Gamification User Types and Preferred Game Characteristics Amongst Student Teachers

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ABSTRACT

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The teaching community has been struggling to engage learners, whether it be a traditional classroom setting, a completely online platform or a blended learning environment. One innovation that has shown to increase motivation and generate situational interest in individuals is gamification of learning. 'Gamification' is defined as the "use of game elements in non-game contexts" for the purpose of making a service or product more enjoyable and engaging as online games have demonstrated intense user-motivation for sustained durations.

This study targets student teachers in Finland to identify the predominant gamification user types amongst them as well as their preferred game elements. It analyses and presents results from two different pilots carried out under the ADeAPTIVE project. The study involved a total of 130 student teachers at the University of Jyväskylä. The ADeAPTIVE team carried out both pilots with student teachers in the context of a university course on ICT in education, which was offered on Moodle platform. Data from questionnaires was analysed using SPSS 27 and quantitative content analysis.

The results show *Philanthropist* and *Socializer* to be the predominant user types amongst student teachers. In addition, most student teachers reported *challenge*, *achievement* and *audio-visuals* of the game to be the preferred characteristics that make gamification experiences worthwhile, leading to sustained interest and hence improvement in learning. The results of this study can potentially be used to create personalized gamified experiences, and in-turn improve engagement and motivation of learners in teacher education programmes to facilitate better achievement of learning outcomes.

Keywords: gamification, user-types, teacher education, Hexad framework, motivation

CONTENTS

1   INTRODUCTION

Educational research from various fields points towards the increasing difficulty with learner engagement at all education levels worldwide. The fast-changing world places strenuous demands on education that are challenging to keep up, despite extensive research that focuses on designing effective innovations for learner engagement. The teaching community has been struggling to engage learners, whether it be a traditional classroom setting, a completely online platform (Liyanagunawardena et al., 2014; Erikson et al., 2017; Veletsianos & Shepherdson, 2016; Glazewski, 2019) or a blended learning environment (Ullah & Anwar, 2020) . Even though technology has multiplied the possibilities for innovation in education (Cachia et al., 2010), most forms of e-learning today, in the form of wikis, open online courses (MOOCs) or flipped classrooms (FCs), still fail to provide the kind of engagement people experience with the technologies they use in daily life (Adesope & Rud, 2019). Adesope and Rud (2019) emphasize the need to move beyond the classroom as well as static web-based learning towards innovative approaches in education.

One such innovation that has shown to increase motivation and generate situational interest in individuals is gamification of learning. 'Gamification' is defined as the "use of game elements in non-game contexts" for the purpose of making a service or product more enjoyable and engaging as online games have demonstrated intense user-motivation for sustained durations (Deterding, Dixon, Khaled & Nacke, 2011). Various definitions collected by Deterding et al. (2011) bring out the potential of gamification in driving participation, solving problems and engaging users.

In the context of online learning, Nousiainen et al. (2020) emphasize the importance of a clear purpose for gamification as well as being aware of the challenges due to differences in motivational orientations of students. In other words, certain game design elements that motivate one person might be counterproduc-

tive for another (Hamari & Tuunanen, 2014; Lopez & Tucker, 2019). Personalization of gamified experiences using the player type or user type models is an effective way to tackle this challenge (Nousiainen et al., 2020). Tondello et al. (2016) as well as Nousiainen et al. (2020) found the Hexad model (Marczewski, 2015) of user types for gamified learning to be more suitable for personalization of gameful systems than other user type models that were limited in their scope and applicability. The Hexad model is based on Self-determination Theory (SDT) (Deci & Ryan, 2000) and dwells on factors that internalize motivation for different individuals. In addition to human motivation, the Hexad framework also builds on research on player types and practical design experience (Tondello et al., 2016).

This study targets student teachers in Finland to gain insight into the predominant user types as well as their preferred game design elements. The focus of the study—students studying to be teachers—are of particular interest because although gamification of platforms, courses and lessons has been explored with limited outcomes in teacher education programmes, personalization of these gameful experiences or gamified platforms for student teachers remains unexplored so far (Ferreira and Santos, 2018; Slamet et al., 2019; Özdener, 2018). The results of this study can potentially be used to create personalized gamified experiences for student teachers, improving learner engagement and contributing to better achievement of learning outcomes in teacher education programmes.

1.1   Learner Engagement and Motivation

Improving learning experiences for learners contains modifying learning contexts to generate interest as well as facilitate motivation that is enduring. Hidi & Renninger (2006) advocate the four-phase model of interest development, where the first two phases pertain to generation and maintenance of situational interest, which is defined as focussed attention and reaction triggered in a particular situation or moment in time. Situational interest with time can develop into individual interest; a process that can be facilitated by "organization of the environment" and content along with a person's own effort. Cognitive performance— including the ability to draw inferences, the ability to blend new information with prior

knowledge and the ability to focus attention— can also be improved with situational interest generation (Hidi & Renninger, 2006). Situational interest is easier to sustain when learners are more self-regulated. Amongst other aspects of self-regulated learning, Zimmerman (2002) lists self-awareness, self-motivation and appropriate behaviour to implement knowledge or skills.

