the guiding responsibility was given to Seppo platform expert Anna Uusiniitty, who went around the groups during the brainstorming, giving advice and asking guiding questions to the participants. Finally, the game ideas were presented to the other groups.

Overall, the workshop was successful because of its intimate nature. A lot of material was gathered from the workshop to be used as input for the development of the game. The workshop resulted in a total of five different game ideas on this topic. All of the game ideas had a story, such as a conflict situation to be resolved. The game ideas also included confrontational situations typically seen in games, such as hero vs. villain or clerk vs. customer, etc. The following subsection presents the created game ideas in more detail.

4.3 Game ideas produced in the workshop

This subsection presents the game ideas produced as accurately as possible, as they were presented orally to all participants at the end of the event. All five game ideas were varied and different from one another. Each of them clearly illustrated the risk management setting. They also made it easy to visualise interesting events and imaginable game scenarios that could be brought to life.

The game ideas demonstrated several characteristics of fun, games and learning. They were clearly designed to deepen the player's understanding of risk management. There was also an easily sensed entertainment aspect to the ideas. Although the entertainment aspects were evident in all the ideas, it was still obvious that the game ideas were designed with an educational purpose, as is the aim of utility games (Schuller et al., 2013).

Next, we will go through each of the game ideas in more detail. Game ideas have been transcribed on the basis of notes taken during the workshop. For the sake of clarity, unnecessary repetition has been removed and the presentations have been translated into English.

4.3.1 Game 1: The Negotiator

The Negotiator game is a chatbot-type program where you have a conversation with an AI. The game deals with exciting risk management situations in the role of a hostage negotiator or a spy. As a spy, for example, you think about what information is important for planning, say, sabotage, and why it is important for the targets to carry out the desired threat. As a hostage negotiator, on the other hand, negotiating skills and the ability to handle important information carefully are assets. Emotion in the game is built not only through tension but also through fear of uncertain outcomes and time constraints. An example of this is the intensity of hostage situations in terms of what happens to the hostage, the negotiator or the spy.

The overall aim of the game is to increase understanding of what kind of information would be difficult for individuals or organisations to release or retract. In addition, the thrill of observing the chain reaction of situations such as unauthorised information going out into the world adds to the player's understanding of the need to take good care of their own information. The game gets content from the dangerous actions of a spy and how an organisation can manage the risk of its secrets being leaked to outsiders.

4.3.2 Game 2: All Fails – brawler-infiltrator

All Fails is about a rampaging demon-like brawler who possesses people in various situations of danger and risk. The idea behind the game is based on the concept of reverse brainstorming, which is the brainstorming of how to make problems even harder or how to make all the risks' problems happen at the same time. The aim of the game is to achieve the worst possible outcome in each situation by answering multiple-choice questions. The greater damage, harm or consequences caused open up avenues in the story for ever new opportunities to cause more havoc.

The player's task is to try to stay safe from threats. Another aim of the game is to teach how to prepare for as many risk situations as possible through a reverse scenario. The game explains the details of why the option chosen by the player is the most destructive. This inverted setting emphasises the problem of risk management and fundamentally fights against the player's often perceived need to protect resources and choose the least risky solution.

The active character in the game is the brawler-demon, so the player is not forced to think about the issue at hand from one person's point of view. In the setting of the game, a person may be told in a mighty voice not to do this or that. However, behind the prohibitions, there is not necessarily an understanding of what it will do to other people if the whole house of cards falls apart at once. Through the processes of the game, empathy grows and the understanding of what certain kinds of damage do to people increases.

4.3.3 Game 3: The Cleaning Lady

The Cleaning Lady is a game in which the player takes on the role of a fictional female clerk cleaning statistics at the employment centre. Her task is to decide whether or not a client is eligible for benefits, based on various reports, documents and regulations. Computer-generated text content and different faces add variety to the game. The idea of the game is similar to the indie game *Papers, Please*, where the player's task is to decide on the basis of the papers and passport of a person crossing the border whether or not to enter the country. The team that produced the idea highlighted this similarity in their presentation: in the Papers, Please format, the customs officer plays a big and scary role, so the game idea is that the powerful influence of the employment centre officer is different in its immediacy. The problem then becomes the player's motivation in terms of how much he or she decides to facilitate or increase the difficulty for the customer being served.

Papers, Please has shown that very large and frustratingly detailed documents can be made into playable content and still be played with enthusiasm. The continuity of The Cleaning Lady comes from the fact that the examined papers tell people's stories. The shift in emotion in the game is a way of saying that you shouldn't curl up in a corner amidst the risks that the world is currently facing. The important thing is to see that life goes on despite everything, and to be inspired by this to continue with your own life, making new plans.

4.3.4 Game 4: Between Two Worlds

Between Two Worlds is a risk management game that moves between the digital and real worlds. In the game, the real world is represented by an office with computers as a game

board. The digital world is accessed via the computer in the office. In the digital world, the game board is the desktop of a graphical operating system. Various programs and operating situations are open on the screen. It is up to the player to identify the risks involved.

For example, the player is connected to a public Wi-Fi network over an unencrypted connection and a web page is open in a browser program. If a player carelessly accepts the terms and conditions of the browser, the result could be a screen full of spam.

The player solves tasks one by one by evaluating the threats displayed on the screen. The game sometimes moves to similar risks in the real world, so that what you learn in the digital world can be used to manage risks in the real world and vice versa. Clicking on different types of risks will explain to the player in more detail what type of threat is involved. A catalyst between the two worlds is, for example, a boss character who drives the story forward. For example, the boss can ask the player what constitutes a risk in the situation presented. The feedback from the boss will drive the story forward.

4.3.5 Game 5: Oh, Kyle

The idea behind the ”Oh, Kyle” game focuses on how to turn risks into opportunities. The idea is that even when risks are realised, you can still come out of it all in the end. The story of the game begins when the main character, a young man named Kyle, wakes up in ambiguous circumstances, obviously with the night of his life behind him. Everything has gone wrong. The phone is lost! On the table is a marriage certificate made online! In his pocket, a crumpled piece of paper with the crypto wallet numbers on it, with a few numbers erased.

The game starts in Kyle’s room, where the missing objects are replaced by outlines showing the missing items. The player clicks on the outline to see a more detailed description of the mission. The description is initially short, along the lines of ”Oh no! The phone is lost.”, followed by a choice of what the player could do next. In the case of the phone, different threat scenarios can be shown of what happens when the phone is lost.

The idea behind the game idea is that only when a solution is found will the player be given more information about what should have been done to prevent it in the first place and why, for example, backups and protections are important. More lost items will then be revealed to the player.

Firstly, the game shares information about what bad things can happen when everyday risks are realised, such as the unpleasant consequences of losing things. On the other hand, it also teaches how to deal with troubles. At the end of the game, the character finally calms

down. From an informational point of view, the player is first given a chance to think and respond. Only after this is the learning process started, because the idea of the game is that in a slight panic the player is more suited to absorb information.

4.4 Background of workshop participants

Participants in the workshop were asked to fill in some mandatory background information for participating in an ESF project. This subsection will go through this information in more detail. As noted earlier, a total of 29 participants registered for the workshop and a total of 24 people attended. Responses were received from a total of 19 people. Some participants did not want to fill in the ESF monitoring form provided, filled it in only partially or left in the middle of the workshop, so the data could not be fully collected.

The age distribution of the group was reasonably heterogeneous, despite the fact that more than half (53%, n=10) of the respondents were in the '26—40' age group. However, there was representation from every age group, as shown in Figure 4.

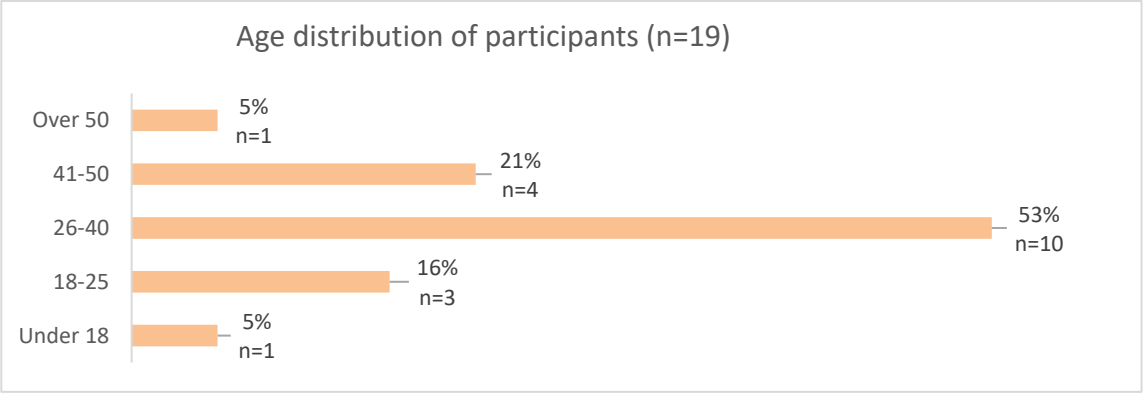

Figure 4. Age distribution of participants

It was also pleasing to see that both male and female participants could be attracted to participate in the workshop (Figure 5).

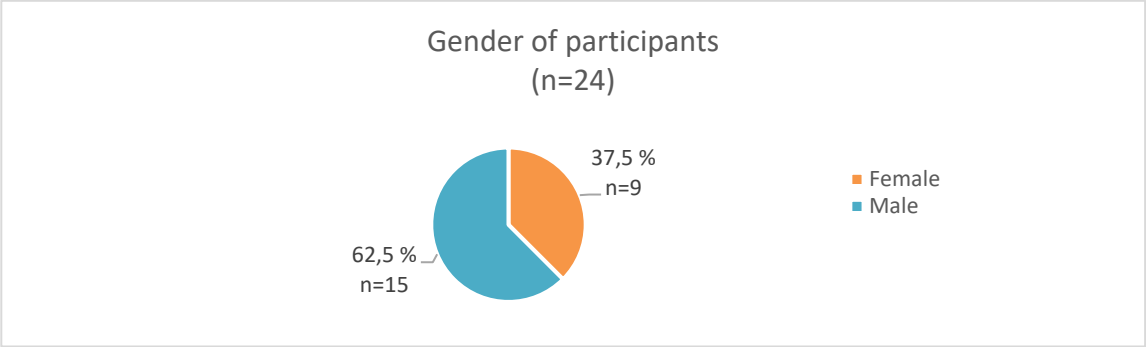

Figure 5. Gender of participants

As Figure 5 shows, more than half of the participants (62.5%) were men and 37.5% women. The next question (Figure 6) dealt with the respondents' employment situation.

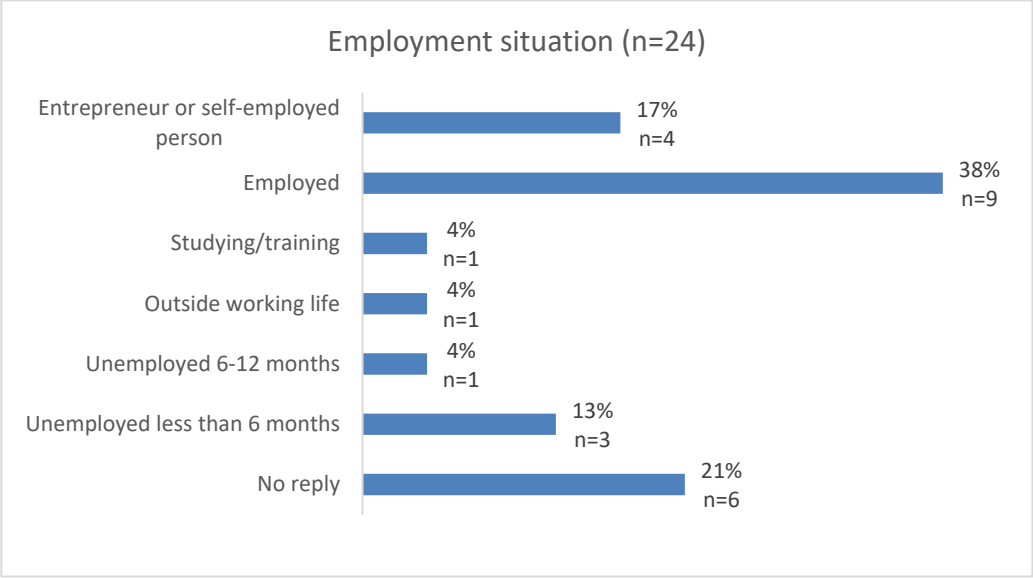

Figure 6. Employment situation

As can be seen in Figure 6, the participants were representative of the project's target groups, i.e. for businesses and people outside working force, with four of participants (17%) being self-employed, nine of those (38%) otherwise employed, one student (4%), one outside working life (4%), and in total four people (17%) unemployed for varying lengths of time. Six persons (21%) did not answer the question.

Participants were also asked about their educational background (Figure 7) as part of the ESF requirements.

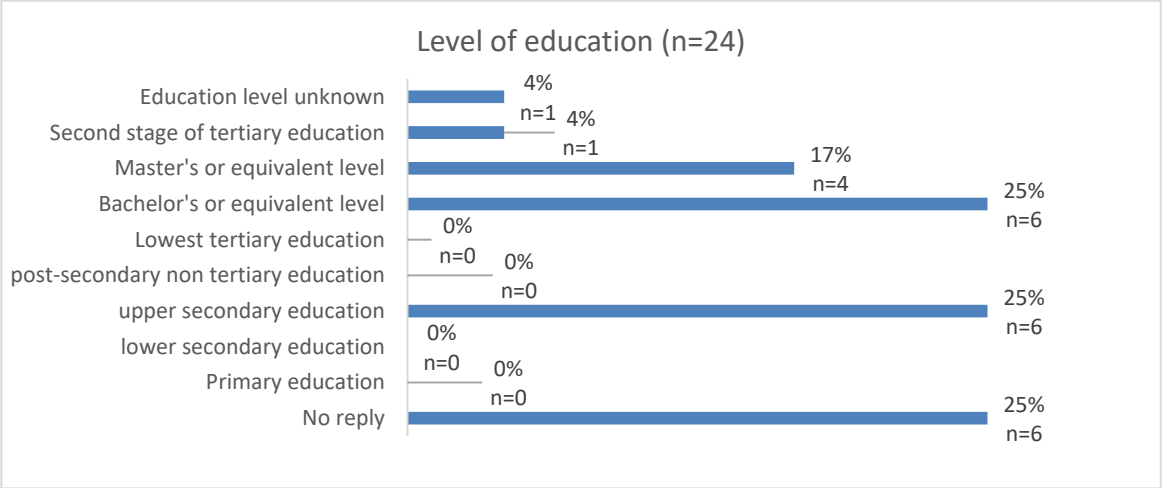

Figure 7. Level of education

The data indicates a diverse range of education levels among the participants, with 6 people (25%) having Bachelor's or equivalent degrees, 4 persons (17%) holding Master's or equivalent degrees, and 6 persons (25%) completing upper secondary education. Additionally, one (4%) reported having second stage of tertiary education, one (4%) had an unknown education level, and again, 6 people (25%) did not provide a response.

