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Surprise in Gamification

Designing Surprise Mechanisms for a Gamified Learning Platform

Ann-Sofi Trux

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Author Ann-Sofi Trux

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Thesis supervisor PhD Marko Turpeinen

Thesis advisor(s) M.Sc. (Eng) Eeva Myller

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Abstract

The positive effects of surprise have been studied in learning and in the game industry. This study focused on how surprise can be added to learning through gamification. The study was conducted using Seppo, a gamified learning platform. Gamification and educational experts were interviewed for supplying ideas for the design. The design of the mechanisms was further supported by a gamification workshop.

Based on the results, three randomization mechanisms were developed. The mechanisms were tested with potential users concerning intuitiveness, clearness, visuality, suitability for learning, and fun. The most appealing mechanism was the wheel of fortune, whilst the die mechanism was the least appealing. Instructor motivation emerged as a new observation. The results of this study supported the interpretation that surprise is a factor in both learner motivation and engagement in games.

Keywords Surprise, Gamification, Learning, Randomization mechanism

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Tiivistelmä

Yllätyksen myönteisiä vaikutuksia on tutkittu oppimisessa ja pelialalla. Tässä tutkimuksessa keskityttiin siihen, miten yllätyksellisyyttä voidaan lisätä oppimiseen pelillistämisen avulla. Tutkimuksessa käytettiin Seppoa, pelillistettyä oppimisalustaa. Ideoita mekanismien suunnitteluun haettiin haastattelemalla pelillistämisen ja koulutuksen asiantuntijoita. Mekanismien suunnittelua tuettiin lisäksi pelillistämistyöpajassa.

Tulosten perusteella kehitettiin kolme arpomismekanismia. Mekanismeja testattiin mahdollisilla käyttäjillä intuitiivisuuden, selkeyden, visuaalisuuden, oppimiseen soveltuvuuden ja hauskuuden osalta. Onnenpyörä oli kaikkein houkuttelevin mekanismi, kun taas noppamekanismi oli vähiten houkutteleva. Ohjaajien motivaatio nousi esiin uutena havaintona. Tutkimuksen tulokset tukevat tulkintaa, jonka mukaan yllätyksellisyys toimii välittävänä tekijänä sekä oppijan motivaatiossa että pelillisessä sitouttamisessa.

Avainsanat Yllätyksellisyys, pelillisyys, oppiminen, arpomismekanismi

Contents

1 Introduction

The use of digital technologies and services has widely spread during the past decades, and the rapid growth of digitalization has already been changing our economies, societies, and ways of living. Digital technologies are used in almost every aspect of our lives including e-commerce, media, education, and maintaining social relationships.

Digitalization has been widely adopted in education and in various working practices and corporate training programs. For instance, the field of human resource development has lately been using different training delivery technologies (i.e., eLearning and MOOC platforms), and equipment such as smartphones and tablets (Li & Herd, 2017). Progressive employers no longer see the employee only as a task performer but rather as a learner and a constructor who creates and shares information within the working community. This understanding of the nature of the employee as a learner underlines the need for developing interactive and participatory solutions to support learning (Ifenthaler, 2018). One potential trend for developing novel solutions has been gamification.

In scientific research, gamification is often broadly defined as adding game elements to a non-game context (Deterding et al., 2011; Hamari, 2013). The aim of gamification is to engage people in an activity with the same enthusiasm and immersion as in entertainment games (Gallego-Durán et al., 2019). Gamification has become part of our everyday lives and it is used in various contexts such as life management, household economy, sport tracking and creation of social relationships (e.g., Tinder) (Niemi & Salmenkangas, 2021).

The effects of gamification on education and learning outcomes have been widely researched, especially in the context of educational settings such as schools and universities (see e.g., O'Donovan et al., 2013; Jones et al., 2014). Gamification has also been much studied in the context of corporate training, and various guidelines exist on how to design training using gamification mechanisms (see e.g., Wang et al., 2022). The assumption in adding gamification in teaching and training programs is to get people engaged in these activities with the same motivation and immersion as when playing entertainment games (Gallego-Durán et al., 2019). One of the challenges in gamifying teaching and training is to come up with an engaging solution that still meets the learning objectives. The gamified activity should remain of high quality and relevant for

those who use it (Braad et al., 2016). Properly applied gamification challenges the player's intelligence and creativity via playfulness and discovery (Gallego-Durán et al., 2019).

As one emotion, the feeling of *surprise* can be considered to be one of the most desirable feelings in both learning and playing (Gallego-Durán et al., 2019). Although the effects of surprise in learning have been widely studied, there is a lack of research on how surprise mechanisms can be applied to teaching methods in practice. In game design, surprising events have often been implemented with randomization, using for example a die.

The aim of this thesis was to design surprise mechanisms in a gamified learning platform and evaluate the designed mechanisms. The hypothesis was that positively experienced surprise would enhance the engagement and motivation for playing the game, which in turn would foster learning.

This thesis was conducted as Design Science research. The aim was to design a surprise mechanism in the gamified learning platform Seppo. First, background research was made on gamification and motivation and how they affect learning. Based on the theoretical background, expert interviews were held to gain a wider understanding of how surprise mechanisms can be used in teaching and learning. Expert interviews and the conclusions of a gamification workshop with an external company Zaibatsu framed which surprise mechanisms were selected to be the design artifacts of this thesis. The designed surprise mechanisms were evaluated by users with a user experience survey. Both qualitative and quantitative data were used to draw conclusions from the gathered research material. The research questions of this thesis were the following:

1. What kinds of surprise mechanisms foster engagement and learning in the context of gamified learning platform?

2. What kind of reception do users have for such mechanisms?

Chapter 2 presents the theoretical background on digital learning and how learning is affected by engagement and the feeling of surprise. In addition, the chapter introduces the phenomenon of gamification and discusses how it has been used in contexts of teaching and training. Chapter 3 presents Seppo, a gamified learning platform to which the surprise mechanisms of this thesis are designed. Chapter 4 discusses the

research process and the methods in detail. It describes step by step how the research was conducted and justifies the selection of research methods. Chapter 5 presents the results of this study. It describes what kind of insight was found from the collected data and how it affected the selection of the mechanisms to be designed. In addition, it includes a description of how the potential end-users experienced the designed mechanisms. Chapter 6 concludes the main findings of this thesis and discusses further research possibilities. Finally, chapter 7 summarizes the whole study process.

2 Theoretical background

2.1 Engagement and motivation in learning

In order to understand the rationalities behind gamification mechanisms in teaching and training, it is first necessary to understand how engagement and motivation affect learning outcomes. This section presents an overview of the use of digital technologies in teaching and training contexts. As the focus of this thesis is on *surprise mechanisms*, this chapter also discusses more in detail how the feeling of surprise (i.e., the occurrence of unexpected events) affects learning.

2.1.1 Digital technologies to support learning

Teaching and learning practices have increasingly exploited digital solutions in support of traditional methods, and people have had to adapt to new ways of working. During the COVID-19 pandemic, digital learning even completely replaced contact teaching in a large extent. The term *digital technology* covers a wide range of different methods, practices, systems, and devices that transmit data and deliver information using digital solutions (Li & Herd, 2017). In turn, *digital learning* can be defined as any digital technology-based solution that supports learning (Ifenthaler, 2018).

In the context of e-learning, a common struggle is often how to design such activities that would engage learners (Haig, 2007). Today, the learner is no longer seen only as an audience but rather as an active constructor (Ifenthaler, 2018). The current understanding of the nature of the learner has underlined the need for developing interactive and participatory solutions to support learning. The use of technology has been seen as one potential way to increase interactivity and participation in learning processes. Opportunities for digitalized learning include game-based learning, massive open online courses (MOOC), simulations, and social networks (Ifenthaler, 2018). Since the COVID-19 pandemic, remote learning, webinars, e-workshops and hybrid learning events have become mainstream.

The use of digital technologies in education has often been justified by the increased efficiency of delivery and personalization of learning processes. In addition, the potential of digital technologies in education has been seen in remote, adaptive, and data-driven practices. The increased use of digital technologies in education has often been reasoned by the already immerged state of the so-called digital natives. The term

digital native refers to people who can quickly and comfortably adapt to new technologies and digital practices. This leads to assumptions that these people are using and even requiring the use of digital technologies in their studies and work. For them, digital technologies are seen to be a way of living rather than only a discrete functional tool that can be switched on and off. The assumptions concerning the needs and the behaviour of digital natives have been criticized by researchers and experts. According to them, the meaningful and beneficial use of technology in teaching still needs further research (Henderson et al., 2017).

2.1.2 Workplace as a learning environment

The discussion around learning is often related to the formal context of educational settings like schools, but in fact, learning takes place in every aspect of our lives (Billett, 2004; Ifenthaler, 2018).

A good example of a non-school-related learning environment is the workplace. Compared to institutional learning in schools, learning in a workplace is often seen as 'informal' and 'unstructured' since it remains immersed in work practices and does not follow any curriculum. However, work practices are often highly structured and regulated. Even teaching takes place in structured curriculums and degrees; particularly in larger organizations. As a learning environment, the workplace should be understood as a complex negotiation including knowledge-use, different roles, and processes of the learner's participation in situated work activities (Billett, 2004).

In corporate organizations, the use of digital solutions enables the creation of a customized learning environment and cost-effective delivery modes. Workplace learning often aims at improving the personnel's skills and knowledge as well as their productivity. At the workplace, learners are seen as constructors who create and share their knowledge within the working community (Ifenthaler, 2018).

The field of human resource development, as part of the managerial context, regularly receives new organisational innovations and business fans. Many of these interventions have aimed to improve the effectiveness of learning and training. Different proposed approaches include instructional design processes, the use of training delivery technologies (i.e., e-learning and MOOC platforms), and incorporating equipment and products such as smartphones and tablets (Li & Herd, 2017).

As the use of digital technology has spread in working practices, companies have exploited different e-learning solutions in their corporate training programs. Cost-effectiveness, customizability, maintainability and functionality are among promised factors when considering adding e-learning to corporate training (Kimiloglu et al., 2017). Although, shifting towards e-learning practices in corporate training has many benefits, Kimiloglu and her colleagues (2017) emphasize that corporate trainings are above all social practices where interaction between colleagues has a significant role. They argue that e-learning solutions in corporate training cannot be fully automized, individual processes. Instead, they should support real-time interactivity with colleagues as much as possible.

2.1.3 Motivation in learning

In the field of education, motivation has been identified to be a critical factor affecting learning outcomes (Lim, 2004). Motivation is a psychological state that makes an individual behave in a certain way to achieve a specific goal. In other words, to be motivated means to be moved to do something (Ryan & Deci, 2000). According to Ryan and Deci (2000), motivation should not be considered as a unitary phenomenon that varies from little motivation to act to a great deal of it, but rather as a multidimensional phenomenon, where people have different *levels* (i.e., how much motivation) and *orientations* (i.e., what kinds of motivation) of motivation.