Self-motivation or intrinsic motivation was also found by Howard, Bureau, Guay, Chong & Ryan (2021) the highest form of self-determination to improve learner outcome, leading to psychological and social well-being. SDT presents to us a continuum of self-determination (Ryan & Deci, 2017, 2020) describing different kinds of motivation with varying degrees of autonomy and internalization of desirable behaviour. The continuum varies from amotivation to intrinsic motivation, encompassing extrinsic motivation (figure 1) presented from the least self-regulated to the most self-regulated forms of motivation respectively. However, intrinsic motivation is only achievable when an activity or task is performed merely for its inherent satisfaction— a classic prototypical instance of self-determination— which is rare in most formal education scenarios. External regulation is characterised by behaviours driven by external incentives or rewards or the avoidance of external punishments. Introjected regulation is connected to concepts of self-worth and self-esteem through maintaining the validation of self through others (Paradise & Kernis, 2002; Crocker, 2008; Deci & Ryan, 2017). Identified regulation, on the other hand, is achieved by internalizing the values connected to a task that might not be entirely interesting or immersive within themselves.

Figure 1

The continuum of self-determination. (Deci and Ryan, 2000, p.72)
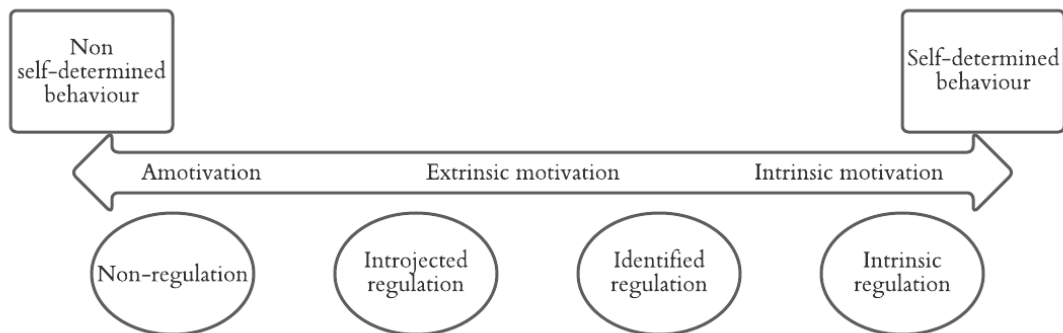
According to Self-Determination Theory, the natural human tendency to grow and integrate and the propensity towards well-being is facilitated by the three innate psychological needs: autonomy, relatability and competence. Intrinsic motivation can be enhanced by both autonomy and competence, either supported by the environment or perceived within oneself. It also flourishes when individuals feel a sense of security and relatability, i.e., if the task at hand is valuable to an individual or community that the person considers of significance. The same three psychological needs, when addressed, also facilitate integration of external regulation through evaluation and subsequent alignment with own values and needs. (Deci & Ryan, 2017).

Research on motivation has now extended to show the different outcomes for different kinds of motivation with new and unexpected results. Howard et al. (2021) show some examples of this by pointing out that intrinsic motivation does not always result in the most desirable outcomes, like some research suggests, counting on the fact that it is the most self-determined form of motivation. According to Howard et al. (2021), Losier and Koestner (1999) found out that identified regulation, instead, has appeared to be more effective in achieving desired results according to a number of recent studies; for instance, in encouraging voting behaviour. Such instances suggest the importance or purpose of the task to be more driving in order than intrinsic motivation to achieve results. However, within education, there is still not enough research on the kind of results identified regulation can attempt to achieve (Howard et al., 2021).

1.2   The Gamification Approach

Achievement of desirable outcomes, self-determination, engagement and overall well-being are not necessarily dependent on personal competence but can be understood and developed externally by other individuals through provision of appropriate environments and processes (Zimmerman, 2002). Amongst other approaches to create an engaging environment and facilitate learning is the approach of gamified learning.

In education, certain factors to keep in mind while designing a learning environment that have shown to facilitate intrinsic motivation are "challenge, curiosity, control, fantasy, cooperation, competition, and recognition" (Malone, 1987). The gamification approach in learning, based on these factors, has shown to improve learner engagement by increasing motivation, generating interest, presenting material in a different way, creating opportunities for collaboration, increasing self-efficacy, giving them a sense of control, and promoting learning by doing, amongst other ways (Grove, Bourgonjon & Looy, 2012; Egenfeldt-Nielsen, 2011). However, Grey, Grey, Gordon and Purdy (2017) alert teachers and game designers about the negative impact of extrinsic motivators used in game-designs along with the importance of intrinsic involvement of learning outcomes and learning content within the game design in order to truly achieve the desired result in terms of learning.

Gamification in teacher education still remains an under researched area despite the increasing research trends in gamification. Although the number of studies on interaction of student teachers with gamified learning experiences is limited (Slamet et al., 2019), there seems to be increasing interest in the use of gamified learning in higher education in general as well as pre-service teacher education in particular. Slamet et al. (2019), from their study of engaging student teachers on a gamified platform, reported that the student teachers found the platform adaptive, helpful and with potential to engage learners. In a similar study focused on Wikis by Özdener (2018), student teachers were reported to have positive attitudes towards gamification, believing that it could positively

impact academic success of these future teachers as well as their students. However, Özdener (2018) did not notice any long-term impact of engaging student teachers with gamified learning platforms and suggests changing the gamification design to make it more collaborative and/or personalized (for example connecting the gamified platform to their individual social networking accounts). In yet another study on the use of gamification as a teaching strategy as a part of a teacher education programme, Ferreira and Santos (2018) related the mechanisms of gamification with learning styles of individual learners, which have some elements in common with the motivational aspects that drive these learners. They found the adaptation of the gamified teaching/learning platform to individual learning styles of participants to be a successful strategy in increasing motivation and engagement of the trainee teachers.