4.5 Workshop participants' views on gamification

Also, more informal feedback was collected from participants. At the end of the workshop, participants were given the opportunity to fill in a feedback questionnaire if they wished. When responding, giving your name was optional.

The feedback explored their attitudes towards gamification in risk management, as well as their general experiences and opinions on gamification of learning materials. A total of 14 participants provided feedback. This is a small sample, although relevant for this report, as the participants were mainly amateur game developers. The given feedback is discussed below, question by question.

In the first question of the feedback survey, respondents rated how experienced they think they are as game developers on the one hand, and in managing risks in their everyday life or profession on the other. A modified Likert scale was used on the survey form, with the middle, generally neutral option being replaced by "slightly experienced". This forces the respondent to take a clearer stance on his/her perception of his/her own skills. Figure 8 compiles the respondents' assessments of their own experience as a game developer (as an idea creator, game designer and/or developer).

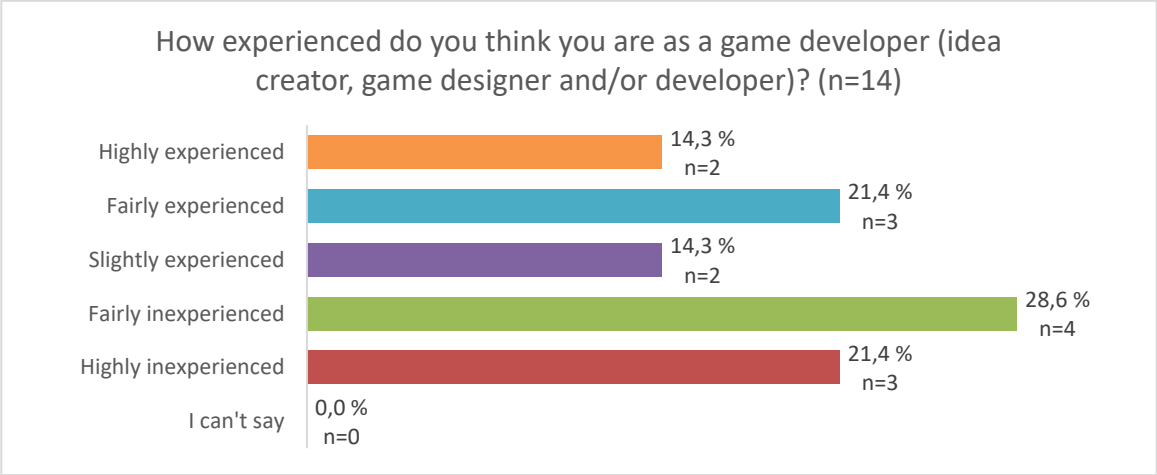

Figure 8. Experience as a game developer

Figure 8 shows a heterogeneous sample of respondents, with both clearly highly inexperienced (21.4%) and highly experienced (14.3%) respondents. The largest group of respondents was in the "fairly inexperienced" category, with 4 respondents (28.6%). Overall, however, a majority of respondents had at least some experience as game developers, which provided a good starting point for gathering diverse insights in light of, for example, Iuppa and Borst's (2006) findings that the collection of tacit knowledge from experts is of great importance when coupled with the development of educational materials.

The second question (Figure 9) asked the respondents' opinion about their own experience in risk management.

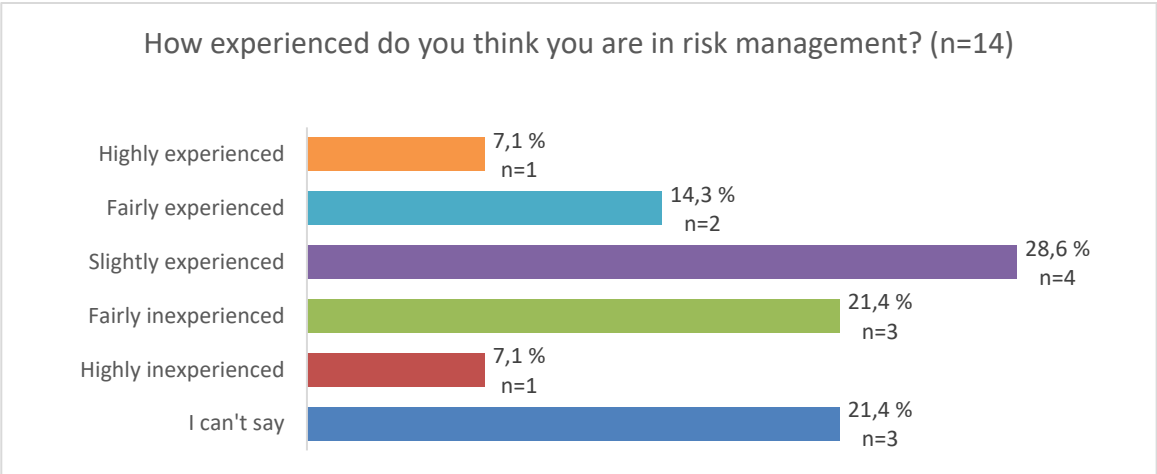

Figure 9. Experience in risk management

Figure 9 shows that respondents were clearly less familiar with risk management. Three (21.4%) of the respondents could not state their opinion and only one respondent (7.1%) felt highly experienced and two respondents (14.3%) felt fairly experienced. However, almost everyone had some idea about risk management, with only one respondent (7.1%) saying they were highly inexperienced. Overall, half of the respondents were either fairly inexperienced (21.4%) or slightly experienced (28.6%) in the subject. The dispersed nature of the distribution can be compared, for example, to the findings of Ilmonen and colleagues (2016, p. 18) in the business world, where risk management is often only considered in more detail once a risk has already actualised in one's own case. The question posed might have needed clarification on the respondents' more specific experiences of risk management. Next Figure 10 deals with the clarity of the workshop topics.

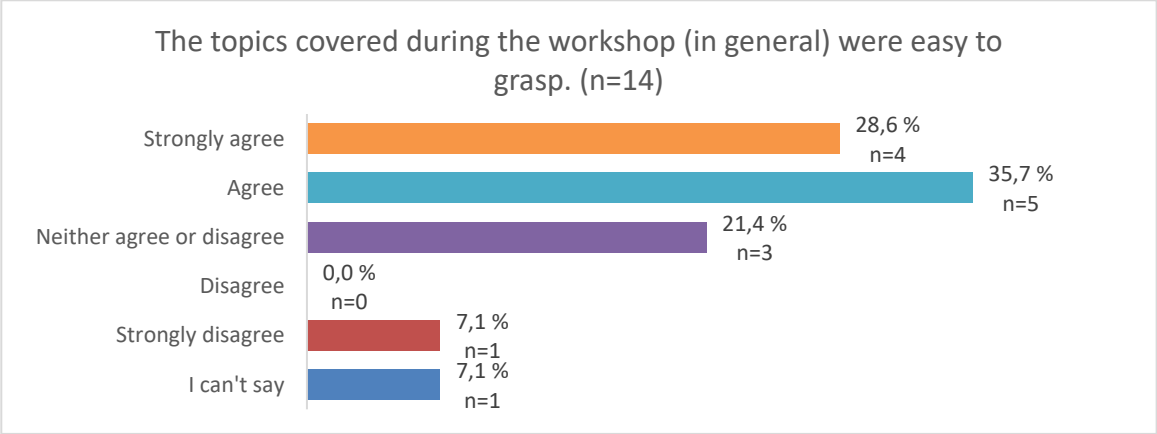

Figure 10. The topics covered during the workshop

It can be seen from the Figure 10 that the majority of respondents did not find the topics covered very difficult. Around two thirds of respondents either strongly agreed (28.6%) or agreed (35.7%) that the topics were generally easy to understand.

Next two questions asked about respondents' experiences with the Seppo gamification platform presented at the workshop. Figures 11 and 12 show the respondents' opinions on the gamification platform from both the developer and student perspectives.

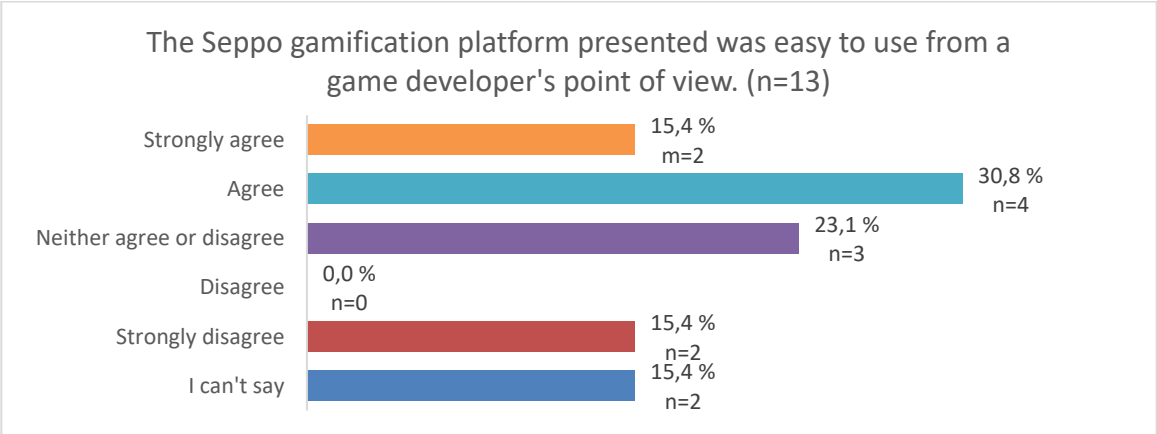

Figure 11. Seppo gamification platform's usability (developer)

Based on Figure 11, the majority of respondents either strongly agreed (15.4%) or agreed (30.8%) that the Seppo gamification platform was easy to use from a game developer's perspective. Three respondents (23.1%) considered the gamification platform to be neutral and two respondents (15.4%) considered the gamification platform to be difficult to use, disagreeing completely on the ease of use from the game developer's perspective.

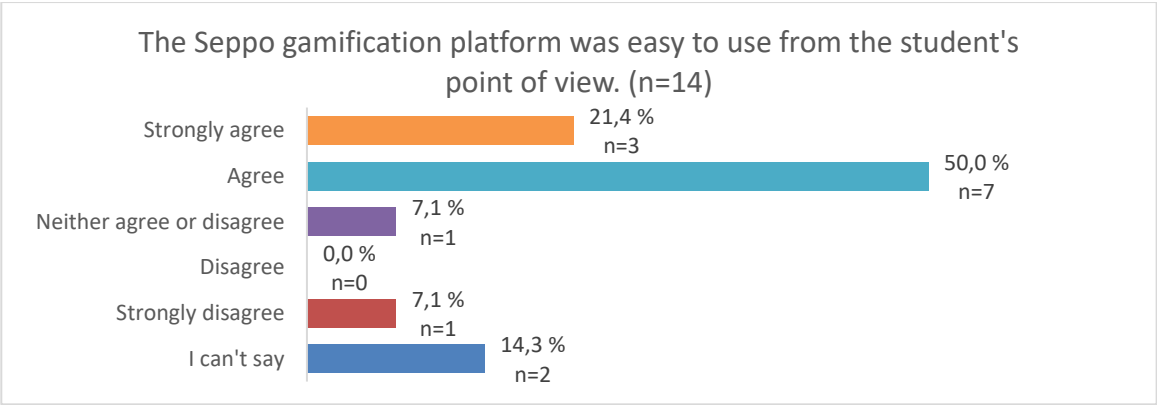

Figure 12. Seppo gamification platform's usability (student)

Similarly, comparing the student perspective in Figure 12 with Figure 11, we see that the student perspective was seen as more accessible compared to the game developer perspective. Regarding the ease of use of the Seppo gamification platform from the student perspective, three (21.4%) of the respondents agreed strongly and seven (50%) agreed.

Opinions on the comprehensibility of the risk management learning material discussed in the workshop were measured in next question (Figure 13).

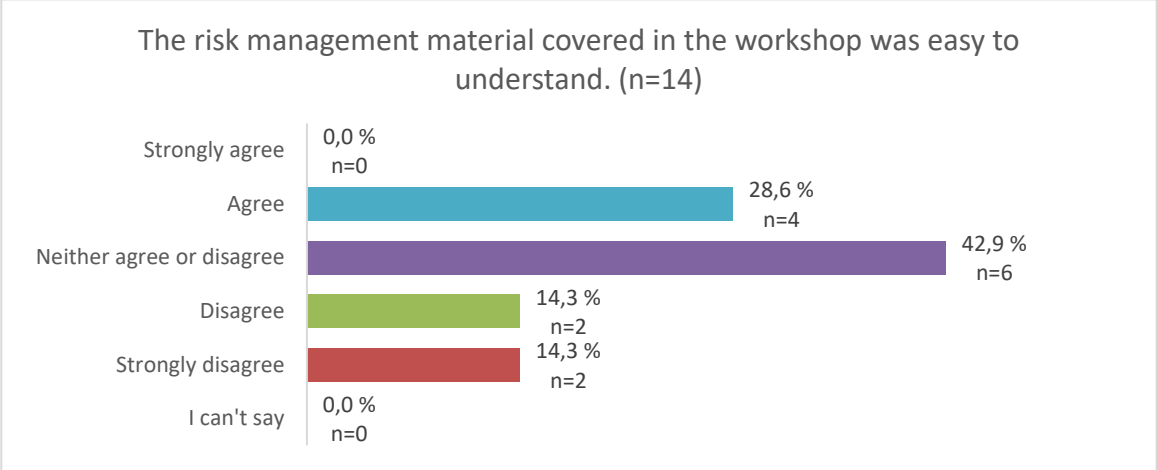

Figure 13. The risk management material understandability

Figure 13 shows that the learning material distributed to the participants on paper could have been clearer, as only 4 respondents (28.6%) agreed on the comprehensibility. None of the respondents strongly agreed that it was easy to understand. A little less than a third of respondents disagreed strongly (14.3%) or disagreed (14.3%) on the overall ease of understanding. The majority of respondents (42.9%) had a neutral opinion on the comprehensibility of the learning material, indicating neither agreement nor disagreement. The result is understandable, as it can be difficult to adopt a paper version of the teaching material in a relatively short period of time in the middle of the activity.