Previous research indicates that the increased learner motivation tends to keep the individual engaged in a learning activity longer and further the achievement of certain learning goals. There are different factors affecting individual motivation. For building motivation, the activity needs to be relevant to the learner. In other words, the learning contents must meet the learner's needs and interests (Lim, 2004).

Individual motivation in learning can be increased in various ways. One possibility is to use *reinforcement motivators* such as grades, instructor feedback, or peer support. However, the discrete use of extrinsic motives such as these reinforcement motivators is rarely sufficient for deep learning to occur. In addition, intrinsic motivators such as challenge, learner control, and curiosity need to be implemented in order to increase learning outcomes (Lim, 2004).

One important aspect of motivation is *engagement*. If learning is engaging, the individual is more motivated to learn. The term is used to describe an individual's

commitment and full attention to an activity. The difference between motivation and engagement is that engagement is related to a single task or activity whilst the concept of motivation is broader (Haig, 2007).

2.1.4 The role of surprise in learning

Emotions play a significant role in learning (Wolfe, 2006). As one emotion, surprise has been identified as a cognitive-emotional phenomenon affecting individual learning and decision-making (Foster & Keane, 2019). Like all emotions, the experience of surprise is subjective and the effects on the learning outcome are individual (Reisenzein, 2000). Some researchers even argue that surprise can be seen as one of the most desirable feelings in both learning and playing (Gallego-Durán et al., 2019).

According to Foster and Keane (2019), surprise affects learning outcomes through memorability. When the learner encounters a surprising event, his/her attention is aroused, making the learning subject more likely to be remembered. In the event of an unexpected situation, people try to make sense of it as best they can, comparing the occurring event to their prior knowledge and past experiences.

But why do some events feel more surprising than others? According to Adler (2008), the stronger individual expectations are towards an event, the greater feeling of surprise will occur if the outcome does not meet the expectations. Surprising or unexpected pieces of information arouse the learner's attention and provoke more intensive processing of the material to be learned (Adler, 2008). The more the material is processed, the better it is remembered.

According to Adler (2008), the surprising event does not necessarily have to be positive for learning to occur. The role of surprise in learning is especially significant in cases of failure. When the learner makes a mistake, a *call-to-explain* occurs: the learner tries to correct the mistake and understand the reasons that caused it. Gallego-Durán and his colleagues (2019) refer to this same self-correcting activity as learning by trial and error. An example of learning by trial and error can be seen when observing someone playing a video game with levels. Even though the player fails the level, he/she might try again several times to pass it through.

On the one hand, previous research shows that surprise has a positive effect on learning through memorability (Foster & Keane, 2019). On the other hand, gamification

research has established a strong link between surprise and motivation building elements such as immersion and engagement (Gallego-Durán et al., 2019). Drawing from these two traditions of research, it may be relatively safe to conclude that surprise is linked to motivation.

2.2 Gamification

Digital games and gamified information systems have increasingly become a common form of entertainment and enjoyment in our everyday life (Koivisto & Hamari, 2019). Some researchers argue that due to their increased adoption and institutionalization, video games have become a cultural medium alongside literature, the film industry, and other forms of mainstream media (Deterding et al., 2011).

This chapter discusses *gamification* as a means to increase engagement and motivation. One of the promising applications of gamification is *serious games* (Richter et al., 2015). Common to both gamification and serious games is that they use elements characteristic of games to achieve something beyond enjoyment and playfulness (Richter et al., 2015).

2.2.1 Serious Games

Serious games, as a field of study, is not an invention of the 21st century. The study field of serious games has been strongly affected by Plato's early discussions regarding the purpose of play, especially in the context of educational purposes (Wilkinson, 2016). The term *serious game* refers to games that aim for other purposes than simple entertainment (Alvarez et al., 2012).

In everyday speech, *play* often refers to any kind of activity that includes pleasure and enjoyment. However, in game studies, the concept of play has further been divided into two subtypes. The French sociologist Roger Caillois introduces the distinction of *ludus* and *paidia* in his seminal work *Man, Play and Games* (1961) which has strongly influenced the field of game studies:

- **Ludus** is controlled play, that requires effort, patience, skill, and ingenuity. The rules are set from the beginning and there is a clear goal that the player tries to achieve, e.g., chess.
- **Paidia** is spontaneous, improvised play and does not have a pre-defined structure. The rules are invented during the gameplay. Good examples are roleplaying or designing a city in SimCity.

Regarding these definitions, serious games can be described to be *ludus* types of games because they are pre-defined and rule-bound. However, not all learning outcomes are

as narrowly definable as winning in chess or go. For instance, learning French includes learning vocabulary, grammar, pronunciation, etc. It is worth considering that learning French is not only about linguistic learning. The motivation of learning arises in addition from personal motivation. One might want to learn French because he is spending his summer holiday in Saint-Tropez. Another wants to learn French because he is moving to France to join his partner. Playing chess or go can also include a wider goal setting than simply winning the game. However, the context of play is more restricted compared to for example language learning. Serious games have been criticized for controlling the players overmuch and leaving little space for exploratory, spontaneous play (Deterding et al., 2011). The unification of the players does not allow for the individual player to tailor his efforts according to his needs.

Serious games often combine gaming with one or several of the following purposes: training, communication, education, health, or commerce (Alvarez et al., 2012). Some researchers have proposed differentiating between *serious games* and *serious gaming*. *Serious games* are games proper that aim to further learning through gameplay, whereas *serious gaming refers* to a broader field of practices that use game features for any (educational) purposes (Deterding et al., 2011).

The challenge of creating a serious game is to ensure that the desired goals are achieved. Using serious games is seen as a powerful tool to promote learning, foster healthy lifestyles, or change behaviour. In the case of educational games, the purpose of the game is to help the player achieve the pre-defined learning goals by playing the game. Unlike in *entertainment game design*, serious game design usually requires user validation and previous research of existing literature and best practices (Braad et al., 2016).

In the serious games industry, small and medium enterprises commonly offer tailored or customized solutions for their customers thus leading to high-cost productions and low re-usability of the product (Baalsrud Hauge et al., 2014). Serious games often have a more specific target group compared to entertainment games and hence may have a low return-on-investment compared to entertainment games. As a less lucrative business, a lower design budget has often been allocated to serious games (Braad et al., 2016). Many developers are struggling with a long time-to-market and low market

shares while simultaneously the rapid technology changes increase the risk of failure when entering the markets.

While serious game development has previously focused on customized, often unique, product development, the markets have been evolving quite dynamically with rapidly changing technologies, development concepts, and user needs. As a result, serious games production has no longer been able to keep pace with the ever-changing market trends. Therefore, designers and developers have turned towards malleable products that have a longer market cycle (Baalsrud Hauge et al., 2014).

In the serious games industry, the customers often differ from the end-users. The funding customers may be governmental organizations such as schools, government offices, local authorities, assurance companies, or employers whereas the end-users are most likely to be teachers, students, employees, patients, or health care professionals. The challenge for serious game developers and designers is to find a solution that provides a tangible value proposition to all actors (Baalsrud Hauge et al., 2014).

Serious games approach teaching through experiment and play (Wilkinson, 2016). In public discourse, learning and playing are often seen as opposites. Learning is often seen as a serious activity associated with work, effort, and concentration whilst playing is often described as fun and enjoyable, involving the freedom of choice (Breuer & Bente, 2010). However, this juxtaposition is often misleading. Both learning and playing are processes in which the learner learns novel things through iteration (Breuer & Bente, 2010). According to Gallego-Durán and his colleagues (2019), *learning* is the most relevant thing games convey. Proper challenges in a game put players to the edge of their capacities, where learning occurs by trial and error (Gallego-Durán et al., 2019).

2.2.2 Gamification – potential for better engagement

Gamification is already used almost in every sector of our life, such as life management, household economy, and the creation of social relation s (Niemi & Salmenkangas, 2021). The potential of gamification has already been seen in the methodologies of educational and social fields, as well as in the healthcare and youth sectors (Helms et al., 2015; Niemi & Salmenkangas, 2021). Common gamification elements (e.g., points, leader boards, timers, and badges) have already been implemented in many

different non-game contexts, such as schools, change management processes, and e-commerce bonus systems (Deterding et al., 2011; Niemi & Salmenkangas, 2021).

But what is gamification? The term *gamification* has no strict academic definition, and its interpretation varies slightly between researchers (Alsawaier, 2018). The term is often used to describe a combination of existing concepts and human-computer interaction inspired by (video) games. The trend of gamification in software services spread massively after the second half of 2010 (Deterding et al., 2011). Many researchers define gamification broadly as the use of game design elements in a non-game context (Deterding et al., 2011; Hamari, 2013). Koivisto and Hamari (2014) define gamification as a means to motivate behavioural and psychological outcomes such as the feeling of flow and the feeling of mastery. According to Richter et al. (2015), gamification attempts to promote participation, persistence, and achievement by increasing the players' motivation.

The motivation toward games is often considered to be intrinsically motivating, engaging the players with the game simply for the sake of playing it (Koivisto & Hamari, 2019). The assumption for gamification is to get people engaged in learning with the same motivation and immersion as in playing games (Gallego-Durán et al., 2019). Koivisto and Hamari (2019) interestingly note that, at their core, many of the gamified systems motivate and support the user towards some given activity or behaviour. Furthermore, many of the commonly gamified activities such as learning and healthy behaviour require long-term commitment. Gamification of such activities aims to prologue user commitment towards the activity by making it more enjoyable.

At its lightest, gamification can be a word bingo or a set of multiple option questions. At its most complex, gamification can be about creating a multilevel exploratory game set in collaboration (Niemi & Salmenkangas, 2021). The possibilities of gamification are nearly infinite. However, gamification does not suit every situation and is very context dependent. Numerous gamification research has been conducted with mixed results. Many of them highlight the benefits of gamification but some are even reporting damage to learning outcomes (Gallego-Durán et al., 2019).

In their research paper *A guide for game-design-based gamification*, Gallego-Durán and his colleagues (2019) criticize gamification studies that have measured the

influence of gamification on motivation by isolating statistical variables (i.e., game elements such as points and badges).

One pitfall in designing gamification is to underestimate the complexity of creating such a solution that can be applied in practice. Creating a successful one is a challenge itself. Gallego-Durán and his colleagues (2019) argue that the best way to reach a good understanding of gamification design is through iterating the designer's own work and testing the different versions midway.

There are numerous gamification guidelines and heuristics for game designers. However, many of them are targeted at experts that already have previous experience in game design (Gallego-Durán et al., 2019). As a psychological approach to game design, Self-Determination Theory (SDT) is the most cited. Gallego-Durán and his colleagues (2019) argue that in the context of evaluating game design, SDT is too generic, and in addition, it is purely psychological. With his research team, Gallego-Durán proposes a game-design-based rubric for measuring how well the gamification of a service or an activity is designed.