Personalizing gameful designs requires the designers to understand the specific traits of personality of the learners with respect to their motivation factors, i.e., designers need to understand individual users in terms of what motivates them to learn as well as to play.

1.3   Personalized Gameful Designs and User Types

Personalization of a game or gameful design entails adjusting the interaction of the game platform to the preferences of individual player styles, also called user types (Marczweski, 2015) or player typologies (Hamari & Tuunanen, 2014). Research reveals the increasing need to differentiate game experiences and hence understand the different player typologies and motivations. The same holds true in the context of gamification, where game designs are used in other non-game environments (Deterding, Dixon, Khaled & Nacke, 2011). Hamari and Tuunanen (2014) have comprehensively reviewed the attempts to personalize game designs by player typologies in both game and non-game contexts. I present the user types more relevant to gameful designs in this section.

Player typologies are generally based on different motivation factors, personality traits or behaviour trends. Stewart (2011) divided players as hardcore and casual based on level of immersion of players, which was criticized to be too

simplistic. Drachen et. al (2009, as cited in Hamari & Tuunanen, 2014) identified four different playing patterns based on behaviour: *veterans, solvers, pacifists and runners.* These typologies were, however, based on customer behaviour more than player behaviours, since they draw on marketing research. Bartle's (1996) player types, instead, are based on player behaviours in MUDs (Multi-User Dungeons). He classified the players across two different axes: action vs interaction and player-orientation versus world-orientation. Based on where the player lies on each of these axes, Bartle (1996) classified them into Achiever (prefers action and world-orientation), Explorer (prefers interaction and world-orientation), Killer (prefers action and player-orientation) and Socializer (prefers interaction with other players). This categorization received criticisms for not taking into account the fact that a player can have more than one motivation and to different degrees.

Yee (2002), after he performed a factor analysis on Bartle's user types, came up with subcategories based on three identified motivational factors: achievement, socialization and immersion. Even though he improved the issue of rigidity with Bartle's user types, his analysis was still based on a specific game genre (Tondello et al., 2016). Xu's (2012) player types (achievers, active buddies, social experience seekers, team players and free-loaders) included both motivational and behavioural factors, however, they were not validated to be used in personalization of game designs. Tondello et al. (2016) mention a more promising model, the Brain Hex model, that classified players as Achiever, Conqueror, Daredevil, Mastermind, Seeker, Socialiser, and Survivor. This model is a reliable and validated model and has been successfully used in personalization of game designs but is limited to game contexts and has not established its relevance for gameful contexts. In fact, none of the aforementioned player types were created for gameful contexts.

Considering the absence of a valid user-type framework for gameful designs, the Hexad framework was designed by Marczewski (2015), which covers more gameful systems and has been validated for personalization of gameful contexts (Marczewski, 2015; Tondello et al., 2016). Building on Self-Determination Theory (SDT) (Deci & Ryan, 2000), the user types in the Hexad framework

take into account 'meaning' in addition to autonomy, competence and relatability as essential pre-requisites to motivation (Tondello et. al., 2016). The Hexad framework lists six user types based on different motivational aspects:

1. Philanthropists — motivated by purpose
2. Socializers — motivated by relatability
3. Free spirits — motivated by autonomy
4. Achievers — motivated by competence
5. Players — motivated by rewards
6. Disruptors — motivated by change

Tondello et al. (2016) also clarify that there are overlaps between these user types and motivation factors, however, they can be significantly differentiated despite the overlaps. They add that all individuals are motivated by multiple factors to differing degrees, so the categorization does not imply an exclusive motivation factor for one person.

1.4   Features of Effective Gameful Designs

Although gamification of learning has shown to improve learner engagement and performance, Deterding (2013) warns against replicating game design surfaces for the sake of gamification, as it might not serve the intended purpose without gaining an in-depth understanding of how game structures influence learning. Creating effective and appealing gameful learning experiences, therefore, requires designers and educators to engage with the various design factors that make the games worth playing as well as achieve the intended learning outcomes. Different authors have used different terminology to describe such factors that educators can make use of while designing gameful experiences. For the purpose of this study, I use the term 'gameful design features' and 'game characteristics' interchangeably to mean characteristics or features of a gameful design

which when taken into account can enhance the design and improve learner motivation.

Deterding (2013) records visible progress, clear short- and long-term goals, player choice and autonomy, freedom to fail, competition and cooperation as "common features" that make games or gamified lessons engage students more than traditional presentation-style lessons or training sessions. Werbach & Hunter (2012, pp. 78-80) use "dynamics", "mechanics" and "components" as relevant aspects of game design. Dynamics are largely the abstract, big-picture features, for example the **narrative** of the game or **emotions** it aims to generate in the user. Mechanics are the "basic processes that drive the action forward and generate player engagement" (p. 79), some examples of which are **challenges, chance, competition, cooperation, feedback, resource acquisition and rewards**. Components are the "specific instantiations of mechanics or dynamics (p. 80)," like **achievements, avatars, badges, leaderboards, levels, points** etc. Bharathi, Singh, Tucker & Nembhard (2016) identify certain common "game design features" across successful task-based gamified applications — the ones that could sustain user-engagement over long periods of time. Out of 24 features identified through literature, they found **points, avatars, challenges, virtual goods, competition, boss fights, teams and leaderboards** to be a few (among others) that increased the probability of a game to be successful (Bharathi et al., p. 369). However, they concluded that no single game design feature alone is enough to predict effectiveness of a game or engagement of people in the game (p. 367).