The question on the benefits of gamification in risk management (Figure 14) confirmed views on the usefulness of gamification.

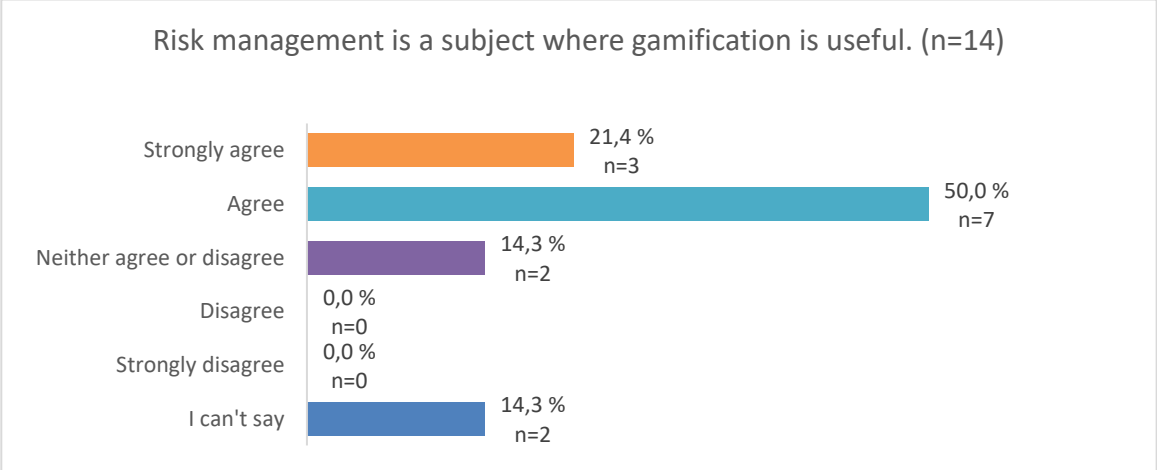

Figure 14. The usefulness of gamification

As shown in Figure 14, gamification in risk management was seen as a largely positive issue, with none of the respondents disagreeing completely. Half of the respondents (50%) agreed and a fifth (21.4%) strongly agreed. Two respondents (14.3%) neither agreed nor disagreed and two respondents (14.3%) could not say. This result confirms that respondents see potential in risk management learning materials for transfer to a gamified environment, so there is less reason, at least based on these responses, to fear Kalmpourtzis'(2018) view that a piece of the fun is lost in gamifying the finished learning material.

Almost the same result was obtained by a question on gamification of teaching material in general (Figure 15), which asked about the statement "gamification of teaching material helps (in general) better assimilation of the subject matter". Respondents were of the opinion that gamification would help in this respect.

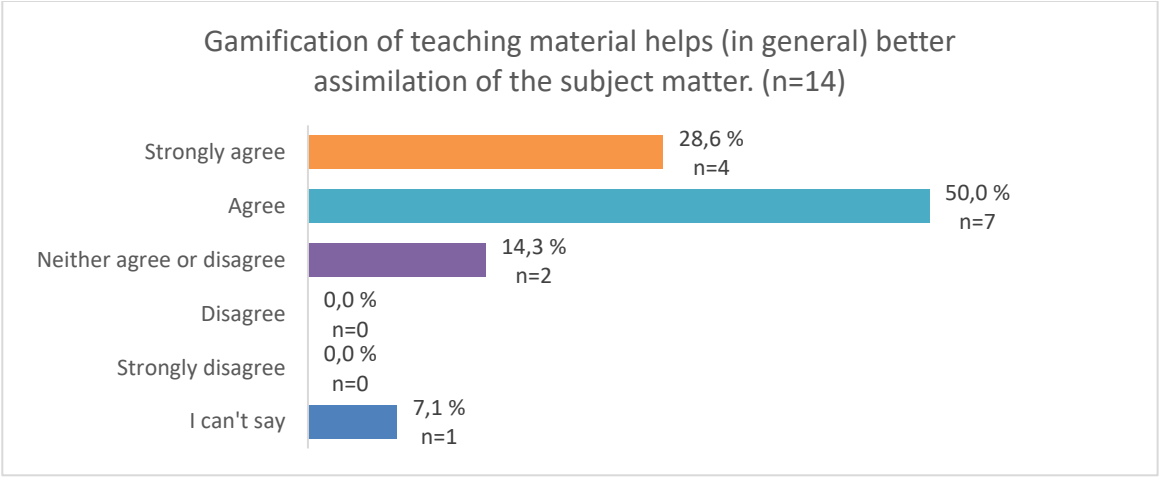

Figure 15. Gamification of teaching material

Gamification was seen as a positive thing in the context of teaching material in terms of learning to assimilate the subject matter. As shown in Figure 15, none of the respondents disagreed completely. Two respondents (14.3%) neither agreed nor disagreed and over three quarters felt they strongly agreed (28.6%) or agreed (50%). This result confirms the benefits of combining games and learning in terms of motivation, engagement and effectiveness as presented by Egenfeldt-Nielsen and colleagues (2016) and Van Eck (2006).

The last question of this type was a more in-depth exploration of whether respondents felt that gamification should be used more in online learning (Figure 16).

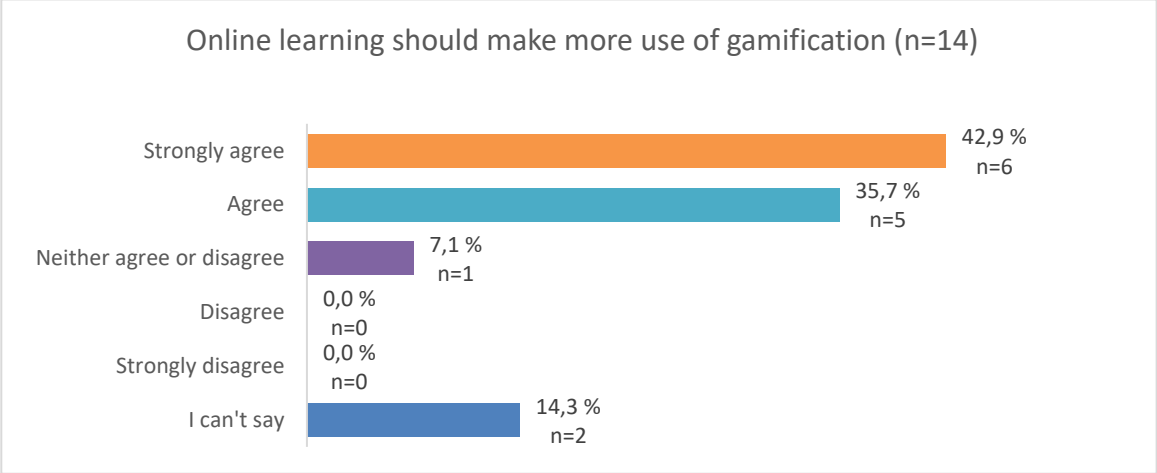

Figure 16. Gamification and online learning

Again, the results were not surprising. The use of gamification in online learning was positively received by almost 80% (11) of respondents. Six (42.9%) respondents strongly agreed and five (35.7%) agreed. Only one respondent (7.1%) neither agreed or disagreed. Two (14.3%) of respondents could not answer.

In next question, respondents were asked to select their preferred way of learning risk management-related learning material in digital format from the options provided (Figure 17). The options were website, learning platform (e.g. Moodle), stand-alone game, .pdf format or other (what) if no other preferred option could be found.

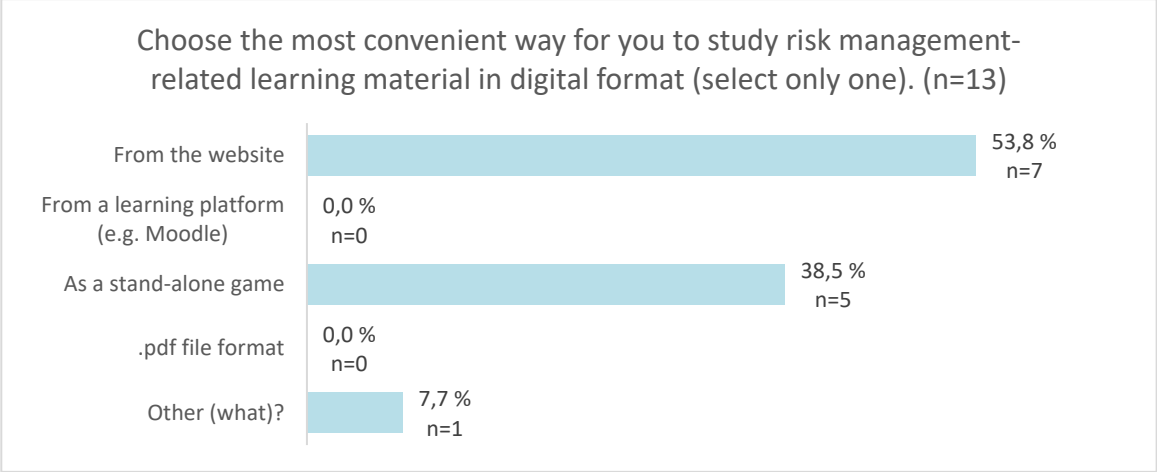

Figure 17. The easiest way to study risk management content

There were 13 responses to this question (Figure 17). The majority of respondents (53.8%) would study risk management-related learning material in digital format on a website. Learning the material as a stand-alone game was also seen as a possibility (38.5%). In

addition to the options mentioned above, lectures and discussions were also mentioned in one of the responses (7,7%). This suggests that the web-based learning game and learning environment designed for the Kompassi project are on the right track.

The second to last question on the feedback form was open-ended. It asked respondents to tell us in their own words what could be done to improve the gamification of digital teaching materials. A total of 8 people responded to the question. The number of responses is small in relation to the number of respondents, but all of them are nevertheless very supportive of the theory and provided guidance for the development of gamified solution for this study. Each is therefore mentioned separately.

In example 1, one respondent describes the extent of the use of gamification and the teaching opportunities.

> *(1.) In general, I think that gamification is not used enough in pedagogy. Game-based simulations could be used to teach even complex subjects more easily*

Example 2 calls for a wider use of existing games for teaching different subjects.

> *(2.) Instead of creating games specifically for teaching a particular subject, existing games should be selected which deal with that subject and in which the pupils have to use their skills. This way, the game does not feel like homework.*

The third example refers to various uses of artificial intelligence based on augmented, enriched and enhanced reality and deep learning.

> *(3.) AI, chatbot language models (GPT-3), VR, AR, XR, MR*

Example 4 calls for gamification to include stories, missions, worlds and other features more often associated with commercial games.

> *(4.) They should be more like ”real” games. Character movement, large worlds and different tasks, with an in-depth story.*

In the fifth example, the respondent refers to the attention paid to the target groups of the games, as well as to the rewarding and interesting nature of the material.

> *(5.) Make interesting material and rewarding gamification for the student, taking into account the target audience for the game.*

The comments also call for new inventions, for example in the form of different forms of educational games, as example 6 shows.

> *(6.) In order to make ”educational games” interesting for pupils and others, one could try something ”new” for them, i.e. not sticking to the same overused game*

> *formats. Depending, of course, on how the teaching material itself can be created in a game format (some people learn better through games as opposed to just reading or listening, for example).*

The above comment correlates with the need for courage to try new solutions, already highlighted at the beginning of this report. The seventh example emphasises clarity, which is often perceived as an important element of quality learning material.

> *(7.) Clarity*

The last example, 8, again highlights the importance of story, environment and the central interaction of the player as factors in making the learning experience interesting.

> *(8.) By creating an engaging story and a rich background milieu for the player to interact with, even the drier content of the lesson becomes more engaging.*

Overall, the comments highlight the need to use different gamified elements in training. Indeed, there seems to be no harm in taking a model from past gamified solutions. Embracing technology and tailoring different gamified solutions for specific purposes would also seem to be useful. The responses also reflect the importance of innovative game formats, clarity, and engaging storytelling in designing effective digital teaching materials.

The last question of the feedback form gave the possibility to give free feedback, for example on the programme of the workshop or other issues. From the feedback given, it was clear that most people liked what was done on the day, as the following comments (9 and 10) show.

> *(9.) It was a really inspiring event! Thank you for organising it!*

> *(10.) […] I would at least play a game invented by my own group!*

Of course, there was some criticism, as comments 11 and 12 show:

> *(11.) […] Seppo was not really interesting as a game platform either, so it was difficult to design a game for it.*

> *(12.) […] A small snack would have been useful..*

Other feedback complimented the food, the free refreshments, the nice atmosphere and the good and interesting presentations.

4.6 From ideas to implementation

After the workshop, the actual game design and implementation process was started by the Seppo game platform expert pedagogue from Lentävä Liitutaulu Oy. Based on the game ideas implemented in the workshop and the learning materials, potential implementations were discussed with the project team. The initial intention was to select one of the game ideas from the workshop to be implemented. The expert expressed the idea that it might be possible to use elements from each of the game ideas in the actual game, as they all had very good elements to be used in the game. Thus, it was decided to build the final game by taking inspiration from each of the game ideas from the workshop.

Input for game development came from game ideas generated in the workshop such as carefully handling important information, referring to different emotions, realising worst-case risk scenarios, achieving empathy, dealing with different rules and regulations, making life choices, moving between the digital and real world, assessing threats, characters that move the story forward, turning risks into opportunities, and issues such as the loss of everyday objects and related issues.

The expert started the implementation of the game on the Seppo platform during the summer of 2022. The first version of the game was made available to the project team for testing in late July 2022. According to the comments of the expert who created the game, the aim was to avoid filling the game with a large amount of information from the learning material. The tasks in the game were designed from the point of view that the players would really make use of what they had learned in the past and that the game would be designed to leave a memory trace. Similarly, the aim was to provide an experiential way of teaching through the game and to give each player the opportunity to succeed.

Iteration rounds were initiated between the project team and the game developer, which resulted in changes being made to the game and a general review of the game, including correcting any factual errors, errors in the sound files and typos.