Gallego-Durán and his colleagues (2019) present ten characteristics for well-designed gamification. The characteristics are the following (the list is in no particular order):

- Open decision space
- Challenge
- Learning by trial and error
- Progress assessment
- Feedback
- Randomness
- Discovery
- Emotional entailment
- Playfulness enabled
- Automation

These ten rubric characteristics are overlapping to some extent with the ten key elements for gamification proposed by (Wang et al., 2022). Both lists are highlighting the importance of *feedback*, *challenge*, and *freedom to fail*. One of the key differences between gamified learning and traditional learning environments is that while

traditional learning environments are often designed to prevent, prosecute, and punish failure, gamified learning even fosters the player to fail and learn by trial and error.

One interesting notion is that while the key elements of gamification (Wang et al., 2022) emphasize the importance of *game rules*, Gallego-Durán (2019) and his colleagues highlight the significance of *open decision space* and *discovery*. Gallego-Durán and his colleagues argue that autonomy is one of the central points of intrinsic motivation. In pre-defined gameplay (i.e., game flow), the player might have a feeling that he has a choice between different paths. However, the game path has been set in advance, and the player only has a seeming decision to make. Instead of giving real decision alternatives, the player is actually being tested. In a truly open decision space, the answers should not be defined as correct/incorrect. The gameplay should rather encourage the player to discover and experiment with different options and learn from the results.

Additional achievement systems are often implemented in serious games. Players are collecting points or badges while proceeding in the game. These reward mechanisms provide additional goals and enable friendly competition and comparison among players. These sub-goals can provide excitement, entertainment, or surprise and they can be accomplished either alone or in a group (Richter et al., 2015).

When designing gamification, the selection of game elements needs to be carefully argued. Some research suggests that promoting motivation by extrinsic reward systems (i.e., points and leader boards) might in fact have a negative effect on motivation by undermining the player's freedom of choice and personal interest in the given task. On the other hand, it has also been shown that sometimes a reward system's negative effect on motivation is due to poor design implementation (Richter et al., 2015).

2.2.3 Gamifying corporate training

Even though gamification has recently been a hot topic in corporate training, the definition of relevant key elements has remained vague (Wang et al., 2022).

In the context of training, gamification often aims to change "traditional and boring" training methods into something "fun and engaging". However, gamification should not only be done for the "sake of gamification" (Wang et al., 2022). Instead, the gamification elements should be chosen based on scientific evidence showing that

gamification has a positive effect on learning. Rather than replacing existing training methods, gamification should be used to further improve learning outcomes by approaching training with redesigned elements influenced by video gaming and psychological research (Armstrong & Landers, 2018).

Wang and his colleagues (2022) conducted a study where they aimed to define the key elements of gamification in corporate training. 14 corporate training experts participated in a three-round expert opinion collection where they were asked to rank the relevancy 35 gamification key elements based on their importance using the Likert five-point scale (1-5 points). The results showed that 12 elements got a mean of more than 4 points. The top-ranked key elements were (in order):

1. Integration with the training goal
2. Rapid feedback
3. Game rules
4. Fairness
5. Tasks with challenging goals
6. Teamwork
7. Points or scoring
8. Time pressure
9. Increasing difficulty
10. Experiential activities
11. Competition
12. Freedom to fail

In addition to these key elements, many of the interviewed experts emphasized the importance of the points and leader boards as game mechanisms. According to them, points and leader boards often boost participation by displaying the progress of the learners and their peers (Wang et al., 2022). However, it should be noted that points and badges might not be successful in all training contexts and may even be harmful. Points and other rewarding systems only motivate people when they have a psychological meaning for them. In other words, if points do not mean anything for the player, having them as a game element is useless. What people find rewarding depends on their intrinsic needs, values, and goals (Richter et al., 2015). Another pitfall of implementing points and badges is that they are often used to address motivational

problems, yet low motivation may not be the core problem with the training program (Armstrong & Landers, 2018). According to Armstrong and Landers (2018), these kinds of motivational problems likely cannot be solved through gamification and should be approached by traditional methods instead.

Gamification in corporate training can be done in numerous ways. According to Armstrong and Landers (2018), it is often done by implementing game elements in either training content or training methodology. When designing gamification of training or work, the following questions should be addressed: Will gamification improve the productivity of the training or work? Will gamification make the tasks involved in the instruction feel more interesting and relevant to the end-user? Will gamification improve employee engagement in training or work? (Noll Webb, 2013).

2.2.4 Randomization mechanisms in games

Gallego-Durán and his colleagues (2019) proposed *randomness* as one characteristic of the game-design-based rubric. According to them, learning in its most fundamental definition is about discovering novel things through experimentation and iteration. An appropriate degree of randomness reinforces the iteration process and engages the trainees for a longer discovery process (Gallego-Durán et al., 2019). Well-designed randomization can provide the feeling of *surprise*, which can be considered to be one of the most desirable feelings in both learning and playing.

Several reasons exist for including randomness in entertainment games. Randomness adds variety to the gameplay and makes it more unpredictable. The player cannot memorize the course of the game by heart and (s)he needs to adapt to changing occurrences. Randomness can also be used to balance multiplayer games. For instance, in Mario Kart, the players that are clearly behind other players will most likely receive random boosters that raise them to closer to the leading players. In addition, randomization mechanisms can be used in the reward system of the game. The most valuable badges and rewards are more unlikely to get. Randomness affects the gameplay and the creation of game strategies. The more information the player gets, the easier it is to predict the gameplay. Too much information available and obvious predictability can lead to flat and uneventful gameplay. Surprises and changes during the game force the player to change the game strategy (Brown, 2020). For these reasons, virtually

every entertainment game includes some degree of randomness, making the gameplay different each time.

The game designer and visual artist Keith Burgun (2014)makes a clear distinction between *randomness* and *unpredictability* in games. Rolling dice is a closed system that is not affected by the gameplay itself. Compared to chess, the game outcome is unpredictable, but the players have a limited number of turns they can look ahead. Within the frames of this definition, chess indeed includes unpredictability, yet not randomness.

Randomization mechanisms have been applied in numerous ways in entertainment games. Here are some common examples, of how different randomization mechanisms have been used to increase player engagement:

Rolling dice is a randomization mechanism used in many tabletop games, dice games, role-playing games, and games of chance. For example, in role-playing games, the progress of the game is often defined by rolling dice. If fighting against a monster, the result of the dice roll defines the outcome of the fight. If the result is between 1 and 3 the monster wins, if the result is between 4 and 6, the player wins.

In games of chance, randomization can also be applied by *drawing a card from the deck*. For example, in *Patience* the order of the drawn cards is random, and the game is different every time.

In the video game industry, the implementation of *Loot boxes* as a randomized game mechanism has increased significantly. Loot boxes are virtual "mystery boxes" that are usually bought directly with real-world money or earned more slowly by gameplay. Typically, these boxes contain in-game rewards e.g., some superpowers that help the player faster or cosmetic features for the player's avatar. Loot boxes can also often be empty. Research shows that loot boxes are particularly engaging and hooking. They have received criticism for targeting especially young players with gambling-like game mechanisms (Brooks & Clark, 2019).

Randomness can be divided into two types in the entertainment game industry: *input randomness* and *output randomness*. Input randomness is the kind of randomness that informs the decision, e.g., how many steps a player may proceed on the game

board. Output randomness decides the outcome of the gameplay, e.g., defining the result of a battle by rolling a die (Burgun, 2015).

This thesis aims to explore the contexts in which surprise mechanisms could fit and how these mechanisms could be implemented in practice.

3 The Seppo platform

Seppo, a product of Lentävä Liitutaulu Oy, is a platform for gamified mobile learning and training. Originally, Seppo was created for the school environment enabling teachers to create interactive educational games to support learning. Lately, Seppo has been shifting towards corporations and training professionals. By creating Seppo games, corporate users can gamify recruitment, onboarding, and different training programs and teambuilding activities (Seppo.io, 2022).

The growing interest in using gamification in learning and training has brought numerous digital solutions to the market. In a competitor analysis conducted for Seppo in 2022, the gamification solutions were divided into four categories: solutions that aim to increase employee performance (e.g., Hoopla, Centrical, and Mambo.io), learning management systems (e.g., Blackboard, Motimate, and TalentLMS), location-based solutions (e.g., Actionbound, GooseChase, and ActionTrack), and quiz tools (e.g., Kahoot! and Quizizz).

Figure 1: Screenshot of the game creator view of the Seppo platform

In the Seppo platform, game instructors (e.g., teachers or HR-managers) create games for teaching and training purposes (see Figure 1). The instructor uploads a gameboard which can be an image, a 360-degree image, or a GPS map. Then, the instructor creates tasks that can include different levels of exercises. There are several different exercise types in Seppo, for example, multiple choice, match pairs and creative production

exercises. Seppo supports text, image, video, and audio as answering methods. After creating a game, the instructor shares the game pin code (or a QR code) with the players. The players can play the game either using a mobile device (see Figure 2) or on a desktop.

A Seppo game consists of exercises marked in the game board as location pins. The game can be for example a biology game with the purpose of learning different body parts. In Figure 2, the player must complete the first, unlocked exercise to proceed to the locked ones. The total number of exercises can be seen at the top middle of the screen. After completing an exercise, the player receives a number of points set by the instructor in advance. The points will be presented as stars. In Figure 2, the first exercise is worth 500 points. The instructor can decide to put a threshold limit to an exercise which means that the player can access the exercise with only a certain number of accumulated points. The player can compare his/her own performance with other player performances on the scoreboard where the best players and their scores are shown.