Klaudia and Bastiaens (2020, p. 4) describe game mechanics as the "backbone of gamification that may help learners to achieve task performance". Kapp (2014) highlights the role of game mechanics in online learning in order to create relevant game content to foster learning. Marczewski (2015) suggests multiple lists of various factors that make a game design more desirable. He classified them as "general", "schedule" and based on user types (Marczewski, 2015, pp. 240-245). General game design elements can be used to support anyone. Schedule elements are time specific. In addition, he lists 36 game elements that can be used to support different user types, 6 elements supporting each Hexad user type. Table 1 lists Marczweski's game elements mapped to different user types.

Table 1

Game element preferences for each user type (adapted Marczewski, 2015, pp. 246-259)

User Type	Related game elements
Socializer	Teams , social network, social status, social pressure, social discovery, competition
Achiever	Challenges, certificates, learning, quests, progression, boss battles
Philanthropist	Meaning, care taking, access, care-taking, gifting, sharing knowledge
Free spirit	Exploration, branching choices, easter eggs, creativity tools, rare content, customization
Player	Points, rewards, leaderboards, badges, virtual economy, game of chance
Disruptor	Innovation platform, voice, anonymity, developmental tools, light/flexible rules, anarchy

Marczweski (2015), however, clarifies that this is not a comprehensive list and there are and can be many more elements to effective gameful designs. Points, badges and leaderboards (PBL; Werbach & Hunter, 2012) are the most commonly used game elements, however, according to Reiners & Wood (2014), more diverse and personalized game elements need to be incorporated in game designs to make them more engaging and meaningful for the learners.

1.5   Research Tasks and Research Questions

Considering the absence of research and valid studies on personalization of gameful designs in teacher education as well as limited research on experiences and opinions of student teachers with gameful contexts, this research study was conducted as a part of the ADeAPTIVE (Advanced Design of e-Learning Applications Personalizing Teaching to Improve Virtual Education) project at the University of Jyväskylä which aims to implement innovative learning systems for students and teachers across Europe.

This research draws on the Hexad framework— a player-type framework for gamification design (Tondello et al., 2016) and follows after Nousiainen et al. (2020)'s research on gamifying student teachers' learning platforms which found out, in a study with 76 higher education students in education, that the student teachers slightly preferred the gamified version of the online platform over the non-gamified one (p. 4).

The aim of this study is to detect the predominant user types, identify and categorise the preferred game design features and find connections between the two amongst student teachers. The research questions this study will try to answer are:

1. **What are the predominant user types of gameful designs amongst student teachers?**
2. **What factors/features of gameful designs make the gaming experience more appealing for student teachers?**

2   RESEARCH METHODS

2.1   Research Context and Participants

This study analyses and presents results from two different pilots involving a total of 130 teacher education students at the University of Jyväskylä, with 76 first year bachelor level students in pilot 1 and 54 master's degree students in pilot 2. The ADeAPTIVE[1] team carried out both pilots with teacher education students at University of Jyväskylä in the context of a university course.

First pilot was carried out between October and December, 2019 as a part of a course on Information and Communication Technology (ICT). ICT is a compulsory university course for bachelor's students in education with the purpose of familiarizing students with ICT tools at the university and efficient and ethical use of ICT in education. For participant groups in first as well as second pilots, this course was designed with a blended learning method that included both face-to-face sessions and tasks that students were expected to complete on an online platform, Moodle 3.6. The overall structure of the course consisted of ten demo sessions with different topics of focus for each session (eg., using Google tools, word processing, introduction to programming, basics of information security, copyrights). Each demo session included a teacher presentation, practice and an online student task.

The course instructor in collaboration with the ADeAPTIVE team modified the Moodle platform during the second half of the course, introducing gamification elements using tools available on Moodle. The team used three main game elements:

1. **A narrative** whose theme also reflected in the visual appearance of the platform to encourage immersion
2. **A digita**l **avatar** that progressed from one level to next as the student progressed in their tasks to encourage immersion as well as visualize progress

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[1] Advanced Design of e-Learning Applications Personalizing Teaching to Improve Virtual Education (https://www.adeaptive.com/)

3. **An award of badges** when a student completed a non-compulsory task to meet the preferences of achievement-oriented user types

The second pilot was carried out in spring 2020, and the context was very similar to that of the previous pilot. The pilot course, *Information and Communication Technology and Acquiring Information 2*, was intended for student teachers who are in the master's stage in their studies. The course aimed to deepen the students' ICT competencies through addressing the use of ICT from the perspective of curricular goals, familiarising the students with children's media environment, deepening their knowledge regarding ethics and copyright issues, and introducing novel digital applications for teaching. As in the first pilot course, Moodle was used as the learning platform. However, in this pilot, the course was gamified from the beginning with similar game elements as in the first pilot: i) narrative, ii) avatar development, and iii) badges. Furthermore, the students were provided some more opportunities for collaboration and teamwork building on the results of the first pilot.