The Riskivirasto game, the result of the design process, was officially opened to the public at the Cyber Security Technology Forum in Seinäjoki in December 2022. The next subsection will describe the resulting game in more detail.

5 FINAL IMPLEMENTATION – THE RISKIVIRASTO GAME

Riskivirasto is an educational game about the meaning and possibilities of risk management in a digital operating environment. It is aimed mainly to younger people who would like to develop their skills in digital risk management. However, the game is not age-restricted and can be played by people of all ages, from young to old.

As stated earlier, the content of the game is based on the learning material presented in the Riskioppi learning environment. The idea is that the player would have read the contents of the learning material before starting the game and the game would also serve as a kind of final exam on the Riskioppi learning environment. However, the game can also be completed as a stand-alone game without studying any of the background material for example if the player searches online for necessary information to solve the tasks presented in the game.

To log in to the game platform, the player must go to the game's online address and type in the pin code provided or point their mobile phone at the QR code displayed in the same frame (Figure 18).

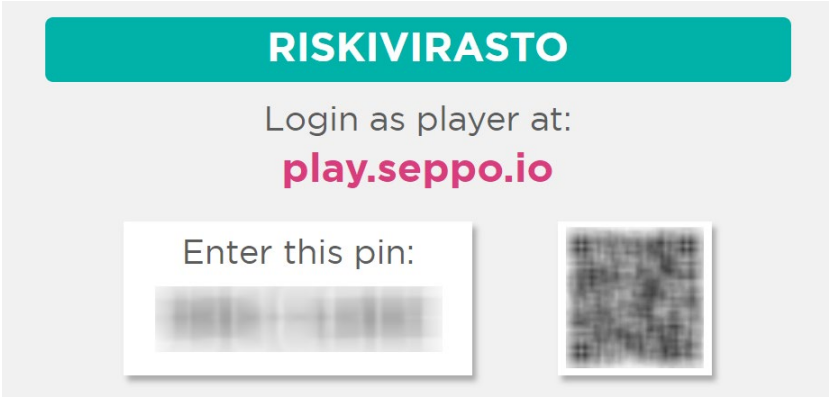

Figure 18. Joining the Riskivirasto game with a pin code or QR code.

When logging in to the game for the first time, the players are asked to enter their name or nickname and email address. At the same occasion, the players can also select the language they want to use for the interface. When logging in, each player will also be shown their assigned game code, which they can use to continue their own game later. Upon joining the game, the player is then shown a short introduction to the game, which explains, among other things, the game's storyline and the player's role as a trainee in a fictitious risk agency - Riskivirasto:

> *Welcome! You are now familiar with the Riskioppi Learning Environment material on risk management in digital environments. Now you're ready for the practical part - an internship at the Riskivirasto!*

> *The Riskivirasto serves people on all aspects of risk in the digital world - from anticipating risks to managing and dealing with the risks that have already emerged and the problems that have followed.*
> *Your role is to complete a day as a trainee with a member of staff of your choice. You will be exposed to a variety of risks in digital environments in the Agency, both in your work and in your personal life, and you will learn how to put into practice what you have learned in theory.*

The player will also be given a brief summary of how to navigate around the game and the estimated duration of the session, which is around 30—50 minutes. Once the player clicks on the 'Start Game' button, the actual game's frontpage is displayed. This is called the *game board*.

The learning environment is based on the use of these different game boards, on which the game material is built (Figure 19). There can be one or more game boards. For the Riskivirasto game, only one board was used for the sake of clarity.

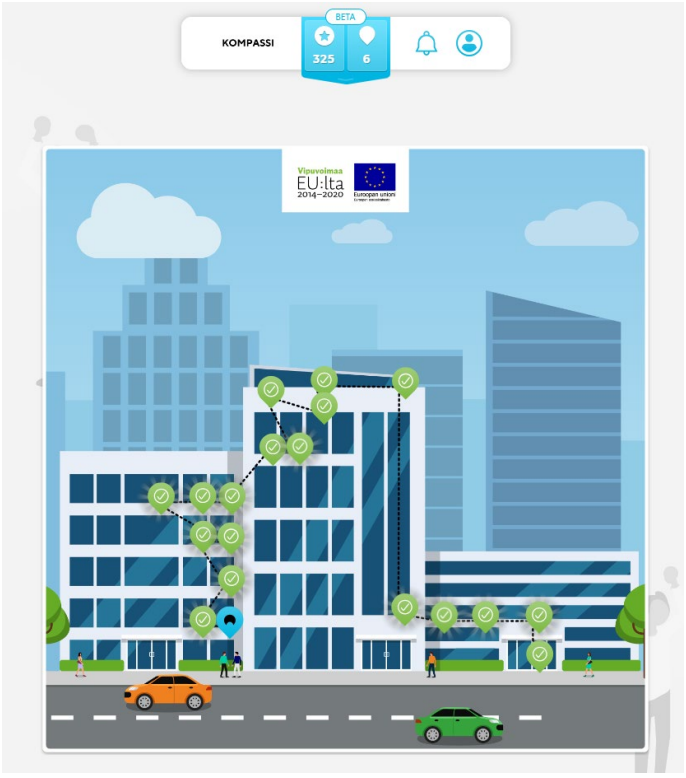

Figure 19. Riskivirasto gameboard as provided by the Seppo platform

As can be seen in Figure 19, the game board in the game of Riskivirasto represents a building that is, the office of the fictional Risk Agency. As the game progresses, the player navigates through the different parts of this building. The game starts by entering the front door of the building by clicking on it.

When playing on a desktop or laptop computer, the learning environment is controlled by the mouse; in mobile environments, it is controlled by the fingers on a touch screen. The game board can be moved around freely and zoomed in on, allowing the different task icons to be separated from each other better or further away for a clearer overall picture. The player's route will appear on the board as the game progresses and tasks are completed. Each time you click on a new game board icon, the task will open. The game board settings are controlled from the bar at the top of the game board (Figure 20), which also provides access to the game scoreboard or the game rules explained at the beginning.

Figure 20. Game board settings at the top of the screen

In practice, the story of the Riskivirasto game starts with the player in a situation where (s)he is doing an internship in a fictional Risk Agency. During the working day, the player is assigned various tasks related to digital risk management. The first of the game's tasks (Figure 21) already opens up the story of the game a bit more. The task is to choose between two agency employees, Laura and Henri, who the player wants to go with in order to complete the various tasks that arise during the day.

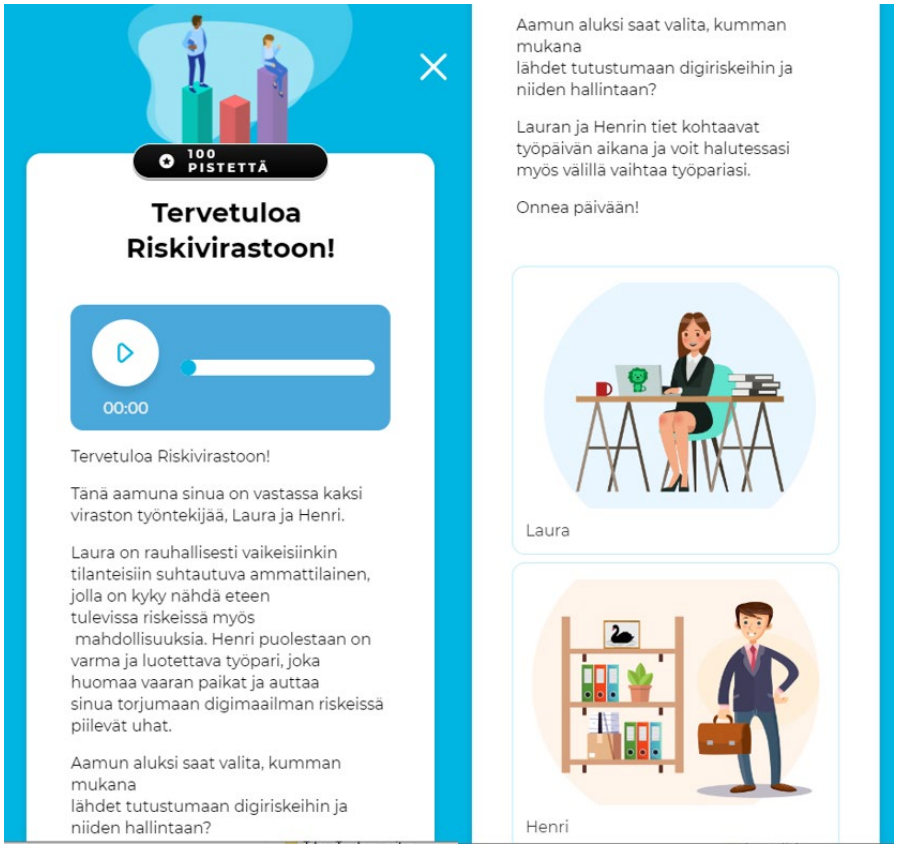

Figure 21. The first task of the Riskivirasto game –choosing Laura or Henri as your mentor

Each of the game's missions consists of a similar structure. After the title of the task, a short narrative is used to move the story forward and the task for that section is given to solve. For accessibility, it is important that the player also has the option to listen to the task by pressing the play button.

The following example, shown in Figure 22, presents the early part of the game's mission ”Lauran luotsissa” (“Laura's tutelage”). The story of the game consists of different case scenarios. These cases, which will be solved during the day, will move the story forward. For example, in this mission, the player wants to take a selfie photo inside the office. However, the instructor interrupts the player and asks him to think about why it might be wrong to take a selfie in this situation.

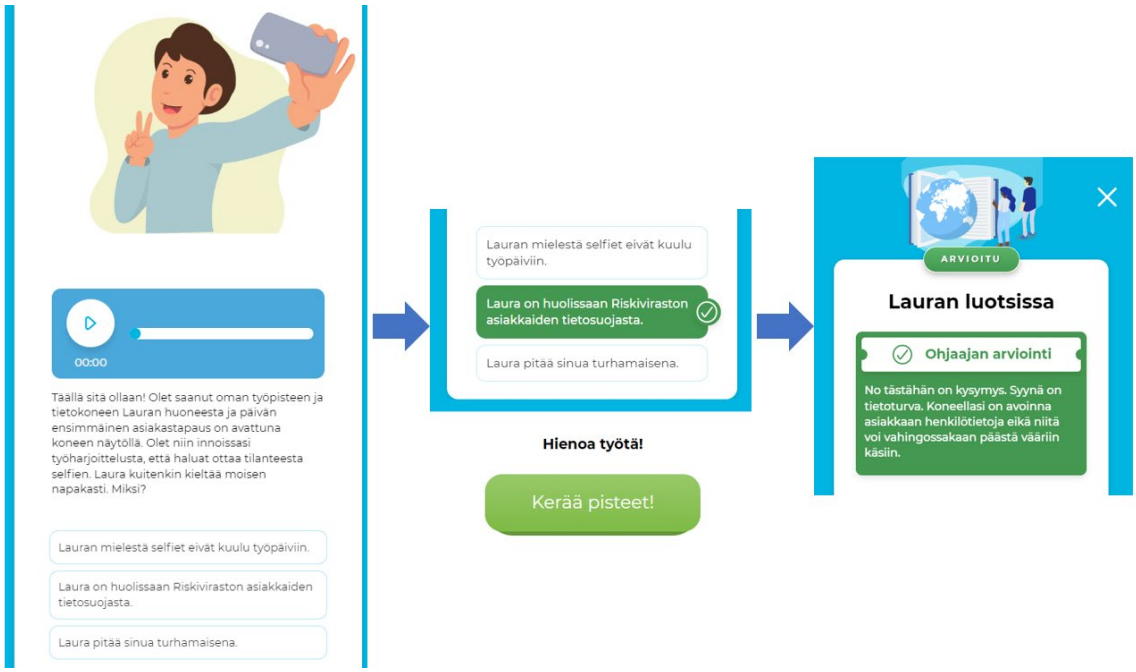

Figure 22. Responding to the task and assessment of the mentor

In the example in Figure 22, the player is offered three different answer choices. When a player submits an answer, they receive immediate feedback and points based on the correctness of the answer. In general, the tasks have been designed to be approachable and to give a positive impression, but also to make the player think about the choices they are making. Even if the player gets the answer wrong, the feedback provided by the game aims to tell them what they could have done differently and what the correct answer would have been.

The game moves the story forward with a variety of mission types, each presenting a different scenario for the player to solve. There are several paths to follow in the game. This gives the game replay value. There are 45 missions in total, of which the player completes a total of 20 on the route of his/her choice. The following Figure 23 shows the possible mission paths in the game, as well as the missions of Laura or Henri, the mentor in each case, and the tasks that are common to both. The tasks presented in the early part of the game focus on dealing with negative risks, anticipating, identifying, analysing and handling them. Positive risks are also more prominent at the end.