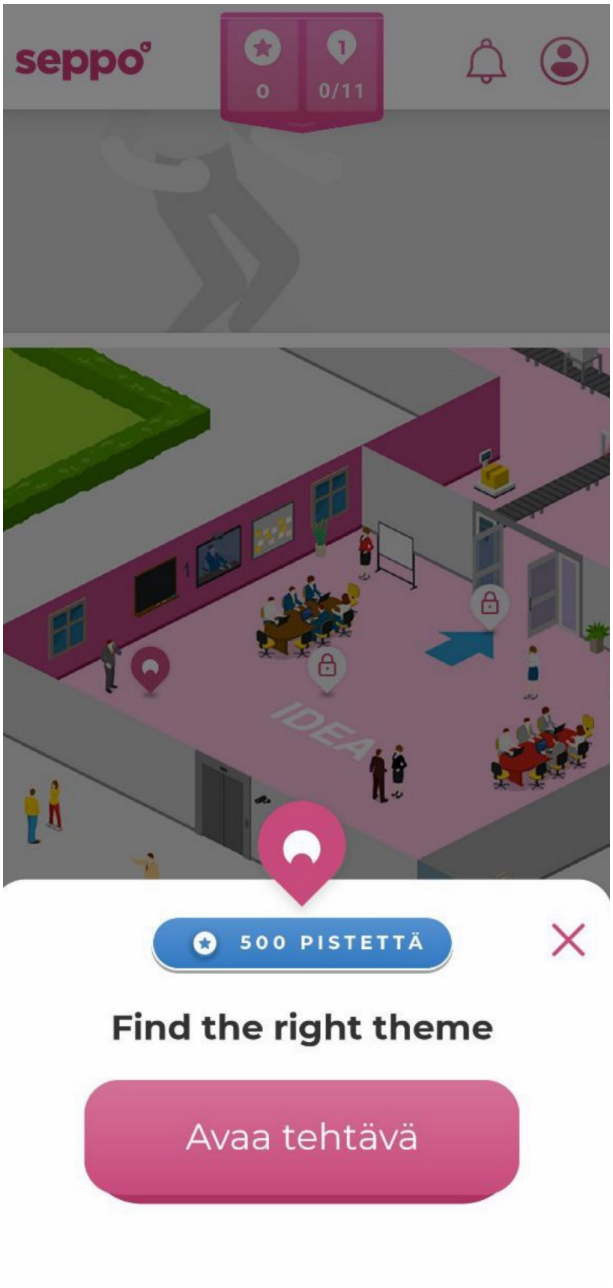

Figure 2: Screenshot of the player "open the exercise" view of the Seppo platform

As a game creation platform, Seppo provides an opportunity to create customized games according to the learning purpose and environment. The platform offers the possibility to share the created games with other game instructors as an editable game base. This feature is widely used in the educational sector where teachers share games with their peers even across schools and can for example look for other games related to their subject. In the corporate environment, this feature is however less used because the content of corporate training is often related to one specific context of use, e.g., the safety training of a specific company.

In Seppo, all the content of the game is created by the instructor. Including similar randomization mechanisms as in entertainment games, by surprising the player with a new exercise or new level, would require a great deal of work from the instructor. In order to randomly assign an exercise, there must be a large pool of pre-defined exercises created by the instructor. The entertainment game industry often uses artificial intelligence to generate random content to games. However, this option – at least so far – is not open to the educational sector where the content must be created by a human instructor.

In games used for teaching and training, following a certain order to complete the exercises and levels is often necessary and cannot be defined randomly. Some educational contents also require a fixed order. For example, in fire safety training, the order of actions can be very important. Despite these limitations, elements of randomization are worth introducing in the educational games. In the entertainment, randomization mechanisms seek to arouse a pleasant feeling of unpredictability and surprise in the player (Keith Burgun, 2014). This energizes the player and prevents boredom (Brown, 2020). In addition, it gives an impression of reality and immersion in a real-like environment.

4 Research and methods

4.1 Problem identification

Several researchers have aimed to define gamification elements that foster learning (see e.g., Antonaci et al., 2019) Gamification elements such as *feedback*, *challenge*, and *freedom to fail* have been found to affect learning outcomes positively. Gallego-Durán and his colleagues (2019) see the potential of adding well-designed *randomness* in training programs. Adding randomization in games creates the feeling of surprise and enables learning by experimentation and iteration. Even though randomization mechanisms have widely been used in the entertainment game industry, there is yet not much documentation on how to apply them in the context of serious games. In addition, little research has been conducted on the effects of adding randomization mechanisms in teaching and training.

One reason that the effects of randomization have not yet been researched to a great extent might be that randomization can be done in numerous ways. In the context of serious games, it might be more relevant to approach adding randomization mechanisms by using *input randomness* which informs the decision instead of defining it.

The reception of the developed gamification mechanism in the Seppo platform depends both on the game instructor (i.e., creator) and the player. If the instructor does not find the mechanism meaningful and will not use it in the game creation, the development of the feature is useless. In addition, if the gamification mechanism is poorly implemented or the player does not find it meaningful, the implementation of such a mechanism might even disturb the gameplay and learning outcomes.

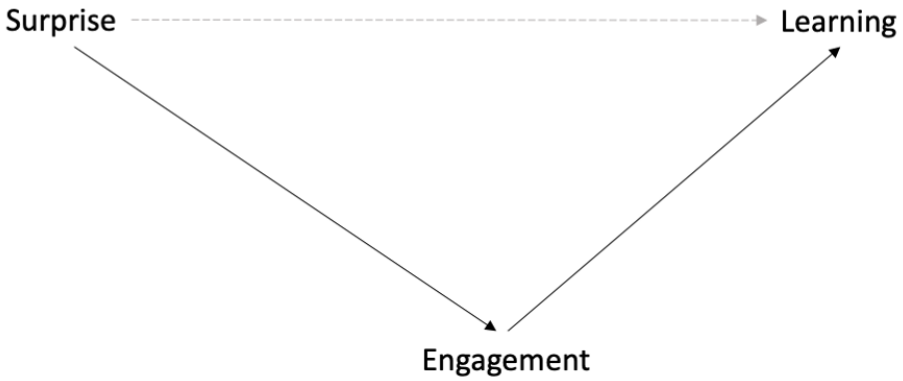

Figure 3: Hypothesis of how surprise fosters learning

The assumption was that positively experienced surprise would affect the engagement in playing the game, which in turn would foster learning (see Figure 3).

4.2 Research questions

This research aims to enlighten how surprise mechanism(s) can be added in the context of serious games in a way that some value is added to the existing solution. The questions this research is addressing are the followings:

1. What kinds of surprise mechanisms foster engagement and learning in the context of gamified learning platform?
2. What kind of reception do users have for such mechanisms?

4.3 Research method

This research was conducted as Design Science research. Design Science research is a paradigm that aims to increase knowledge by designing, creating, and evaluating an artifact (Helms et al., 2015). In this research, the designed artifact was a surprise mechanism for a gamified learning platform.

This research consisted of the following steps:

- Literature review
- Identifying the problem
- Expert interviews
- Gamification workshop
- Design of the surprise mechanism
- User interface testing
- Evaluating the created artifact
- Drawing conclusions

The literature review yielded background information from previous research and allowed to situate the present study in relevant fields (gamification, educational platforms, learning). Problem identification arouse from the literature where a gap was found between the effects of surprise in learning and surprise in entertainment games. How can surprise be added in learning through gamification? Experts in gamification and education were interviewed to gain better insight how surprise might be

implemented in educational settings. The purpose of a gamification workshop was to elaborate on possibilities of adding surprise mechanisms to the Seppo platform. The workshop was held by an external company (Zaibatsu) for Seppo team. Based on the expert interviews and the workshop, three randomization mechanisms were designed. These mechanisms were tested with previous Seppo users and students. The created artifact was evaluated in light of the results of the user testing. Finally, conclusions were drawn from the results and discussed in the context of existing research.

4.4 Data collection

4.4.1 Expert interviews

This study included two rounds of data collection. The first round consisted of expert interviews used to supply ideas for the innovation while the second round was used to evaluate it. The first round was conducted with three professional gamification experts. Thereafter, the designed surprise mechanism was chosen based on the results of the expert interviews and the gamification workshop. After being chosen, the mechanism was designed and modelled with the prototyping tool Figma. The purpose of the second interview round was to evaluate the created artifact by interviewing users (players).

For the first interview round, three professional gamification experts were interviewed to frame the design process of the surprise mechanism to be embedded in the Seppo platform. Semi-structured, in-depth interviews were conducted to gain a deeper understanding of gamification in the context of corporate training. In addition, the interviews aimed to enlighten the use of surprise mechanisms in teaching and training. The method of semi-structured interviews was selected because it is a flexible and interactive data collection method enabling free-form discussion around the theme.

Instead of conducting a large survey to measure the occurrence of a predetermined item, this study is about creating a novel feature in a specific context. Therefore, the research material was produced by conducting semi-structured interviews with gamification experts and validating the implementation of the novel feature with them.

All expert interviews were conducted in Finnish. They were held remotely with Google Meets and recorded and transcript for further analysis. The interviews lasted from 30 minutes to one hour. Among the interviewees, all three professional experts use

gamification in their work and have experience with the Seppo platform. All interviewed experts gave permission to write by their names.

The structure of the expert interviews was divided into six sections/themes. The first one was about collecting background information. *What is the interviewee's professional position in working life? What does his/her job description include?* The second section concerned gamification in general. *How does the interviewee understand the concept of gamification? What kind of experience does he/she have with it? How does the interviewee use gamification in his/her own work?* The third section was about using gamification in training and teaching. *What kind of gamification can be used in training and teaching? How can it be implemented in practice?* The fourth section concerned surprise mechanisms. *Does the interviewee see that surprise elements influence learning or motivation? What kind of surprise could be used in learning games?* In the fifth section, interviewees were asked questions related to the Seppo platform. *How well does it support gamification at the moment? What kind of gamification could be added to it? What kind of surprise mechanisms could be added to Seppo?*

The sixth and last part of the interview returned to the two previous sections, now in an interactive manner. Interviewees were sent a Google Jamboard link consisting of five sticky notes, each with one pre-written surprise mechanism. These mechanisms were identified together with the product owner and the head trainer of Seppo as potential mechanisms that could be added to the platform.

4.4.2 Gamification workshop with Zaibatsu

In addition to the expert interviews, different surprise mechanisms were discussed and evaluated in a gamification workshop. It was organized by an external gamification company Zaibatsu for the employees of Seppo. The workshop lasted for six hours and was divided into two parts: discussion around pre-defined gamification themes (clans/teams, surprise, playful atmosphere, and badges) and ideation of gamification mechanisms related to those themes. The Seppo team had decided on the themes in advance due to their high priority to be added to the platform.

The first part of the workshop consisted of discussions around each gamification theme. Regarding the topic of this thesis, this section focuses on the surprise theme.

The second part of the workshop focused on discussing how could the proposed gamification themes be implemented in Seppo in practice. All members of the Seppo team were divided into two groups of three or four people. First, each team considered individually what kind of gamification mechanisms could be added to Seppo. Then, both groups presented their ideas to everyone. The following list consists of surprise mechanisms discussed in the workshop:

- The order of the exercises would be determined randomly
- The answering type of the exercise (text, video, audio) would be determined randomly.
- In a multiple-choice exercise, there would exist more wrong answers than is being shown. The showed wrong answers would be selected randomly.
- Minigames (e.g., a time-pressure game, re-order the mixed letters of a word). The minigame could, for example, be scheduled to appear after the second exercise.
- A hidden exercise or game that would only appear by hovering it with a mouse (would work on mobile by "painting" over it with the finger)

Coming up with solutions that would not require additional work from the game instructor turned out to be surprisingly challenging. Most randomization mechanisms used in entertainment games define randomly an action or a level from a large pool of options. This means, that the different options must have been defined in advance. Creating a question pool for a drill game would require a great deal of work from the instructor. In addition to finding a solution that wouldn't burden the instructor, the solution needed to be adaptable to various contexts. Picking questions randomly from a question pool works only for specific situations where the order of the questions is indifferent. This kind of mechanism would not work for example in a game designed for fire safety training where the order of the exercise matters.