Participant demographics

Information on gender, age and prior experience with digital games of the participants was collected in order to understand the demographics and gaming background of the participants. Data on gender, age and frequency of playing digital games is shown in tables 2, 3 and 4 respectively.

Table 2

Gender-wise distribution of the participants

Gender	Number of participants	Percentage
Female	109	83.3%
Male	19	14.6%
No information	2	1.5%
Total	**130**	**100%**

Table 3

Age-wise distribution of the participants

Age range	Number of participants	Percentage
<20	13	10%
20-24	92	70.8%
25-30	17	13.8%
>30	8	6.1%
Total	**130**	**100%**

Table 4

Distribution of frequency of playing digital games amongst the participants

Frequency	Number of participants	Percentage
Daily/almost daily	21	16.2%
Weekly	26	20.0%
Monthly	36	27.7%
Few times a year	35	26.9%
Never/almost never	12	9.2%
Total	**130**	**100%**

The distribution of gender and age show clear majority of females (83.3%) and participants who belong to the age group 20-24 (70.8%). However, the frequency of playing digital games is more equally distributed among the participants without a clear majority in any of the frequencies, most participants playing weekly (20.0%), monthly (27.7%) or a few times in a year (26.9%).

2.2 Data Collection

This research uses a mixed method to collect data. Although mixing qualitative and quantitative methods has been criticized with various arguments, one of which is that both take very different epistemological and ontological grounds

so mixing the two would mean ignoring the ontological and epistemological assumptions underlying research methods. Bryman (2008) counters this argument by emphasizing that the idea of methods having fixed ontological and epistemological implications is already not a sustainable one as "they are capable of being put to a wide variety of tasks (Bryman, 2008). Moreover, mixing quantitative with qualitative designs increases the "scope, density, detail and even validity" of the research (Morse & Maddox, 2014).

In the first pilot, the ADeAPTIVE team collected data with two online questionnaires, an initial questionnaire before the students participated in the course and the final questionnaire at the end of the course. This kind of data collection method was chosen taking into account the considerably large sample size as well as better data quality in online questionnaires as compared to paper questionnaires (Newby, 2014). The original questionnaires were in English to which the participants could respond either in English or Finnish. All the Finnish responses were translated into English first using a translation software and then checked by my supervisor who is a Finnish native speaker with background in gamification research. This study only uses data from the **first initial questionnaire** which collected information about age, gender, frequency of playing digital games, familiarity with online learning platforms, expectations from an online learning platform, participants' preferences of fun game features as well as motivation factors in study assignments/activities. Although access was granted to the entire data corpus, a decision was made to not use data from all the questions in the first questionnaire, keeping in mind the practicalities and limited duration of the study. Components of data analysed for this study are presented below:

i)   Responses to the questions on demographic information (name, age, gender and frequency of playing digital games) of the participants (question 1-4, appendix 1)

Demographic information of the participants was considered important to relate the findings to any peculiarities relating to age, gender or background in gaming.

ii)   an instrument to identify the different user types, based on the Hexad user type framework (Marczewski, 2015), amongst the participants

Question 7, the user-type identification instrument, consisted of 24 statements (4 statements per user type) to which the participants answer on a seven-point Likert scale, ranging from 'strongly agree' to 'strongly disagree'. Each participant, then, could score anywhere between 4 to 28 for each of the user types. This score provides information about the user type that can *most likely* be assigned to a participant, which was used to find the answer to RQ1

iii)   An open-ended question on students' perception of "fun factors in a game" (for more details, see appendix 1).

Question 8 of the initial survey asked an unstructured, open ended question ("What, in your opinion, makes a game fun?") which was used to answer RQ 2. Since an open-ended question does not pre-impose a specific framework for participant responses (Newby, 2014), it was chosen to get a richer picture of their opinions.

The final questionnaire collected data about participants' experience of the gamified platform which is not relevant in the context of this study. In the second pilot, data collection followed the same overall procedure as the first. The initial survey (including the user type scale) was identical to that of the previous pilot.

2.3   Data Analysis

I did a statistical analysis using SPSS 27 to identify predominant user types (research question 1) and quantitative content analysis to code data from the open ended questions about preferred game design elements of the participants. A count of the number of instances in each code provided information about the most and least preferred design elements (RQ 2). Before giving a detailed description methods, I will briefly present the researcher's background and epistemological beliefs.

Despite the use of content analysis as a method to analyse responses to the open-ended question on game features preferences, the overall approach to data analysis in this study is predominantly quantitative. Even though qualitative and quantitative content analyses share many similarities in the way responses are coded and themes/subthemes are assigned (Schreier & Flick, 2013), the method used in this study is focussed on describing trends in the frequency of usage rather than an in-depth analysis of meaning or intention of the participants , hence, I prefer to call it *quantitative* content analysis (see section 2.3.3 for details).

2.3.1   Researcher's ontological and epistemological assumptions

This research is focused on technologies, hybrids, the digital, in that it attempts to make relevant connections between technology and human behaviour as well as motivation. The ontological assumption in this research relates to the assumption that the social world consists of people with differing perceptions, ideas and attitudes that make up different personality types which are limited. And the research also assumes that most human beings fit into one or more of these types which suggests the existence of one reality, but with non-static nature, as these user types based on personality types can change with context and time (Tondello et al., 2016). I also do not expect all the participants to belong exclusively to one user type, i.e., they might have traits that suggest differing personality types to differing extents. My research indicates a structural realist perspective embedded in the existence of a non-static reality which changes as humans' capacity to describe and understand it changes.