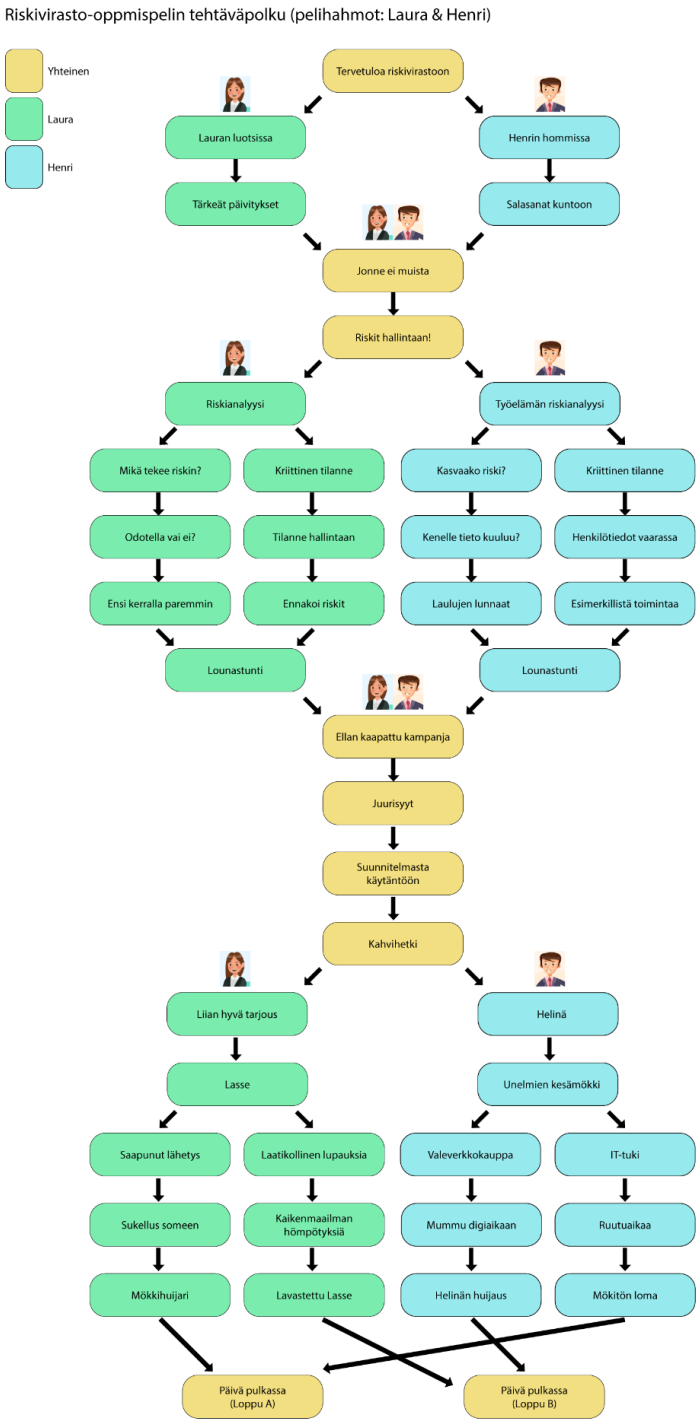

Figure 23. The mission path of the Riskivirasto game

At three points during the game, the player has the option to choose which mentor they want to continue their day with.

The game has two possible endings, depending on who the player has travelled with and the choices the player has made towards the end of the game. When a player completes their training day in the game, they also receive their own achievement badge for completing the Riskivirasto game (Figure 24). This was one feature added to the game in response to feedback.

Figure 24. A badge rewarded for completing Riskivirasto game

Although the badge is a sign of passing the game, the Riskivirasto game also has the competitive element of scoring. Players' scores are recorded in a scoreboard (Figure 25) that is available for all to see. This scoreboard can be accessed via the game board at any time.

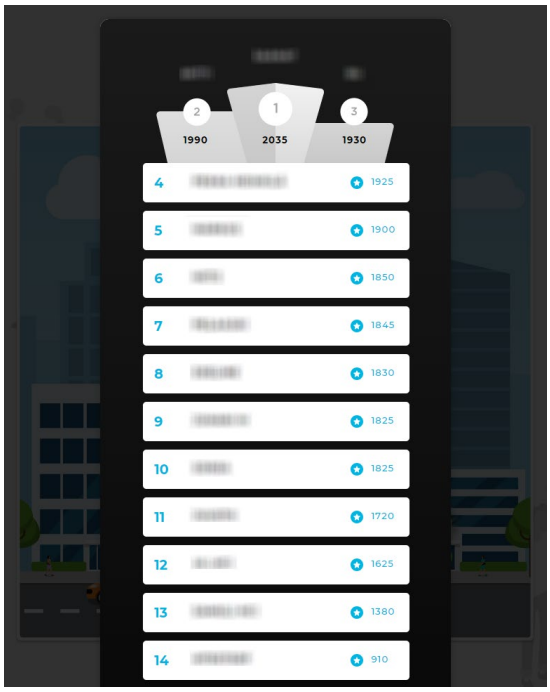

Figure 25. Game scoreboard

In the scoreboard, the Top-3 are separated into their own podium-like element at the top of the board. When a player wants to stop playing, they can do so simply by either closing the browser window or, preferably, by logging out via the profile icon in the game's top bar.

5.1 Accessibility

The game was developed with accessibility in mind as much as possible. The goal was to respect the Web Content Accessibility Guidelines (WCAG) as much as we could. WCAG is a set of recommendations for improving web content accessibility (Lawton Henry, 2023). In terms of accessibility, the development work started with the Seppo platform, which has WCAG 2.1 AA as its accessibility standard. However, this only applies to the Seppo game platform. As regards content, the accessibility of the content is ensured by the game creator. (*Seppo Gamification Platform*, 2023.)

The project team aimed to maintain the same level of standard by ensuring, for example, that the game missions / tasks are available as audio recordings, that alternative texts are defined for the game images, and simply by iterating through the game content during the process, both by the project team itself and with the help of experts to clarify it.

Although the Seppo game platform had limited possibilities to make use of, for example, html code, an attempt was made to avoid various gimmicky situations, such as using tables

defined as invisible to indicate a specific place on the page for an image. This is not accessible as it could potentially confuse any assistive devices.

The project team also wanted to pay special attention to the functioning of the gaming environment, also in different situations of visual impairment. Extensive testing of the game environment and the game tasks was carried out along the way, which resulted in the environment taking into account different visual problems with colour tones (Figure 26). For various colour vision deficiencies, the learning game was tested for Protanomaly, Deuteranomaly, Tritanomaly, Protanopia, Deuteranopia, Tritanopia, Achromatopsia and Monochromatism.

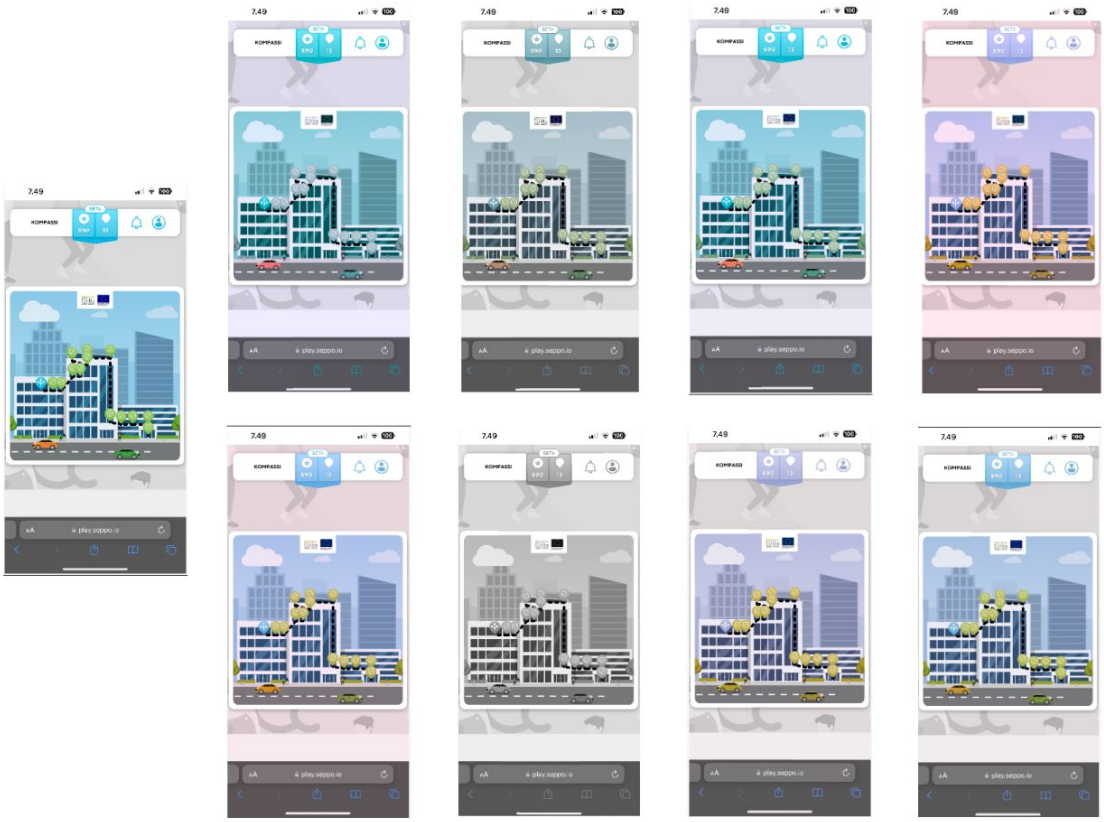

Figure 26. Tests assessing various types of colour vision deficiencies.

Accessibility also involves collecting feedback. At the end of the game, the player was given the opportunity to tell with open feedback how the game experience went. Unfortunately, no answer was commented on this last task. In addition, the goals of the game were also clearly highlighted, as well as, for example, the estimated time required to complete the game. The times were clocked by the representative of the project group several times during the construction process. According to preliminary estimates, the duration of the

game was announced to be around 40—60 minutes. In the end, the previously estimated time turned out to be slightly higher than the actual time, as statistics show that the average time spent on the game was just over 30 minutes. In any case, the timing was not far from the reality. More detailed aspects of time use are discussed later in chapter 6.5.

All in all, accessibility was managed to be taken into account in the Riskivirasto game even better than initially expected, especially with regard to audio recordings and colour vision deficiencies. Full WCAG compliance is hard to achieve because it's a very large collection of guidelines. However, the game was built to be accessible, and finally there was no major specific feedback from the players directly regarding WCAG issues. In addition, where some minor issues arose, accessibility improvements were made based on testing feedback received throughout the development process.

6 TESTING A GAMIFIED LEARNING GAME

The game was thoroughly user-tested during the different phases of the Kompassi project. The very first tests were carried out by the Lentävä Liitutaulu Oy's expert. This was followed by an online survey aimed both at members of the Seinäjoki Game Developers' Association and as a publicly available survey.

The game was also made available for usability testing in the Introduction to Human Computer Interaction course at the University of Vaasa, which is strongly linked to the VME Interaction Design Environment, which supports collaboration between the university and companies.

This chapter will therefore go through each round of game testing in detail in order to provide a comprehensive overview of the whole game testing process and the observations made at each stage.

6.1 Preliminary testing

The first round of testing the actual Riskivirasto game was carried out before the final delivery of the game to the project team in July 2022. An expert from Lentävä Liitutaulu Oy, the developer of the Seppo platform, Anna Uusiniitty, conducted her own test during the game development process. The project team received a report on the tests carried out.

The game design was tested during the summer of 2022 with test users aged between 20 to 45, most of whom were not very familiar with the digital environment. The feedback received was mostly positive and constructive. Some changes were made to the game as a result.

The main message from the testers was enthusiastic. One of the comments was: "*this was a bit of a thrill*", which was exactly what was wanted from the game. Everyone had found the game clear, easy to follow and suitably challenging. Each player also felt they learned something new during the game. The audio recordings of the tasks were also praised, especially by the younger players.

Following feedback from test users, changes were made to reduce the number of tasks so that there was only one task per question. This was found to clarify the progression of the game for those not previously familiar with the platform. It was also hoped that the number of missing word type tasks would be kept to a minimum. Mention was also added of the progression of the game in the Lounastunti (Lunch Break) and Kahvihetki (Coffee Break) tasks. These points would now indicate how many tasks are left of the total number of tasks.

Further changes were made to the final version of the game based on comments from the project team, such as making the logos required for ESF projects more prominent, adding small jingles at the start and of tasks if the task is listened to with voices. The game's early tasks were made to further highlight the risk management theme by using visual cues such as a *black swan* representing an unknown threat and a *green lion* representing an unknown opportunity, both animal metaphors much used in risk management theory. These concepts were explained in the Riskioppi learning materials. Colours specifically defined as accessible were also added to the game platform, and the name of the Kompassi project was also highlighted on the game board.

However, some of the changes suggested by the project team could not be implemented without completely changing the game mechanics. Changes that could not be implemented were, for example, the addition of a numbering system to the task titles to indicate the progress of the game, as the game developer reported that the initial test users had found that numbering the task titles made the game visually less attractive.

The project team also considered that the game could make it clearer that the character Laura would be more interested in seeing opportunities in risks, while the character Henri would be more interested in countering threats in risks. It was not possible to add such a differentiation to the game as it would have required a change in the game structure. Risks are currently handled in such a way that each player faces risks and realised threats at the beginning of the game. Towards the end of the game, risks are also examined as opportunities.

A further development idea was to add a separate 'risk professor' character to the game, acting as a link between the Riskioppi learning environment and the Riskivirasto game. This would also have required a rewrite of the story, so it was decided not to implement this character in Riskivirasto but use it elsewhere in the digital learning environment.

There was also a need to slightly resize the game board to make it easier to find the first task. On some devices, the game board would zoom in at the start of the game and hide the starting task from view. For this reason, it was necessary to manually scroll the image to the correct position. However, the size of the game board could not be changed in this case. The solution proposed by the game developer's representative was to encourage players to play the game via a separate downloadable Seppo app, so that the whole game board would be visible to the player and not zoomed in randomly. The project team noted that the problem is unlikely to be very serious and only occurs on some phone models. In addition, forcing the installation of a separate application would in any case make playing process unnecessarily difficult.

6.2 Human Computer Interaction course feedback

The Riskivirasto was included in the Introduction to Human Computer Interaction (HCI) course on usability and human-centered design at the University of Vaasa. It was one of the options to make the game heuristic evaluation and usability testing by the students. In autumn 2022, a member of the project team visited the course to present the functionalities of the Riskivirasto game to the students and to give the desired assignment for the exercise. Based on the presentation, a group of four students was selected to take a closer look at the Riskivirasto game.

As a guideline, the group was given the task of evaluating and improving the mobile version of the game in particular. It would be possible, if so desired, to focus on a specific part of the game and improve it. In general, the aim was to find out what could be done to make the game experience smoother, whether some usability problems could be found and what kind of development ideas the testers would have. The Kompassi project offered support if needed, should any problems arise. The team that had chosen to work on the Riskivirasto game started its work and returned the finished project before the January 2023 deadline, providing the project team with the possibility of accessing it.

After studying the game, the team made a heuristic evaluation of the game in terms of usability. They used Jakob Nielsen's list of heuristics, which has become a standard for usability and outlines rules of thumb for general principles for interaction design (Nielsen, 1994). Three of the most serious usability problems identified by the group were related to Nielsen's heuristics 'Flexibility and efficiency of use'. In this group, problems were identified with issues such as clarity of the default view, multiple choice tasks, and unnecessary transitions. A finding related to the heuristic called 'Visibility of system status' was that the progress status of the game is not clearly visible to the player. In the 'Aesthetic and minimalist design' group, four observations were made. The findings were that task names are not always clear because they can be stacked on top of each other, the game view does not tell the player if the game is running, there are no different sound effects (despite the tasks read aloud in the context of the tasks and jingles in the same context), and the game has unnecessary options for editing and selecting the game view.