As a conclusion, in games that are mainly played only once the feeling of randomness can be created by using surprising events. Such an event seems random to the player even though it would be carefully designed and scheduled in advance and would have nothing to do with randomness.

4.4.3 UI/UX survey

The second data collection round was a UI/UX survey directed towards the learners. The survey was created with Google Forms. A survey was selected as the data collection method for the user insight because it enables the collection of subjective states (such as attitudes) in a comparable form (Martin, 2006).

The aim was to collect answers for both users who had previous experience with Seppo and users who hadn't used the platform before. It was distributed to Seppo customers in the monthly newsletter, to Aalto University students via different Telegram groups, and to Metropolia students in a presentation concerning Seppo. The survey was in Finnish. All questions of the survey were mandatory, except for the last "additional thoughts" question.

The survey consisted of five parts. The aim of the survey was to collect user insight on the intuitiveness and the visual attractiveness of the designed prototypes. In addition, the users were asked to rate how well the designed prototype fits in the learning context. All the questions were mandatory, except the last open one where the user could write additional thoughts.

The first part was about collecting background information (previous use of the Seppo platform, age, employment status, experience using technology). The three following parts were all discussing a specific prototype and included five questions related to it. All the questions were presented in a statement format (e.g., "The use of wheel of fortune felt intuitive") and the user were asked to answer the statement with a 5-point Likert scale (1 strongly disagree – 5 strongly agree). In the last part of the survey, users were asked to rank the three designed randomization mechanisms based on which one they found to be the most appealing. In addition, they were asked to rank in a 5-point Likert scale how important an aspect they consider "fun/engagement" to be in learning. Using the same scale, they were also asked to evaluate how much the aspect of "fun/engagement" improves their learning. In the last mandatory question, the user was briefly presented the concept of gamification and asked to write thoughts about gamifying learning. The very last question of the survey was an open-ended "additional thoughts" field where the user could freely add any comments and thoughts about the survey, the designed mechanisms or gamification in general.

5 Results

5.1 Expert insight

All the interviewees were professional gamification experts who had used gamification in their working life for several years. Sonja Ängeslevä is an influential game researcher. Currently, she works as a game designer, dealing with the product side, analytics, customer data, product strategy, and feature prioritization. She has designed several games and has worked lately mostly with mobile games. Jouni Piekkari works as a teacher in social sciences at Metropolia University of Applied Sciences. He specializes in action methods and artistic methods in social work. In addition, he develops action pedagogy for both children and immigrants. Teppo Manninen is a visual art teacher in a primary school. He develops pedagogical methods for the schools in Helsinki and works in the gamification company Upgrade EDU.

5.1.1 Expert perception of gamification

In the section concerning gamification in general, interviewees were asked to share positive and negative experiences related to gamification. These could have been either personal experiences or general observations on different implementations of gamification. First, the interviewees were asked to describe a situation where gamification had really worked well. Two out of three interviewees pointed out that they had had very positive experiences when gamification had been implemented in sports. According to Ängeslevä, applications built for exercise or sport are a natural way to activate people. Ängeslevä mentioned that gamification also works when implemented in recruitment processes for testing a person's way to react to surprising situations, problem-solving skills, and strategic perception.

Piekkari uses gamification with his students. According to him, one of his best experiences with gamification is when it fosters even the quietest students to come out with knowledge and skills hitherto completely hidden. Manninen found that gamification is an efficient way to motivate pupils to study. Of course, gamification does not make miracles. Pupils with severe problems with motivation are hard to get engaged even with gamification. On the other hand, when gamification works, it brings people together and the group/team will start working in collaboration. Manninen interestingly pointed out that gamification also motivates the instructor or the teacher. This

deviates from the prevailing focus of previous gamification research lingering on engaging and motivating learners.

When interviewees were asked to describe situations where gamification had been poorly implemented, bad game design was the most mentioned reason for failure. Ängeslevä described a situation where a company had used gamification for improving efficiency among customer service personnel answering customer calls. The most efficient employees were rewarded with prizes such as gift cards. However, the game enabled the employees to cheat in the game and they were trying to increase their score using devious ways. Instead of long-lasting motivation, the motivation was only momentary, and the quality of the work and customer service did not improve by using external motivators. The main purpose of the action had disappeared under gamification. In addition, interviewees had had bad experiences with gamification that resembled multiple-choice exams, which is actually not a game in the proper sense. Another poorly implemented variation was a too difficult game causing frustration instead of motivating the students.

In the section concerning teaching and training, interviewees were asked what kind of gamification can be used in teaching and training. Answers confirmed the assumption that gamification is very context dependent, and its implementation should be carefully addressed in advance. According to Piekkari, the use of gamification in teaching depends on what is being done and what is to be achieved. For example, sometimes giving points makes sense and competitiveness bring playfulness and challenge. On the other hand, points can sometimes feel useless, and the players are more interested in the actual playing and doing. Ängeslevä especially likes when gamification is implemented in teaching in form of drill games (systematic repetition of the concept) for developing different skills, such as mathematical thinking. According to her, these game mechanisms concretize learning differently compared to traditional teaching methods. However, she emphasized that people learn in different ways and drilling gamification does not suit everyone. In addition to drill games, Ängeslevä sees that at its best, gamification supports collaboration and peer learning where players pursue a common goal. Manninen uses gamification in teaching to motivate pupils and make learning more fun. He uses gamification because it enables automation and gives immediate feedback on the pupils' performance. In addition, Manninen argues that gamification makes teaching more interesting for the instructor compared to traditional

teaching methods. According to him, gamification makes it easier to follow student progress and provide feedback.

5.1.2 Surprise mechanisms in Seppo

In the last part of the interview, interviewees were asked what kind of surprise mechanisms could be added to the Seppo platform. Many of the ideas were inspired by popular family games. For example, there were requests for randomness in card drawing, similar to the *chance* and *community chest* cards in Monopoly. Monopoly was also mentioned as an example of unfortunate luck when the players get stuck in the prison and need to pass their turn. Ängeslevä sees the potential in adding such a mechanism also in learning games. According to her, it would add challenge and game dynamics to the game.

Piekkari sees that some kinds of surprise exercises during the game would be fun and engaging. Currently, Seppo supports *flash exercises* that can be activated by the instructor during gameplay. The exercise is shown to the players at the same time it is activated. Manninen uses flash exercises to create surprising events in his games.

In addition to using the Seppo platform in his own teaching, Piekkari also coaches the use of the platform for other instructors in Metropolia. According to him, a common challenge for the instructors is to create an interesting and engaging game. For a new Seppo user, it might be difficult to choose between different game mechanisms and to know how to them use best. Piekkari argues that new Seppo users would benefit from some ready-made game formats and guidance (e.g., in creating storylines and choosing the right exercise type) for making a more playful and engaging game. He was also thinking of some pre-designed "surprise models" so that the instructor could choose what kind of surprise mechanisms would be added to the game.

After having first thought on their own what kind of surprise mechanism could fit the Seppo platform, the interviewees were shared a Google Jamborad link consisting of five pre-defined surprise mechanisms. Each mechanism was written on a separate virtual sticky note that could be moved by dragging.

Figure 4: Pre-defined surprise mechanisms

First, the interviewees were given a short description of each mechanism (from left to right):

Randomization generator: A virtual randomization generator, e.g., a die or a wheel of fortune.

Minigames: Small games outside the actual gameplay, e.g., a Hangman game, or "arrange the mixed letters of a word in the right order". These games could, for example, be activated randomly during the actual gameplay.

Loot boxes: Surprise boxes, containing randomly generated goods/items/advice.

Rewarding systems (other than points): Instead of collecting (only) points, the rewards could be something visually more appealing, e.g., collecting sectors in a circle like in Trivial Pursuit, or collecting cats of different colors.

Code locks: Code locks are already used in the Seppo platform. The game instructor can decide to lock an exercise with a 3-digit code and give the player a written hint of it. This mechanism could be supported even more by the Seppo platform itself, for example, by revealing parts of the code when the player completes a previous exercise successfully.

After being introduced to the different mechanisms, the experts were asked to arrange them in order (from left – the most, to right – the less) by the two following criteria:

1. arouses interest
2. fosters learning.

For comparing the different surprise mechanisms, each mechanism was given a score from 5 to 1 (left 5, right 1). Table 1 shows the total score of each mechanism ordered by "arouses interest" whilst Table 2 shows the total score ranked by "fosters learning".

Randomization generator	Mini games	Code locks	Loot boxes	Rewarding systems
5	3	4	2	1
3	4	5	2	1
5	4	2	1	3
13	**11**	**11**	**5**	**5**

Table 1: Total score of the surprise mechanisms (ordered by "arouses interest")

Randomiztion genarator	Rewarding systems	Loot boxes	Mini games	Code locks
5	3	4	1	2
5	2	1	3	4
2	5	4	3	1
12	**10**	**9**	**7**	**7**

Table 2: Total score of the surprise mechanisms (ordered by "fosters learning")

The randomization generator mechanism aroused the most interest and was expected to foster learning the best. Interestingly, rewarding systems were not experienced to be very interesting but external rewarding was reported to increase motivation in learning. The variation in the total scores is notably greater when the mechanisms are ordered by interest. The little variation between the total scores when ordered by "fosters learning" may be due to learning being affected by various factors (such as motivation, personal interest, and previous knowledge). Learning cannot be drastically increased by simply gamifying teaching. According to Manninen, all these gamification mechanisms were quite equivalent when reviewing which mechanisms foster learning the best.

To conclude, at its best, gamification can be motivating and engaging for both the instructor and the players. However, if gamification has been poorly implemented it can frustrate learners and the main purpose of the action may disappear under gamification.

5.2 Design of the surprise mechanisms

Based on the gamification workshop and the analysis of the expert interviews, the **randomization generator** mechanism was selected as the design artifact of this thesis. According to the experts, this mechanism was the one that best promoted learning, with a total of 13 points (see Table 1). In addition, it was also rated to be the most

interesting of the pre-defined surprise mechanisms with a total of 12 points (see Table 2).

Because Seppo games are used in various situations and instructors create games for different purposes, the designed mechanism had to be versatile enough to use in various contexts. The wider idea of a randomization generator mechanism was narrowed down to a mechanism that determines an item from a pool of items defined by the instructor. For example, the instructor could create an exercise with countries and their capitals. The player would then be asked to answer the capital of a randomly generated country.

In practice, the instructor would be given the option between three visualization options for randomization. For items in textual form, the instructor could choose between **a wheel of fortune** and **a deck of cards**. In addition, there would be an option of a traditional 6-sided **die**. The aim was to select familiar elements from the game context so that their use would be intuitive for the players.