From an epistemological angle, this study has elements of phenomenology since I am interested in the participants' experiences and perceptions that I will interpret based on a pre-existing framework that emerged from previous research. It also has components of psychosocial research as data collection methods include questions about the participants' perceptions of themselves and factors that motivate them to learn. Since the whole purpose of this research is to make learning platforms more accessible, effective and useful, I can say that the knowledge that I'm trying to gather through this study is significant as it serves human purpose and hence the research is pragmatically inclined.

2.3.2   Statistical analysis

All data was transferred to an SPSS file using SPSS 27. The total score of a participant was calculated out of 28 (4 questions corresponded to each user type and each question was answered on a scale of 1-7) for each user type. For one user type, a participant could score anywhere between 4 and 28, 1 being the minimum they could answer for a question and 7 being the maximum. Two kinds of results were deduced from these scores: prime user types of the participants as well as the predominant user type/s amongst all participants. The prime user types were calculated by looking at the user type where a participant scored the highest. The mean of sums of scores of all participants for a particular user type were also calculated. I used these mean scores to report the predominant user types.

Even though the student teacher population in Finland can be considered fairly homogenous, the difference in demography also shows heterogeneity to a large extent. An attempt was made to enrich findings from RQ1 by connecting the demographic aspects of the sample population to their prime user types, so the heterogeneity within the sample is taken into consideration. Since the sum variables for user types are not normally distributed, a Mann-Whitney U-Test was conducted to find out correlations between prime user types and gender. Only the correlations where $p < 0.05$ were considered statistically significant (Bryman, 2012). The effect sizes were also calculated for statistically significant correlations and were then placed according to Cohen's criteria for effect sizes (Patel, Yada & Yada, 2020).

2.3.3   Content Analysis

I used quantitative c**ontent analysis to analyse the responses to open ended questions** in the two pilots. **Content analysis** is a way to effectively make sense of qualitative data by generating a coding frame and dividing subsequent parts of the data into meaningful categories within the frame (Hsieh & Shannon, 2005). It helps reduce the data and focus on aspects related to the research questions (Schreier & Flick, 2013), in this case the *game features.* Content analysis also gives a researcher the flexibility to present the results in a number of ways and at the

same time the ability to produce robust findings (Elo et al., 2014). Even though Schreier and Flick (2013) note many similarities between qualitative and quantitative content analyses in the iterative coding process, they also recognize the differences, mostly in the way the results are reported. The results of qualitative content analysis are mostly reported in a narrative format and may or may not be supplemented by coding frequencies. Conversely, equating the importance of the themes to the frequency of an utterance through counting the number of instances is an essential feature of *quantitative* content analysis. The focus of this research study is on description of patterns or trends in the frequency of usage of certain words or phrases relating to game features rather than bringing out the depth in the meaning and intention of participants in their responses. For this reason along with other benefits of content analysis listed above, a choice was made to use quantitative content analysis (Roessger, 2017).

I used an iterative approach to content analyse and code the questionnaire responses which involved the following steps:

1. Reading and re-reading participants' responses to the question "What, in your opinion, makes a game fun?" multiple times
2. Pilot phase of analysis (or primary cycle coding) leading to development of a coding frame: This was done using only the first 30 responses from each group (a total of 60 responses) to avoid "cognitive overload" (Schreier & Flick, 2013). I primarily used data-driven codes during this phase of analysis, picking any words or phrases that related to features of gaming.
3. Description of codes with brief definitions or examples wherever the codes were not self-explanatory
4. Use of a "constant comparative method" where the rest of the data set was compared to fit the codes in the coding frame. Some codes were modified, some were deleted and new codes were created when the data did not fit the existing coding frame. As a result of clubbing, modifying, deleting and breaking down of codes, 40 subthemes that referred to various game features were identified.

5. Reference to literature on "game elements", "game features" or "game characteristics" in a gamification context based on the data and identified subthemes

6. Main phase of analysis (or secondary cycle coding) where the broader themes or main categories were created by clubbing some of the sub-themes together. This time the themes or main categories were concept-driven rather than data-driven. A total of 19 themes were identified in this phase of analysis.

7. Second round of coding after 23 days of main phase analysis to ensure consistency: 97.4 % similarity was achieved to the previous coding cycle.

8. Review by thesis supervisors: Two supervisors with expertise in gamification research reviewed the themes as well subthemes along with the codes from participant responses. The overall coding scheme was approved and finalized after a few minor modifications in the way the categories were named.

Mutual exclusivity of the subthemes within a theme was ensured, i.e., a single utterance or unit of analysis (multiple utterances within a single participant response were identified, making a total of 321 utterances) was not categorised in more than one subtheme under the same theme. Nevertheless, some of the utterances indicated a preference that could be categorised under more than one theme. For example, the utterance "I like games that are progressively challenging" (P87) indicated that the participant preferred games that offer a suitable challenge or level of difficulty in addition to the requirement that the challenge should *progress* as the game progresses. Hence, this kind of an utterance was placed under two different subthemes- "challenge" as well as "progress". However, it is to be noted that these two subthemes were not listed under the same theme but two different themes, namely "suitable degree of difficulty" and "achievement" respectively. I also revisited the research questions as well as the rationale of the study throughout the coding process to ensure they were still relevant as the issues I wanted to focus on despite new issues emerging out of the data.