The heuristic 'Match between system and the real world' was attributed to the localisation of the game, where changing the language of the game only changes the language of the menus. A further Nielsen heuristic related to the combination of both 'Help and documentation' and 'Recognition rather than recall' was the finding related to the visual appearance of the game that the clarity of the game's selection icons could be improved.

Based on their findings, the group drew up proposals on how to solve the problems they found. They also produced a prototype demonstration with suggested corrections (Figure 27).

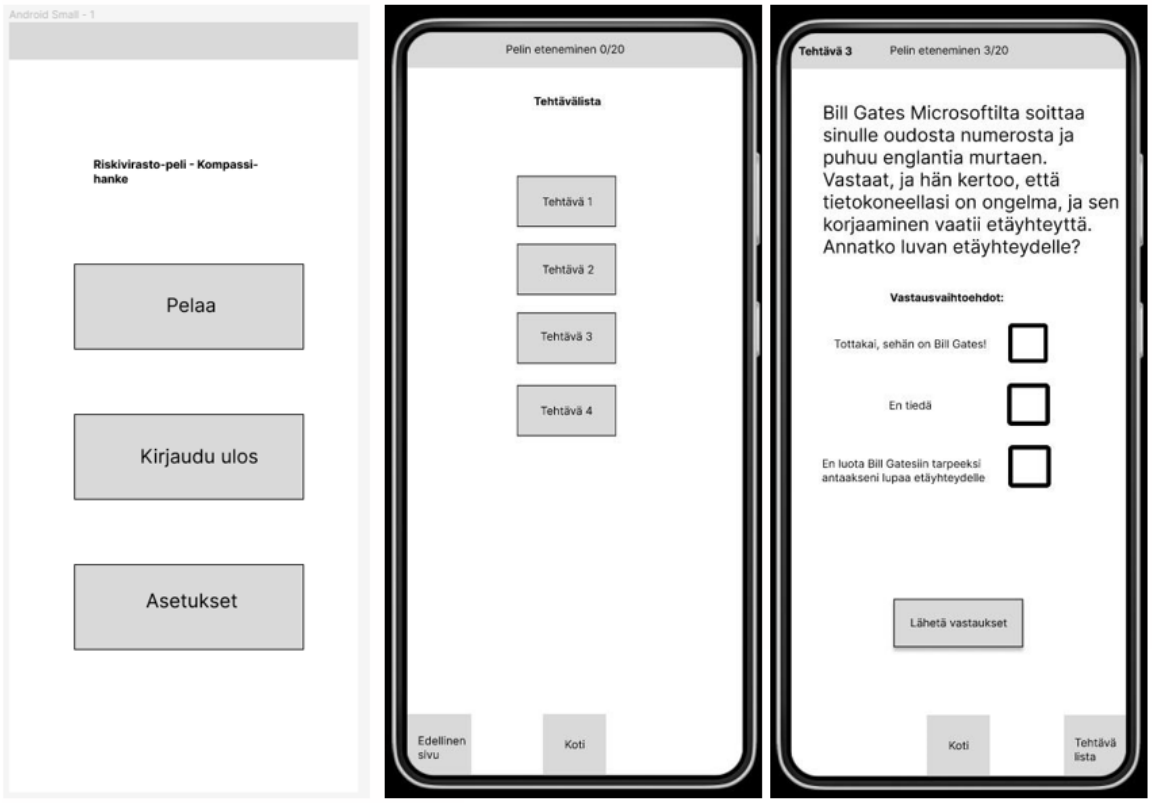

Figure 27. HCI student's improved UI prototype model

The model developed by the team of students in Figure 27 is a wireframe model, as the intention was not to recreate the whole game, but to focus on demonstrating the possibilities of solving the identified problem areas. Suggestions for solving the identified problems were related to clarifying and simplifying the game view. Accordingly, in order to clarify the on-screen experience, it would be useful to add a ”play” checkbox at the beginning of the game to make it easier to start the game. A progress bar has also been added to the top of the screen to make it easier to monitor the progress of the game. The mission list has been simplified and unnecessary intermediate steps have been removed. Attention has also been paid to the ease of answering game tasks, in particular multiple-choice tasks, by making them more concise and visible without scrolling up and down the screen, for example by limiting the number of choices.

The HCI group also conducted facilitated usability testing on the prototype and the original game with two end users. Observations were made by the subjects by narrating their observations out loud while playing first the original game version, then the prototype version. The testers were asked to complete the process of logging in and starting the game, completing one multiple-choice and paired-answer task, opening the scoreboard and opening the game's home screen, followed by an evaluation of the clarity and ease of use of the various features and the layout of the game.

In the results, both the original game and the prototype received the same average score on a scale of 1=poor, 2=significantly needs improvement, 3=OK, but something needs improvement, 4=only minor issues, 5=nothing needs improvement. The average score was 4,19, so both versions had only minor issues. The group also compared the results by removing the question about the game's visual layout, giving the prototype game a mean score of 4,43 and the original game a mean score of 4,14.

The differences between the original game and the prototype proposal were therefore quite small in the opinion of the test persons. Of course, the sample of two people used by the group could be larger, but the results presented above still allowed to identify some good suggestions for improvement, especially with regard to the mobile version of the game and its smoothest possible user experience.

Based on HCI feedback, it was possible to eliminate a few bugs in the finished game related to functionality that would otherwise have been overlooked. For example, the start screen and its instructions were also clarified. Naturally, no changes to the game structure could be made to the version already in use. However, valuable test findings can be used in other contexts.

6.3 General tests

A slightly broader survey was carried out through the Sepeli association members and as a general survey throughout the Kompassi project, which paid more attention to gamification. A total of ten respondents were obtained through the survey. 100% (n=10), i.e. all of them gave permission to use the survey for research purposes. The gender breakdown (Figure 28) of respondents was 40% women (n=4) and 60% men (n=6). This distribution was fairly consistent with the survey conducted during the workshop presented in chapter 4.4.

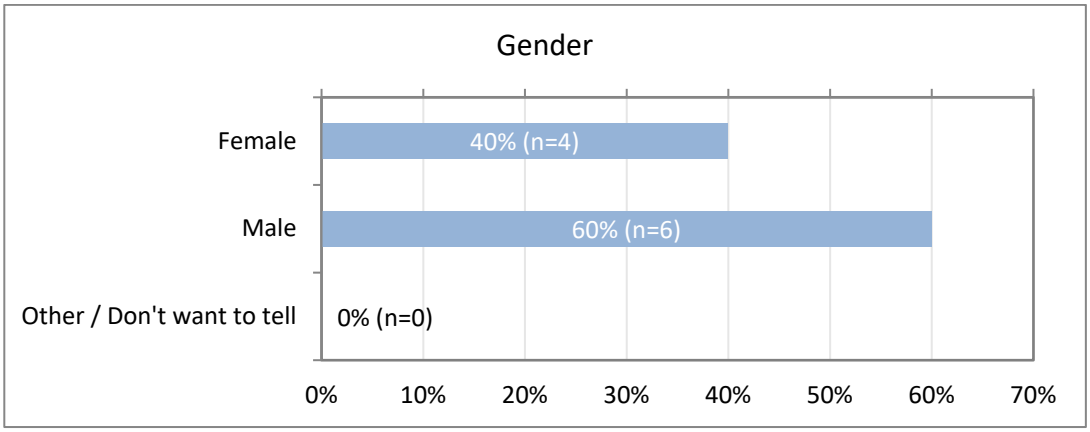

Figure 28. Gender of test users

Respondents also provided their age in the survey. The youngest respondent was 19 years old and the oldest 44 years old. The average age of the respondents was 29.8 years. N=10.

On average, it took players 34 minutes to play through the game. The fastest respondent completed the game in 10 minutes, while the slowest took 50 minutes (n=10).

When asked about playing the game to the end (Figure 29), the responses were positively surprising.

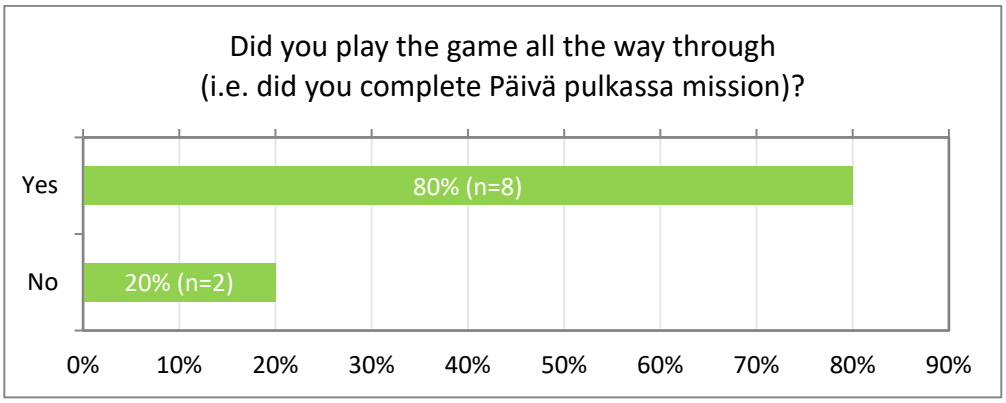

Figure 29. Game completion

As shown in figure 29, 8/10 of the respondents had played the game to the end, i.e. completed at least 20 tasks. This also gives the results of the survey reliability, as it can be assumed that the respondents have a reasonably comprehensive understanding of the game.

The next question was an open question asking respondents: **If the playing ended prematurely during a game session, what was the reason?**

Three testers gave their answers. The first of these comments relates to usability, quality and localisation:

> *(13.) Terrible usability on a mobile phone! Hasn't this been tested in a usability lab? Every screen had tabs and again you had to click on an English button in an otherwise Finnish game. Terrifying.*

The comment 13 shows a deep frustration with the way the game works, especially on mobile devices, and with functionality and testing in general. This shows the importance of a smooth user experience. In addition, the comment on language shows how important it is that, for example in the case of the Riskivirasto game, that the chosen software platform is localised in all aspects if the game itself is built in another language.

The other two comments (14 and 15) were related to time constraints:

(14.) Lack of time. Something else to do in between.

(15.) Other urgent matters came up.

These comments show that it is normal that sometimes a game session needs to be interrupted for one reason or another. It is therefore important that the game allows a smooth exit and, if necessary, a return to the situation before the interruption if the player wants to return again when the time is better. In the Riskivirasto game, this was done by showing the player a code at the start of the game to resume the game from where they left off.

In the next question (Figure 30) surveyed the general attitudes towards the game.

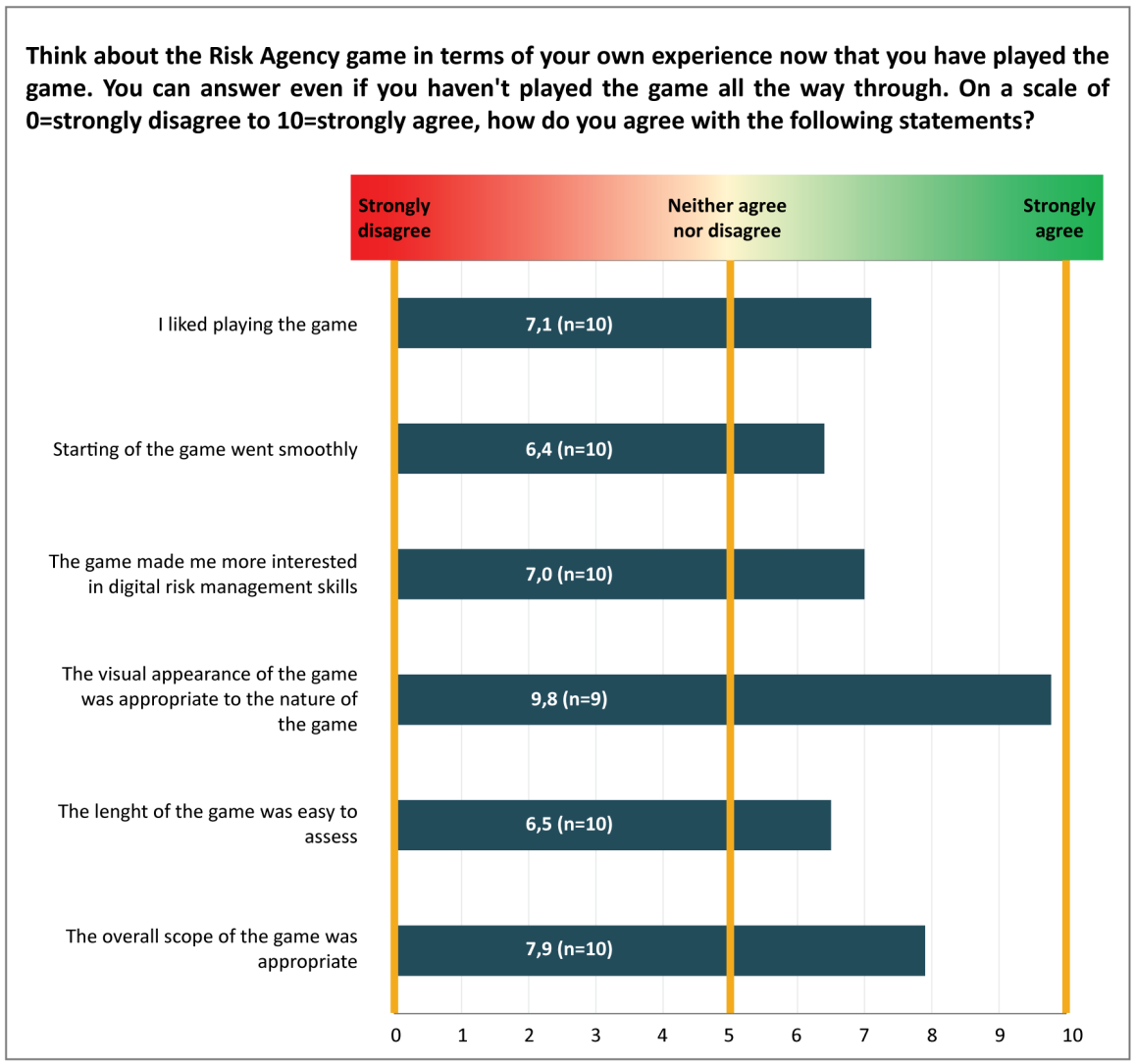

Figure 30. Riskivirasto game - opinions about the game

In the question, respondents were asked to think about the Risk Agency game based on their own experience now that they have played the game. The answer could be given even if the respondent had not played the game all the way through. The scale used was a Likert scale of how much the respondent agreed with the statements on a scale from 0=strongly disagree to 10=strongly agree.