The prototypes were designed by using the prototyping tool Figma. All the prototypes were designed for a mobile user interface because Seppo games are usually played through with a mobile phone. In these prototypes, the randomization mechanism was embedded in the instructions of an exercise. As these prototypes were designed for "proof of concept" purposes, all of the functionality has not been added (e.g., closing the feedback modal), and the outcome of the randomization mechanism is pre-determined. To prevent errors, the button sending the answer ("Lähetä vastaus") only gets enabled when the player has first activated the randomization mechanism and an answer option has been selected.

The wheel of fortune exercise was about countries and their capitals. *Which country's capital?* The player is asked to spin the wheel to determine a country. The generated country is shown in a modal and the player has to select the correct answer from multiple choices.

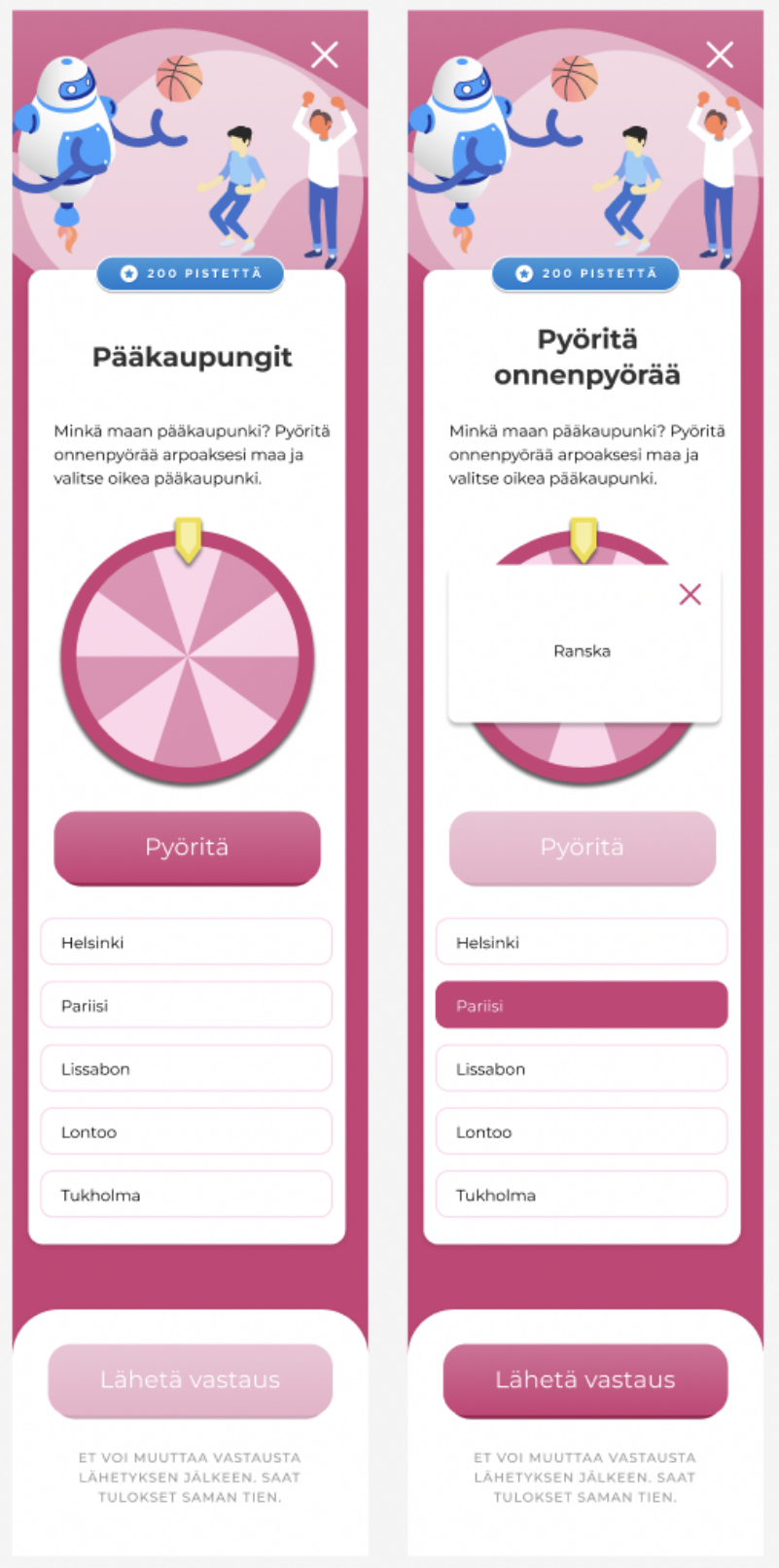

Figure 5: Screenshot of the wheel of fortune prototype

The die exercise was about solving an equation. The player is asked to throw the die three times and choose the correct result. The throwing button (“Heitä”) becomes disabled when the player has thrown the dice three times. In addition, to prevent errors, the player cannot select any answer option before the die has been thrown three times.

Figure 6: Screenshot of the die prototype

In the deck of cards exercise, the player is asked to answer to *which continent the country belongs?* The player needs to turn the card to determine a country.

Figure 7: Screenshot of the deck of cards prototype

The player gets feedback straight away after sending an answer. If the player answered wrong, the correct answer will be displayed in the feedback modal (see Figure 8).

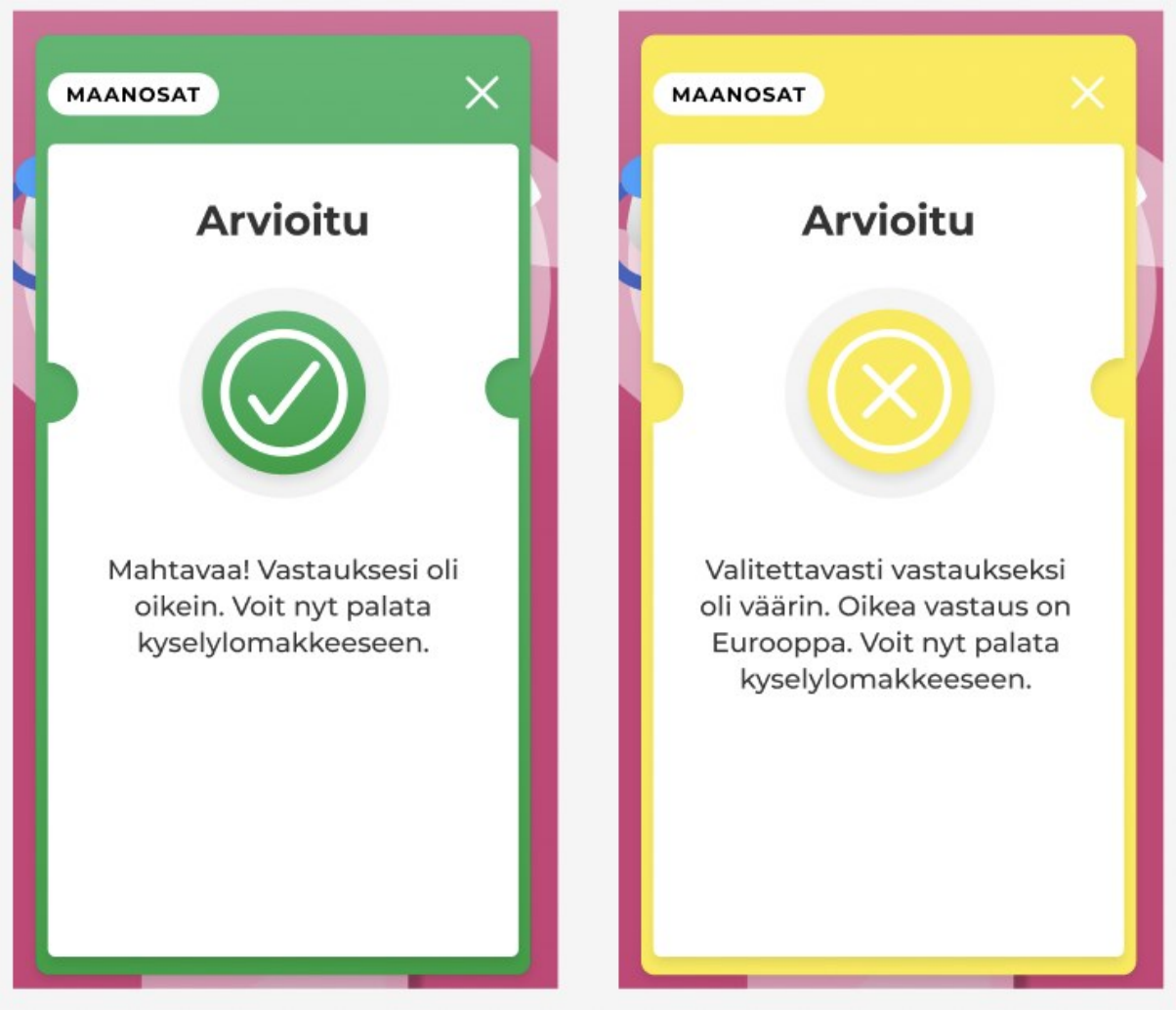

Figure 8: Screenshot of the exercise feedback screens

5.3 User experience

The UI/UX survey was answered by 24 respondents in total. 54.2% (n = 13) of them had previous experience on the Seppo platform. The age range of the respondents was from 21 to 50 years. 58.3 % (n = 14) of them were employed, and the rest identified themselves as students. All respondents consider themselves to be at least moderate users of technology (Chart 1).

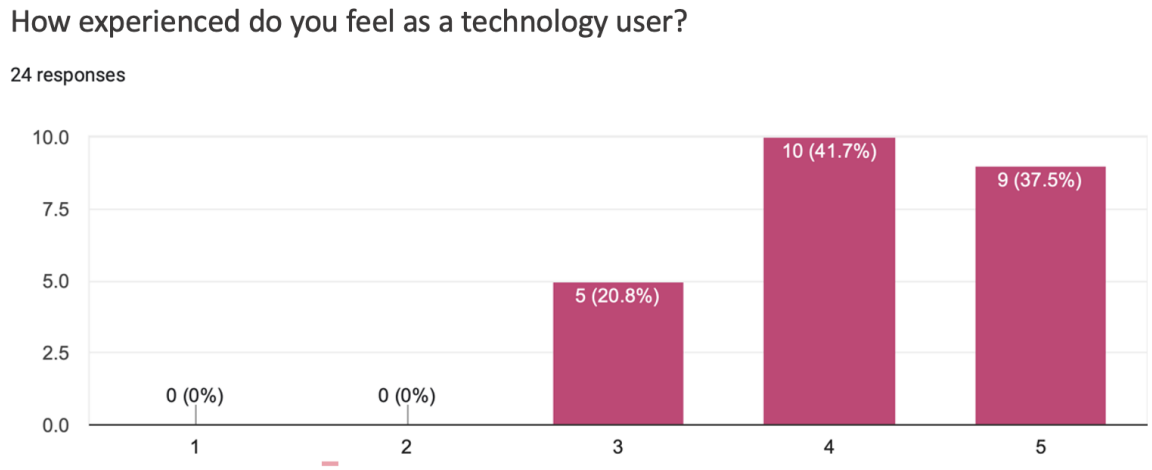

Chart 1: Results of the question "How experienced do you feel as a technology user?".