The approach to content analysis in this case was **inductive content analysis** as I did not start with any reference analysis matrix. I acknowledge that the analysis and coding are driven by the researcher's theoretical and analytical interests (Braun & Clarke, 2008). Another reason to use content analysis for questionnaire responses to open ended questions is to explore relationships of categories that emerged from the questionnaire with existing studies on gameful designs.

2.4   Ethical Considerations

Since the participants of the pilot 2 phase of the research were first year master's students studying education related subjects at the University of Jyväskylä, I possibly was acquainted with some of the participants personally as we might have taken a few courses together. Hence, the first ethical question that comes to mind would be about the true anonymity of the participants. Boman & Jevne (2000) doubt the true existence of anonymity in qualitative research since most researchers choose sites close to their institutions and this also stands true in my case. With the survey and quantitative part, it was comparatively easier to maintain privacy and anonymity as the data was pseudonymised by the time I received it. The second ethical issue I would need to consider is about bias during analysing the findings. As Lewis & Graham (2007) rightly point out, it is important to report the results in an unbiased and accurate manner which can be even harder when you already know some of the participants. To minimize biases while interpreting the findings, I had both supervisors review the analysis and point out to any biases or assumptions.

I also had to be careful about the privacy of data collected by the ADeAPTIVE team, its sharing and discussion of my notions as a researcher as there are very blurry boundaries between a casual discussion with a friend and an ethical violation of privacy.

I kept in mind the ethical requirements stated by Lewis & Graham (2007) to be considered before, during and after the data collection. For example, the participants should know why they are selected and what to expect; making them

feel comfortable and maintaining their right to privacy and confidentiality in storage, access and reporting of data and results (Boman & Jevne, 2000). Permission was taken from every single participant about the sharing of their data as well as to use it for research and open-access publication purposes.

3 RESULTS

This section presents the results of the study in line with the research questions. It starts with a representation of student teachers' most dominant user types and more commonly present prime user types (3.1), followed by a discussion on the game design features preferred by them (3.2).

3.1 Predominant User types

This section presents findings for overall predominant user types in the whole group of participants as well as gender wise distribution of user types within the sample population.

3.1.1 Overall predominance of user types

Table 5 represents the mean scores of each user type (minimum=4, maximum=28) as marked by the participants from both pilot 1 and pilot 2, along with their standard deviations. Due to missing data, the total number of participants are different for every user type—between 126 and 130. The mean score of each user type indicates the degree or extent to which the participants express aspects of that particular user type as gamers. The high scores for Philanthropist and Socialiser user types are comparable followed by Free spirit, Achiever and Player user types respectively. Disruptor type scored significantly lower than all other user types.

Table 5

Predominant User types amongst student teachers

User Type	Mean Score (min=4, max=28)	SD
Philanthropist (N=129)	24.4	2.11
Socializer (N=130)	24.3	3.03
Free Spirit (N=129)	22.2	2.9
Achiever (N=130)	21.2	3.01
Player (N=129)	20.8	2.78
Disruptor (N=126)	13.6	3.36

I also determined the prime user types for each participant, i.e., the type in which a participant achieved the highest score. When the prime user types of all participants were examined, the results were more distinguishable, as represented in figure 2. Some participants had more than one prime user type (see footnote of figure 2), i.e., their scores were identical for two or more user types, hence, the prime user types of participants represented here are not mutually exclusive. The most common user types as prime user types among student teachers were found to be Socializer and Philanthropist, whereas Free spirit, Achiever and Player being less common user types. Disruptor user type was not present as the prime user type for any of the participants.

Figure 2

Prime user type groupings* amongst student teachers
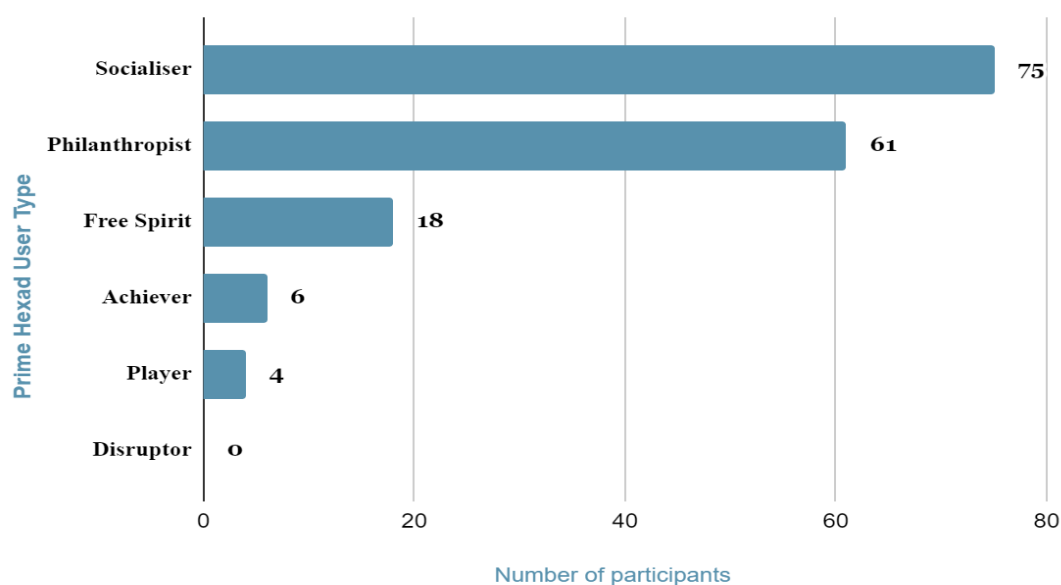
*The total number of participants in the figure is not equal to 130 as there were participants with more than one prime user type: 25/130 participants had two prime user types, 2/130 participants had three different prime user types and 3/130 participants had four different prime user types