In more detail, the game was liked, with a positive average score of 7.1 for ”*I liked playing the game*”. “*Starting of the game went smoothly*” for the most part, with a slightly lower average of 6,4. The average score for the question ”*The game made me more interested in digital risk management skills*” was 7.0, indicating that the game succeeded to some extent in getting players interested in the topic of risk management.

For ”*The visual appearance of the game was appropriate to the nature of the game*”, opinions were almost unanimous. The average score was as high as 9.8, indicating that respondents considered the visual appearance of the game to be very successful and appropriate to its subject matter. On the question on the length of the game ”*The length of the game was easy to assess*”, the answers again showed a moderate level of acceptance with an average score of 6.5. The last question in this set asked for an opinion on the scope of the game ”The overall scope of the game was appropriate”. The average score was 7.9 suggesting a generally positive response.

All average scores in this category were above 5 (on average 7,4) that indicates that the majority of respondents had positive experience playing Riskivirasto game. The respondents had strong agreement on aspects like the game’s visual design and overall scope. On the other hand, perhaps things that could be improved seemed to be the actions of starting the game and clarifying the total duration of the game to the player.

The next set of questions focused specifically on the story of the game (Figure 31).

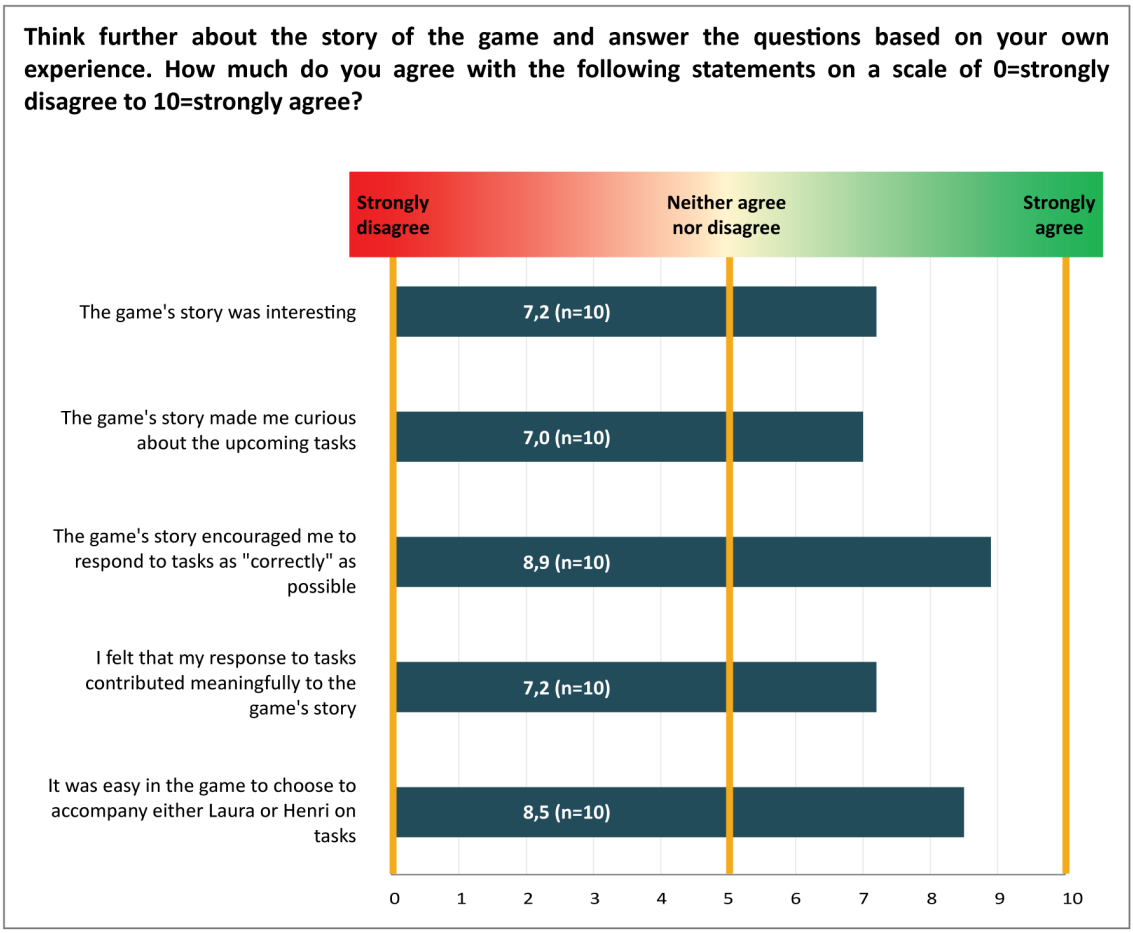

Figure 31. Opinions related to the story of the Riskivirasto game

Among these, the average score for ”*The game’s story was interesting*” is 7.2. This suggests that respondents found the story generally satisfactory. The second question ”*The game’s story made me curious about the upcoming tasks*” received a nominally lower score with an average of 7.0. Cautiously, it can perhaps be said that the story still managed to create a small sense of anticipation and interest. On the other hand, the result ”*The game’s story encouraged me to respond to tasks as ”correctly” as possible*” with a mean score of 8.9 is a good indication that the narrative was able to motivate respondents to strive for correctness in their answers.

”*I felt that my response to tasks contributed meaningfully to the game’s story*” also received an overall acceptable average score of 7.2. This is in line with the other cautiously positive results in the question set. The last question in this section asked about game characters: ”It was easy in the game to choose either Laura or Henri on tasks”. The average score of 8.5 indicates that respondents found it easy to choose which character to accompany them on tasks. As already mentioned in the previous presentation of the game,

as the game progresses, the player has a total of three times the opportunity to switch to one or the other character.

The average score for this whole group was also above 5 (on average 7,8), so it can be concluded that the story of the game was largely successful. In summary, the results of this section show the importance of a good and engaging story in gamified solutions. It also indicates that a compelling storyline can enhance the overall gaming experience. The story not only creates interest in the game, but also motivates players in the tasks they have to perform. In addition, the fact that the story makes it easy to make choices, for example between characters, shows that the content of the game is perceived as versatile.

The last set of questions in the survey was specifically about game tasks and scoring (Figure 32).

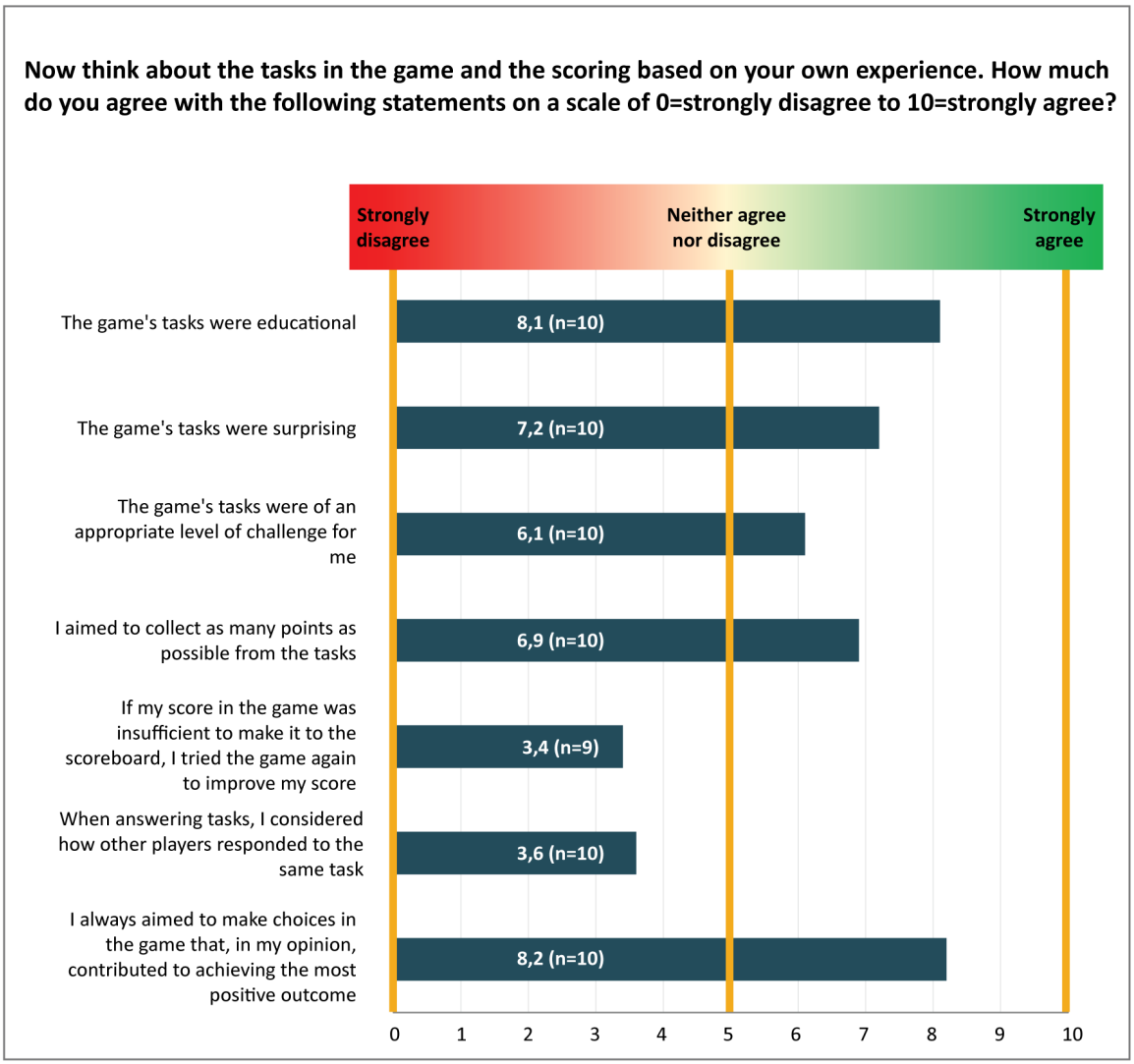

Figure 32. Opinions related to the tasks and scoring in the Riskivirasto game

The tasks in the game were perceived as instructive and possibly learning-oriented. The question "*The game's tasks were educational*" received a high average score of 8.1, suggesting that the game effectively incorporated educational elements. The game can perhaps be said to have at least some kind element of surprise, as the question "*The game's tasks were surprising*" received a moderate score of 7.2. Responses to this question were close to the mid-point, but more in the same generally positive direction, reflecting the lack of any major surprises. The level of challenge was measured by the question "*The game's tasks were of an appropriate level of challenge for me*". This received a relatively lower average score of 6.1, indicating that participants' opinions on the tasks varied. Some felt that the difficulty level of the tasks was appropriate, while others may have found them either too easy or too challenging.

The scoring question was "*I aimed to collect as many points as possible from the tasks*". The average score of 6.9 indicates that respondents were somewhat motivated to keep track of their points. However, the motivation to collect points seems to vary depending on the respondent. Looking at the scoreboard (Figure 25, previously presented) of the game, we can also see the phenomenon that some are clearly focused on getting as many points as possible while others have clearly played through the game without caring about the points. The difference between first and fourteenth on the scoreboard is 1125 points.

The previous question is also confirmed by the question "*If the score I got in the game was not enough for the scoreboard, I tried the game again to improve my score*" with an average score of 3.4. This shows that a relatively small proportion of respondents played the game again, at least to improve their score. The game scoreboard also confirms this. The players also didn't think too much about what others had answered. "*When answering tasks, I considered how other players responded to the same task*". The question showed this with an average score of 3.6. The final question was on the positive outcome "*I always aimed to make choices in the game that, in my opinion, contributed to achieving the most positive outcome*", which received a high average score of 8.2. The responses indicate that respondents generally tended to choose the option that might lead to the best outcome.

In summary, this last set on tasks and scoring, the variation was clearly higher than in the previous sets. Although the tasks in the game were seen as educational and even surprising, scoring was still not seen as having much value here, at least not in terms of replaying the game. However, it seems that the first game session is the one that matters most and that more effort is put into it, for example in the context of trying to answer the best possible answer choice. These insights provide valuable feedback on various aspects of the game's design and player behaviour.

The last question in the survey asked about the game's encourage factor. Respondents were asked: **How would you change the game to make it more encouraging?**

The question received a total of 8 good and varied comments, so it is worth presenting each of them here. The issues appearing in the comments can be divided into three main topics: *issues related to usability, issues related to engagement and issues related to clarity and accessibility*.

Issues related to usability:

Three of the comments highlighted usability in particular (16, 17, 18). Comments 16 and 17 were encouraging in nature, although in both cases the feedback was mainly focused on usability issues, especially on mobile devices. The comments refer to clumsiness and unnecessary cutscenes to click through during the game. Comment 16 also referred to the simplification of the game's login and the removal of the log-in requirement to start the game. In total, the comments emphasise that the smoothest possible user experience increases the overall enjoyment of the game.

> *(16.) I would focus on improving the game mainly from a usability point of view, as it was a bit clumsy on a mobile device now, probably due to the limitations of the platform used (?). However, I believe that the majority of young people use mobile devices to play, so the clumsy usability might take too much attention away from the game itself and thus the learning process. It would also be nice if it were easier to start playing rather than needing to log in.*

> *(17.) The game itself is even good in some fundamental ways. However, more optimisation is needed for mobile devices, especially in the removal of various unnecessary steps, for example when answering tasks.*

Comment 18 was slightly more critical of both usability and the game as a whole.

> *(18.) Poor usability, boring format and no game at all. I don't understand who the game is aimed at.*

Again, this comment also shows the great importance of usability. The sentence also criticises the game for being boring and for the clarity of the target groups. This could be the result, for example, of the fact that the user would have needed more different challenges or rewards or other means of gamification, which can improve engagement and, by extension, the understanding of the game.

Issues related to engagement:

Comments 19, 20 and 21 were in some way related to engagement.

> *(19.) The game is made on a subject that could easily become a boring game. However, the Riskivirasto game had managed to treat the subject in a suitably light way, so that learning was a rather subtle process, which is certainly well suited to the target group of the game - young people. The tasks were suitably challenging and there were sufficient number of them.*

Comment 19 highlights the thematic nature of the game and the fact that it has been possible to make a game with a good level of difficulty and length, especially for young people, out of what could even be considered a boring theme, thus contributing to a positive gaming experience.