5.3.1 User reception of the designed mechanisms

The users were asked to evaluate each randomization mechanism one by one. The link of the Figma prototypes was shared in the survey and the users were asked to answer the following questions (using the Likert five-point scale) after completing each mission:

- I found the *mechanism X* intuitive to use
- The use of the *mechanism X* was clear to me
- I found the *mechanism X* visually pleasing
- I think the *mechanism X* fits into the learning context
- I thought using the *mechanism X* was fun.

Table 3 shows the average user rating for each randomization mechanism.

	The wheel of fortune	**The die**	**The deck of cards**
I found the *mechanism X* intuitive to use	3.79	3.5	4.21
The use of the *mechanism X* was clear to me	3.75	3.25	4.5
I found the *mechanism X* visually pleasing	4.08	4	4.46
I think the *mechanism X* fits into the learning context	3.91	3.71	4.17
I thought using *the mechanism X* was fun	3.79	3.46	3.92
Total	**3.86**	**3.58**	**4.25**

Table 3: Average user rating of each randomization mechanism

The users were asked to rank the three designed mechanisms according to their overall appealingness from (1 least appealing – 3 most appealing).

When rating the different categoriess (intuitiveness, clearness, visuality, suitability for the learning context, and fun) individually, the deck of cards mechanism got the best total score of 4.25, while the die mechanism got the worst score (3.58) (see Table 3). However, when taken as a whole, the wheel of fortune was experienced to be the most appealing of the three mechanisms with a score of 2.33 (see Table 4). The die mechanism was significantly the least popular of these mechanisms with a score of 1.46 on average (see Table 4). From Chart 2 can be seen that the die mechanisms got the most points of the value 1.

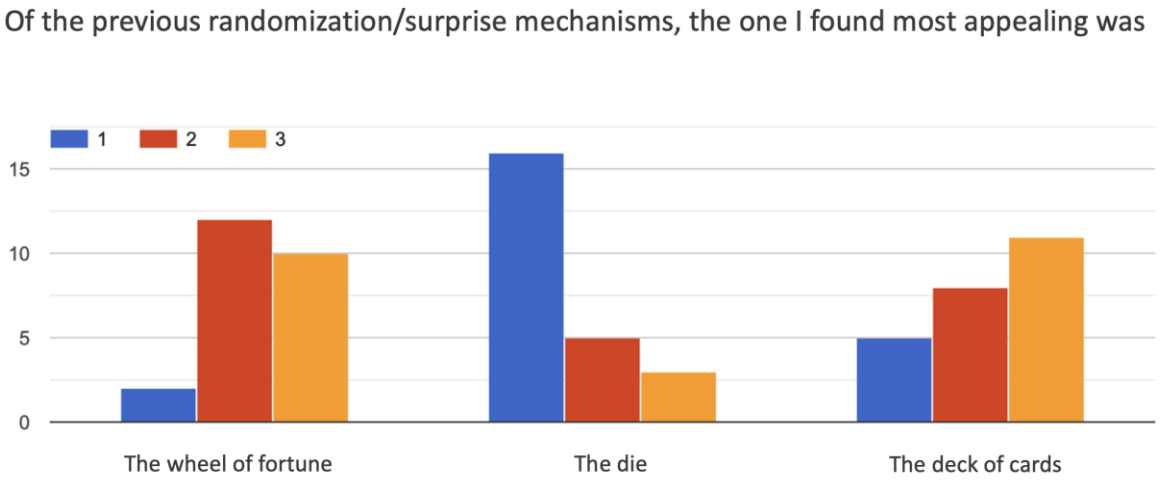

Chart 2: Results of the question: "Of the previous randomization mechanisms, the one I found most appealing was".

	Average score
The wheel of fortune	2.33
The die	1.46
The deck of cards	2.25

Table 4: Average score for the question: "Of the previous randomization mechanisms, the one I found most appealing was".

Both user groups with prior and no prior experience in using Seppo rated the die mechanism to be the least appealing of the three mechanisms (see Table 5). A slight difference could be seen when looking at the popularity of the wheel of fortune and the deck of cards. Users with prior experience in using Seppo rated the wheel of fortune to be the most appealing of the three mechanisms with a score of 2.31 whilst the users with no prior experience rated the deck of cards to be slightly more appealing than the wheel of fortune.

	The wheel of fortune	The die	The deck of cards
Prior experience in using Seppo	2.31	1.54	2.15
No prior experience in using Seppo	2.32	1.32	2.36

Table 5: Average score for the question "Of the previous lottery mechanisms, the one I found most appealing was" categorized by prior experience on using Seppo.

In the open feedback field of the questionnaire, users had given feedback on the designed mechanisms. The unpopularity of the dice mechanism may have been due to the task, rather than the mechanism itself. According to two respondents, it remained unclear why the die had to be thrown three times. Only one throw would have been enough for the purpose of this exercise. One respondent had given the worst points to the die exercise because he/she found the equation problem was hard. In addition, he/she didn't even understand what the die mechanism was related to the exercise.

"As a side note, the die got the lowest score for me because the equation problem was the hardest - and I didn't even understand how the dice numbers related to it :D".

"The questions in the survey were a little difficult to understand. They could have been more clearly explained. For example, some may have misjudged the use of dice as unintuitive because they did not understand the task, even though the use of the dice itself was clear. I would add to the instructions to roll the dice three times and add up the numbers. Now you could only realize at the end that you had to add up all the numbers and not the last number = x."

Figure 9: Screenshot of the UI test view

The die exercise (see Figure 9) received the most criticism. For the purpose of this study, it was unfortunate that the respondents got frustrated with the mathematics, which probably affected their opinion of the mechanism itself.

The respondents would have liked the interaction with the mechanisms to be more intuitive – not only by clicking the "spin" or "throw" button. For example, the animation of the wheel of fortune could have been activated by "swiping" the wheel.

"I clicked both the dice and the wheel of fortune directly as I didn't immediately realize that there was a separate button underneath!"

“On the Wheel of Fortune, it would have been even more intuitive to be able to spin the wheel by "swiping" […]”

The card deck mechanism could be improved by allowing the user to choose the card he/she wants to flip from several options.

“You could choose a deck of cards by clicking on one of three options.”

The animations of mechanisms provoked thoughts. Some of the respondents really liked the animations whilst some found them confusing.

“[…] The animation of the deck of cards was really cool and funny, but if there are several in a row, the "waiting" for the draw can get boring.”

“The animation of the deck of cards was confusing. Why were the cards lined up side by side? Personally, I expected all three to be turned over. Instead, there could have been a faster shuffle animation, followed by the top one being revealed, or the cards opening up into a fan with one card drawn from the middle.”

The respondents’ personal experience of the assignments/tasks turned out to be a challenge when exploring the user experience towards the designed mechanisms. For the purposes of this study, it would probably have been more useful if the same task had been used in all mechanisms. Thus, users' personal preferences for the task would not have affected the comparability of the mechanisms. Collecting user experience of a tool proved to be challenging because the user experience depends much on the context in which the tool is used. In this case, if the user didn’t like the task the randomization mechanism was used to, it may have affected his/her opinion on the mechanism itself. It is therefore difficult to assess whether the users' evaluations concerned the mechanism itself or the task, or both.

5.3.2 User perception on gamifying learning

At the end of the survey, the respondents were asked whether having fun is important for them in learning. 95,8% of respondents found that having fun was either important or very important in learning (see Chart 3). The majority of respondents answered that having fun promotes their learning (Chart 4).

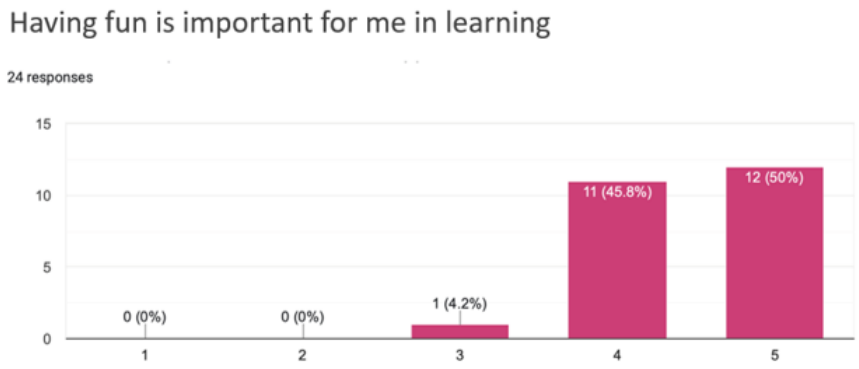

Chart 3: Results of the question: "Having fun is important for me in learning".

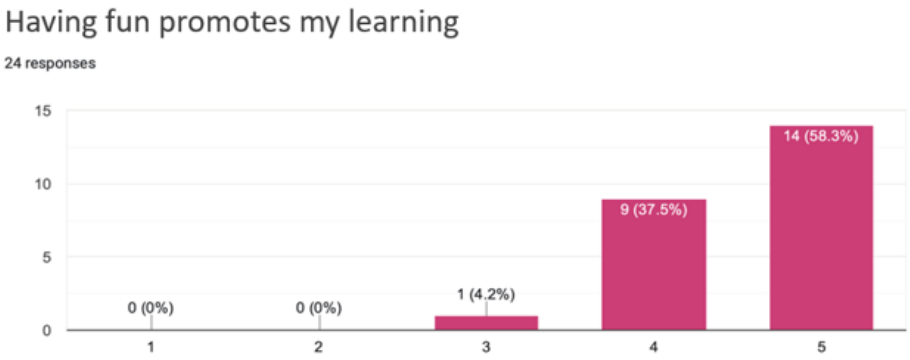

Chart 4: Results of the question: "Having fun promotes my learning".

In the only required open-ended question, the respondents were asked to share their thoughts on gamifying learning. The question was accompanied by a brief explanation of gamification: *Gamification means bringing elements familiar from games into a non-game context. The three scoring mechanisms presented above were examples of how gamification can be used in a learning context. Briefly describe the ideas that gamification of learning evokes in you.*

According to many respondents, gamification supports learning by offering an alternative way to learn. It was perceived to inspire young people in a creative way.

"Gamification is a creative method that can support interaction and decision-making."

"I think gamification is a great way to make learning more fun by removing negative images of "boring" learning."

“Enables variety in the learning process.”

“I find it very interesting. It's always good to find new ways to keep learning meaningful.”

One potential implementation of gamification was seen in learning by repetition. One respondent answered that using randomization mechanisms in teaching helps to develop recall in different situations. The use of flashcards could be an example of how to implement such a mechanism in practice.

Although there was a generally positive attitude towards gamification in teaching, some respondents pointed out critical opinions. According to one respondent, excessive gamification can also reduce the quality of learning if the learning situation becomes too game-like. This can lead to less learning. When gamifying learning, the user expectations, and needs should still be met.

"[…] It should be ensured that the goals created by gamification correlate with the user's goals.”

One respondent was concerned about whether the use of gamification can reduce inefficiency problems in learning.

“Gamification of learning makes learning more enjoyable and motivating, but not necessarily more effective. This raises the question of whether gamification increases motivation and enthusiasm enough to overcome potential inefficiency problems.”

Some respondents had previously had bad experiences with gamification of learning. According to them, sometimes gamification was poorly implemented and felt like an oversight. One respondent experienced the financing methods of many popular games as unethical and wouldn’t recommend their implementation in learning. This claim is easily relatable particularly in the case of advertisement-based revenue models and the much-criticized loot boxes.

“[…] I also think that the funding mechanisms in many modern games are unethical. Using these mechanisms in a learning environment would be a bad thing.”

The concept of gamification in the context of the designed mechanisms caused confusion among some respondents. Two respondents reported that instead of gamification, these mechanisms were rather randomization. One of them was also wondering the

use of randomization in these examples. Why define a random number live instead of having the number already embedded in the assignment? According to him/her these mechanisms were slowing down the task completion and the user had to wait for the animation just for getting an input.

6 Discussion

Identifying surprise mechanisms in the Seppo platform proved to be surprisingly (!) challenging. As the aim was to design a mechanism that would not require more work from the instructor, the mechanism had to be versatile. Based on the expert interviews and the results of the workshop, three randomization mechanisms were selected to be designed: a wheel of fortune, a die, and a deck of cards. All these mechanisms were visual variations of the same random item/number generator. At its simplest, these mechanisms can be used as drill mechanisms where learning takes place through repetition. However, the use of these mechanisms depends much on the instructor who can for example define what kind of tools the player gets to complete a given task.

An interesting observation emerged from the expert interviews. Previous research has mainly focused on the impact of gamification on the *learner* and his/her motivation and engagement. However, gamification can also be seen as a powerful tool for motivating the *instructor*, making teaching more engaging and fun. This might be an interesting topic for future research. It is an advantage for Seppo that their product fosters instructors' professional development and engagement as well as co-operation and mutual support among peer instructors.

Based on the results of the user experience survey, the attitude towards gamifying teaching practices was generally positive. Gamification was seen as a good alternative to traditional teaching, making learning more fun and engaging. However, implementing gamification in the teaching context raised some concerns. Some users had previous bad experiences with poorly implemented gamification in the learning context. Another participant was concerned that gamification would shift the focus from "efficient" learning to merely enjoying the playing. However, having fun and learning are not mutually excluding, as discussed in chapter 1.

Of the three designed randomization mechanisms, the wheel of fortune was experienced to be generally the most appealing. However, when rated by individual categories (intuitiveness, clearness, visuality, suitability for the learning context, and fun), the deck of cards got the best score in each category. While the design of the wheel of fortune and the deck of cards was experienced quite successful, the die mechanism got the worst score in all the individual categories and was ranked to be the less appealing of the three mechanisms. In the feedback section, the users reported that the

instructions for the die exercise were confusing, and it remained unclear why the die had to be thrown three times. In addition, the mathematical equation of the die exercise was perceived as the most difficult of the three exercises. The comments can be interpreted as a criticism towards the assignment/context rather than the die mechanism itself.

Exploring the user reception on the designed mechanisms turned out to be challenging. As respondents' personal experiences of the level of difficulty of the tasks influenced their answers, the questionnaire responses may not fully reflect their experience with the mechanisms themselves. For the purposes of this study, it might have been better if all mechanisms had been tested with the same task, to improve their comparability.

The results of both the expert interviews and the user experience survey confirmed the assumption of the previous research that using gamification in educational settings increases motivation and engagement. In addition to motivating learners, gamification can also be used to engage the instructor. Although there is a great potential for gamifying learning, it cannot be used as a substitute for learning content. Despite the gamification, learning objectives must be met and the activity must feel meaningful for both the instructor and the learner.

The possibilities for new ways of gamification are nearly infinite. New shifts of gamification emerge as new trends sprout in the video game culture. Much literature exists of the impact of surprise on learning. In addition, surprise mechanisms have been widely studied in the context of video games (e.g., loot boxes, and RNG mechanisms). However, there is only a little research on how to implement surprising events in learning through gamification. Since previous research shows that surprise has a positive effect on learning, the educational field could benefit from further research on how to create surprise in learning using gamification.

7 Summary

The effects of surprise have been studied in learning and in the game industry. According to previous research, surprise has a positive effect on learning through memorability. In game industry, surprise is used to make the gameplay more engaging and immersive through unexpected occurrences.

This study focused on how surprise can be added to learning through gamification. The study was conducted using Seppo, a gamified learning platform. Seppo is used for teaching and training purposes in schools and in workplaces. Three gamification and educational experts were interviewed to supply ideas on how to add surprise to the Seppo platform in practice. In addition, with the help of an external gamification company, Zaibatsu, the Seppo team shared ideas on surprise in a workshop. Based on the results of the expert interviews and the gamification workshop, three randomization mechanisms were selected to be designed for the user testing.

Prototypes of the mechanisms were distributed to users, some of whom had used Seppo before. They were asked to fill a UI/UX survey, concerning the intuitiveness, clearness, visuality, suitability for the learning context, and fun of the designed mechanisms. According to users, the most appealing of the three mechanisms was the wheel of fortune, whilst the die mechanism was the least appealing.

An interesting observation emerged in course of the research. Previous research has mainly focused on the effect of gamification on learning and the learner's experience. However, gamification can also be a means to motivate and engage the instructor, making teaching practices more rewarding and collegial. Bringing together the understanding developed in educational research and gamification research allows outlining a future approach to gamified learning. In the future, the effect of surprise may be used to offer gratifying, engaging and immersive learning experiences that do not underestimate the intellectual and creative capacities of learners.

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Appendix 1

Arpomismekanismit

Tämän kyselytutkimuksen tarkoituksena on kartoittaa käyttäjäkokemuksia kolmesta Seppo-alustaan suunnitellusta arpomismekanismista. Arpomismekanismit on suunniteltu osana Seppolle toteutettua diplomityötä.

Seppo on pelillisyysalusta, joka on suunniteltu mobiiliin oppimiseen ja koulutukseen. Seppon avulla voidaan pelillistää muun muassa rekrytointia, työpaikkaperehdytystä sekä oppimista kouluympäristössä.

Kyselyn vastaukset käsitellään luottamuksellisesti ja anonyymisti, eivätkä yksittäiset vastaukset näy tuloksista.

Kiitos etukäteen osallistumisestasi tutkimukseen!

Huom. Figma-prototyyppien suuren koon vuoksi, kyselylomake kannattaa täyttää tietokoneella mobiililaitteen sijaan.

Esitiedot

Oletko käyttänyt Seppoa aiemmin?*
(Kyllä/En)

Ikä* _____

Mikä seuraavista vaihtoehdoista kuvaa parhaiten elämäntilannettasi?*
(Opiskelija/Työssäkäyvä/Työtön/Varusmies-/nainen/Eläkeläinen)

Kuinka kokeneeksi koet itsesi teknologian käyttäjänä?*
(1 En lainkaan kokeneeksi – 5 Todella kokeneeksi)

Onnenpyörä

Ensimmäinen tarkasteltava aropomismekanismi on onnenpyörä.

Avaa seuraava linkki selaimella ja suorita tehtävä.

https://www.figma.com/proto/1l5TIXj93Nmg19RZGyDKlt/Randomization-UI-test?node-id=2%3A9049&scaling=scale-down&page-id=0%3A1&starting-point-node-id=2%3A9049&show-proto-sidebar=1

Onnenpyörän käyttö oli mielestäni intuitiivista*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Onnenpyörän käyttö oli mielestäni selkeää*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Onnenpyörä oli mielestäni visuaalisesti miellyttävä*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Onnen pyörä sopii mielestäni oppimiskontekstiin*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Onnenpyörän pyörittäminen oli mielestäni hauskaa*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Noppa

Seruaavaksi tarkastelemme noppaa.

Avaa seuraava linkki selaimella ja suorita tehtävä.

https://www.figma.com/proto/1l5TIXj93Nmg19RZGyDKlt/Randomization-UI-test?node-id=55%3A6582&scaling=scale-down&page-id=0%3A1&starting-point-node-id=55%3A6582&show-proto-sidebar=1

Nopan käyttö oli mielestäni intuitiivista*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Nopan käyttö oli mielestäni selkeää*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Noppa oli mielestäni visuaalisesti miellyttävä*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Noppa sopii mielestäni oppimiskontekstiin*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Nopan heittäminen oli mielestäni hauskaa*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Korttipakka

Viimeinen tarkasteltava arpomismekanismi on korttipakka.

Avaa seuraava linkki selaimella ja suorita tehtävä.

https://www.figma.com/proto/1l5TIXj93Nmg19RZGyDKlt/Randomization-UI-test?node-id=113%3A17378&scaling=scale-down&page-id=0%3A1&starting-point-node-id=113%3A17378&show-proto-sidebar=1

Korttipakan käyttö oli mielestäni intuitiivista*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Korttipakan käyttö oli mielestäni selkeää*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Korttipakka oli mielestäni visuaalisesti miellyttävä*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Korttipakka sopii mielestäni oppimiskontekstiin*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Kortin kääntäminen oli mielestäni hauskaa*
(1 Täysin eri mieltä – 5 Täysin samaa mieltä)

Edellisistä arpomismekanismeista mielestäni miellyttävin oli*
(Onnenpyörä/Noppa/Korttipakka)

Hauskuus/hauskanpito on mielestäni tärkeää oppimisessa*
(1 Ei ollenkaan– 5 Todella tärkeää)

Hauskuus/hauskanpito edistää oppimistani*
(1 Ei ollenkaan – 5 Todella paljon)

Millaisia ajatuksia oppimisen pelillistäminen herättää sinussa?*
Pelillistämisellä tarkoitetaan peleistä tuttujen elementtien tuomista ei-pelilliseen kontekstiin. Edellä esitellyt kolme arpopmismekanismia olivat esimerkkejä siitä, kuinka pellistämistä voidaan hyödyntää oppimiskontekstissa. Kirjoita lyhyesti, millaisia ajatuksia oppimisen pelillistäminen herättää sinussa.

_____
_____
_____

Muita ajatuksia/lisättävää?

_____
_____
_____