The comments 20 and 21 show that the game was mainly perceived as enjoyable and could have been even more substantial. One commenter (21) even specifically mentioned the fun of helping customers in the game.

> *(20.) If I wanted to make the game even more encouraging, I might add more consequences and options.*

> *(21.) I think there could be even more questions in every situation, and even more challenging ones. I also think that the game is already very encouraging. Helping fictional customers was fun.*

Issues related to clarity and accessibility:

The third group of comments concerned issues related to the clarity and accessibility of the game (22, 23).

> *(22.) Jargon, I would pay more attention to the way questions are phrased.*

The response to comment 22 suggests that the commenter has some concerns about the use of unclear language in the questions and believes that the question should be rephrased for better clarity and engagement in a gamification context. The comment underscores the importance of clear communication.

> *(23.) Does it require written assignments? I didn't understand how the points came....*

Comment 23 also highlights the need to clarify the different functions of the game, such as the requirements, especially regarding written assignments, and also to provide a broader basis for how the scoring of the game works and how points are obtained.

Overall, the above comments also proved the project team's own observations to be on the right track. Based on the comments provided, efforts were made along the way to modify the game as much as reasonably possible during the project period. Among other things, language maintenance was carried out and the mobile version of the game was improved, for example by looking at tasks specifically on mobile devices and paying attention to issues such as line breaks and scalability of images so that they would print well on smaller mobile screens.

6.4 Other considerations

The Riskivirasto game with Riskioppi learning environment were also tested by two intern trainees from the University of Vaasa. They gave their comments about the game. Both of the interns used a computer for testing and they both have some casual gaming background.

The trainees were given informal instructions on how to test the game, with the same login instructions as everyone else. The trainees were also encouraged to learn about the topics covered during the testing, in order to develop their own skills and also to learn for future jobs.

Both trainees tested the game independently and provided short written feedback on the problems they had encountered and suggestions for improvement. In addition, the trainees had a small feedback session with their supervisor from the Kompassi project team, where the supervisor asked them about their experiences in more detail.

In addition to the Riskivirasto game, the Riskioppi Learning Environment developed by the Kompassi project was also included in the exercise, so the comments provided were relevant to both solutions. The verbal comments (24, 25 and 26) given by the trainees to their supervisor were:

> *(24.) Professional, lightly written, encouraging text, which motivates.*
>
> *(25.) Clear, not too complicatedly explained, I liked the look, didn't get the (feeling) of being done overnight, quite an amount of effort.*
>
> *(26.) The Riskivirasto's first working day was a nice idea and nice looking.*

All verbal comments gave the impression that the game and the associated learning environment material conveyed the effort put into it. In their written feedback, the trainees further expressed their experiences with the Riskivirasto game. Among the comments, the main observations were as follows:

Most of the comments made were related to the Seppo platform used by the Riskivirasto and its problems. Such problems included, in some places, the difference between English and Finnish in the game menus in this otherwise Finnish-language game. In some situations, for example, the clickable button to open an exercise was titled wrongfully ”open exercise” (in English) due to problems with the Seppo platform's localisations. Problems were also encountered with scoring, where the game could display ”error occurred” even though the score was correct after the message was clicked off.

The type of task that combines concepts with each other was also perceived as difficult. As an operation, linking works by first clicking on the explanation, then selecting the ”place answer” step, followed by pointing to the place where the concept is to be placed. A comment suggested that the unnecessary intermediate step could be dropped.

Feedback could also be initially ignored, as comment 27 show:

> *(27.) I did not initially notice that the results also show ”instructor's feedback” because the view always opens at the bottom of the page.*

In Seppo, the feedback on the assignments opens at the top of the page, as shown in previously introduced Figure 22. ”Instructor's feedback” may not be reflected in the best possible way.

There was also an intermittent problem with resuming the game, where the game was not saved (comment 28):

> *(28.) At one point I stopped playing just before the end, and when I logged back in I had to start again.*

In this case, it is likely that the player had not remembered the code given at the beginning to continue the game.

Part of the comments were also related to the visual layout of the task icons on the board (comment 29):

> *(29.) “Helinä” ja “Unelmien kesämökki” (“Dream cottage”) sections are a bit too close together, making the “Unelmien kesämökki” task difficult to open.*

Comment 29 relates to the fact that in some situations, for example if the game board is zoomed to its furthest position, the task icons on the game board may be close together. This is corrected by zooming in on the game board.

However, in addition to the criticisms, the trainees generally commented on the game examples with positive remarks. The trainees also praised the game examples as good and practical, fun, memorable and having a clear and simple layout.

In summary, feedback from trainees underlined the importance of user-friendly design, improved localisation and a smooth gaming experience. The fact that a large proportion of the problems identified were related to problems internal to the gaming platform used, with no immediate corrective action available, underlines the importance of reporting bugs and problems to the game platform provider. At the same time, as the same platform is used for multiple purposes, the balancing act is certainly also laborious from the

platform provider's point of view and the time taken to make corrections and bug fixes might be slow.

6.5 Game statistics – how did it go?

The Riskivirasto learning game was open between August 23, 2022 and August 31, 2023. Playing the game was combined with the learning material of the project. During that time, **a total of 66 user IDs were created for players of the game**. Out of all the user IDs created, 47 IDs started to play through the game's tasks.

There seemed to be two different types of completers: those who casually played through the game and then those targeting the top-10 on the scoreboard who actually put time and thought into completing the game. If the finishers are narrowed down based on **the top-10 players on the scoreboard, they spent an average of 31 minutes completing the tasks.** The player who reached the top-10 ranking in terms of points in his playing time spent a total of 20 minutes of playing, while the longest playing session lasted 1 hour and 1 minute.

In total, **there were 14 IDs that played through the game**. In this case, playing the game through means that the player has completed one (or more) paths completely from beginning to end.

The most difficult task in the game turned out to be task: "**Ensi kerralla paremmin**" ("Better luck next time"). On average, the players were able to collect only 21.4% of the full points for this task. In the task, the customer's photos had ended up on the Internet and the player's task was to fill in the open fields of the text about the phone's information security with various instructions related to how digital risks related to the use of the phone can be reduced. In the task, a maximum of 20 points were allocated.

The second most difficult was the task "**Odotella vai ei?**" (To wait or to haste?") that received an average of 38,9% of full points. The assignment dealt with a follow-up situation related to the above-mentioned example in the story, where a person who has lost his cell phone does not know who to tell about the situation. In the assignment, threats related to data leaks and their consequences were summarised. The player's task was to connect different related concepts and their explanations to each other. In the task, a maximum of 150 points were allocated.

On the other hand, the easiest were the tasks where just by answering you got full points, such as the first "**Tervetuloa riskivirastoon"** ("Welcome to the Risk Agency") task or the open-answer tasks "**Lounastunti**" ("Lunch break"), "**Ruutuaikaa**" ("Screen time") or "**Sukellus someen**" ("Dive into social media"). If the tasks scored in this way are

ignored, the task "**Mökitön loma**" ("A vacation without a cottage") was one that all of the respondents knew. It was a pair matching task, where one correctly matched pair received 20 points. A total of 120 points were awarded. In the task, the cabin booked by the player turned out to be a scam. It was not at all as promised. In the assignment, the most typical ways of various online scams were reviewed by combining the described type of scam with the correct explanation. The task also offered a link to material outside the game, which deals with different types of digital scams.

Another example of an easy task was "**IT-tuki**" ("IT support"). For this task, the players collected an average of 93.3% of the full points (maximum 100 points). In the task, the player receives a call informing them that there is a security problem on the player's computer that requires immediate action. The task is to put a tick in the box for things that give reason to suspect that it is a scam. In the task, it was possible to get negative points by answering incorrectly, so overall the players also had a very good command of this task.

7 SUMMARY AND CONCLUSIONS

This report explored how gamification can be used to support teaching risk management skills, such as in the ESF-funded Kompassi project. It served as an in-depth case of gamification to open up the gamification process for digital risk management learning materials. The focus was on the design process of and the experiences related to the Riskivirasto game. The aim of the report was to provide a documented overview of the process and its different stages and outputs, and to contribute valuable insights for future projects seeking to integrate gamified elements into online learning environments, especially those funded by the European Social Fund.

Key findings and observations from the gamification and learning game design process highlight several essential factors. The primary observation was the **importance of thorough advance planning** during the game's design stages. Having prior knowledge of the subject matter significantly facilitated the development of gamified solutions. In our case, the project team identified risk management as an ideal topic for gamification early in the process. **Storytelling was identified as catalyst for gamification**, as it could seamlessly incorporate risk management into various narrative themes. Familiarity with gamification and learning concepts guided the identification and helped to pinpoint the essential building blocks of common elements that are often used in gamified solutions. The game, complete with elements like tasks and scoring, was designed to revolve around the overarching story of an internship at a risk agency with two mentors.

The actual game design process for the Riskivirasto game was initiated through a storytelling workshop. **Keeping the target audience as the primary focus, the workshop combined both the substance knowledge in game development and storytelling**. The starting point for planning the workshop activities was the observation that risk management games are often based on some form of collaboration and idea collection (Griffiths, 2012). This approach was also chosen to ensure that the game would meet the needs and preferences of the target audience (cf. Koivisto & Hamari, 2019). **Another key element was the integration of storytelling into the game's ideation process**. At the beginning, participants were introduced to thematic aspects of game development and storytelling through presentations by experts. This helped everyone to better understand the background and objectives of the project.

Participants included not only young people from the target group but also professional and amateur game developers, and individuals interested in game development in general. Ultimately, all participants joined forces to collectively brainstorm game ideas. The workshop's emphasis on storytelling provided an effective solution, promoting a creative atmosphere where participants engaged in brainstorming to explore different ideas related to risk management. This approach not only ensured the fundamental element of fun

associated with games (Alkhalifah, 2022), but also mitigated the risk of the final game becoming boring (Chou, 2016).

This **collaborative approach facilitated the fusion of different points of view** in line with the needs and expectations of the target audience. It therefore proved to be an effective way to generate ideas and content for the game. The actual game was put together by an expert and in fact, aspects from several of the resulting game ideas were used as input for the final Riskivirasto game. The Riskivirasto game focused on issues related to digital risk management. However, this was done in a way that avoided the mistake of focusing on only one criterion, as mentioned in the studies by Taillandier & Adam (2018). The examples of digital risk management that were developed as tasks from the generated game ideas were able to address and highlight a wide range of situations, and also provide a variety of ways to tackle these tasks. On this basis, it can be stated that the design process of Riskivirasto game successfully encompassed two approaches, as outlined by Van Eck (2006), involving students in the game development process and developing a game with specific educational purpose.

It is also worth to acknowledge the potential of the existing Seppo game platform utilised in the process. The features of the game platform were presented as a frame for the game concepts to the brainstormed. Additionally, one key takeaway from the workshop was the realisation that **creating a digital game does not necessarily require coding skills**. There are alternative solutions for implementing digital games. Nevertheless, it's crucial to be aware of the limitations of an existing game platform. Our choice of the Seppo gamification platform was driven by its versatility, ease of use, and functionality on mobile platforms. However, despite multiple iterations and working with the game developer to resolve issues, some usability issues and limitations arose due to the platform's constraints.

Another challenge encountered when using an existing platform solution was the associated cost for using it. The game created on the platform is available only for a defined period of time, during which the platform licence has been acquired. This approach, though practical at the time, somewhat contradicted the theoretical perspective on cost-effectiveness in utility games, as presented by Kulshrestha et al. (2021). The license for the Seppo platform expired in August 2023 with the conclusion of Kompassi project, making the game inaccessible. All game materials have been preserved, but in order to ensure continuity of the Riskivirasto game in the future, it will be necessary to migrate the materials to new solutions.

The Riskivirasto game was tested in a total of four different contexts: prior to the game's release, as part of the HCI usability course exercises at a university, as test feedback collected during the game's lifetime in general, and as a test with intern trainees at a university. Notably, testing by students in the HCI course and trainees holds relevance

beyond the game itself, aligning with the European Social Fund's initiatives to improve employability skills among young people and encourage employees to acquire new skills using innovative tools. Additionally, the project successfully engaged young people through the Sepeli ry association, and in particular the job seeking young people of Preppaamo. The impacts of the activities could be far-reaching, as the workshop seems to have generated interest in game-making and storytelling.

Pre-testing and usability assessments proved very useful in identifying and correcting numerous issues through an iterative process, highlighting the importance of user-friendly design. The feedback received emphasised the importance of usability, including streamlining processes by cutting out various unnecessary intermediate steps, having comprehensive documentation and clear game state tracking to improve the overall gaming experience. What was particularly positive about the Riskivirasto game and the Seppo game platform it uses was that the various accessibility issues were addressed in a satisfactory way, for example by considering different learning styles by providing materials not only in text but also in audio. The readability of different colours in the graphics was also taken into consideration through extensive testing.

Kalmpourtzis' (2018) observations emphasising that learning could also occur in more informal contexts, beyond the original intent, were also considered important in the initial definition. While the Riskivirasto game was designed for educational purposes, it was considered by some test users to be light in its subject matter, thus also supporting informal learning through games. The Riskivirasto game, although part of wider learning context, deals with real issues that could happen, or perhaps have already happened, to the player in digital environments. Moreover, many of these digital risks have recently been reported in the media as cautionary tales.

By presenting straightforward, real-life cases in Riskivirasto, it is possible to imagine some kind of memory trace for the player. This leads back to the question raised at the beginning of the report about what might be the aspects that make learning from games such, that it takes place almost unnoticed. Perhaps someone who has played through the Riskivirasto game, when setting a new password for a service, might remember from playing the game that they should make their password more complicated than '1234'.

In conclusion, the collaborative approach, involving the target audience in various stages of game development, has yielded positive outcomes. These stages encompassed story creation, testing and giving feedback to initial versions of the Riskivirasto game. The test user group from the university HCI course even created a detailed proposal for an alternative user interface to the game. This report showcased one of the achievements of the Kompassi project: the innovative Riskivirasto game, tailored to meet the learning needs of its target audience. The project utilised a wide range of skills and ideas from

participants. The storytelling workshop demonstrated the value of collaboration with experts and the target audience throughout the design process, an essential element in successful game development and content creation. The findings presented in this report can help to develop effective and engaging gamified learning solutions for risk management skills.

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