3.1.2 Gender wise distribution of user types

Since the sum variables of user types were not normally distributed, a Mann-Whitney U-test was carried out to test the difference between the predominant user types between males and females (Knapp, 2018). The test indicated that player, achiever and disruptor user types were statistically more predominant in males than in females (see table 6 below), whereas there was no statistically significant difference found between males and females in the predominance of user types socializer, philanthropist and free spirit. Effect sizes were only calculated for gender differences in the user types where the results were statistically significant (p<0.05). Using Cohen's criteria[2] (Howell, 2012; Patel, Yada & Yada, 2020), I found a small to medium effect size for all three user types where the differences between genders were statistically significant, i.e., achiever, player

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[2] For Cohen's (1988) criteria,

0.1: small effect

0.3: medium effect

0.5: large effect

and disruptor user types. The researcher considered only two genders in this analysis, i.e., male and female, since the number of responses for other genders were not significant enough to draw any useful conclusions.

Table 6

Mann-Whitney U-test to compare predominance of user types between genders

User Type	Median (M)		Z	Effect size (r)	p value
	Male* (N=19)	**Female* (N=109)**			
Philanthropist	24.00	25.00	-.270	-	.164
Socializer	26.00	24.00	-1.213	-	.787
Free Spirit	21.00	22.00	-1.392	-	.225
Achiever	**23.00**	**21.00**	-2.428	**0.215**	**.015**
Player	**22.00**	**20.00**	-2.584	**0.229**	**.010**
Disruptor	**16.00**	**13.00**	-3.320	**0.294**	**.001**

* Only two genders in this analysis, i.e., male and female, since the number of responses for other genders were not significant enough to draw any useful conclusions.

These results are to be interpreted carefully since a larger representation of male population (if a greater number of males had participated in the course and subsequently the research study) might have produced different results. Since there are other factors at play when calculating these differences in predominance of user types by gender, such as age, frequency of playing digital games, the conclusions drawn here might have hidden factors at play that were not controlled while calculating these results.

3.2   Preferred Game Features

A total of 128 participants answered the question about factors or features that make a game fun for them. A single answer was considered to have multiple utterances or units of analysis, i.e., an answer by one participant brought out multiple preferred fun factors, making a total of 321 utterances. These 321 utterances (see appendix 2) were coded into 40 subthemes (data-driven) which, in-turn, were clubbed under 19 themes (data as well as concept-driven). Table 7 lists

the game characteristics' themes and subthemes with their frequencies of occurrence in the responses.

Table 7

Student teachers' preferences of characteristics in a game that make it fun (n=128)

	Themes	NoI-T	NoP (%)	Subthemes	NoI-ST
1	Achievement	76	60 (46.2%)	1.1 Progression	25
				1.2 Rewards	17
				1.3 Goal achievement	13
				1.4 Succeeding opportunity	11
				1.5 Learning and development	10
2	Challenge	50	48 (37.5%)	2.1 Suitable challenge/difficulty	36
				2.2 Use of strategy/thinking skill	11
				2.3 Problem solution	3
3	Game story	25	19 (14.8%)	3.1 Good plot	11
				3.2 Story base	10
				3.3 Good characters	4
4	Audio-visuals	24	23 (18.0 %)	4.1 Looks	23
				4.2 Background music	1
5	Social dimension	23	20 (15.6 %)	5.1 Team play	19
				5.2 Social interaction	4
6	Competition	18	18 (14.1 %)	6.1 Competition	18
7	Entertainment value	18	17 (13.3 %)	7.1 Fun & excitement	14
				7.2 Humour	4

(*Table continues*)

	Themes	NoI-T	NoP (%)	Subthemes	NoI-ST
8	Clarity	16	14 (10.9%)	8.1 Clarity of rules	6
				8.2 Clarity of objectives	4
				8.3 Clarity of idea and structure	2
				8.4 Clarity of instructions	2
9	Convenience	15	16 (12.5 %)	9.1 Ease	6
				9.2 Functionality	5
				9.3 Adaptability	4
10	Engagement	15	15 (11.7 %)	10.1 Interesting	9
				10.2 Immersive	3
				10.3 Addictive	3
11	Versatility and dynamism	15	15 (11.7 %)	11.1 Variety	8
				11.2 Change factor/novelty	6
12	Player agency	12	11 (8.6%)	12.1 Control of the game	6
				12.3 Free choice	6
13	Creativity	11	10 (7.8 %)	13.1 Creativity	11
14	Surprise Element	6	6 (4.7 %)	14.1 Surprise element	6
15	Fast pace	6	6 (4.7 %)	15.1 Fast pace	6
16	Positive game environment	5	5 (3.9 %)	16.1 Positive game environment	5

(table continues)

	Themes	NoI-T	NoP (%)	Subthemes	NoI-ST
17	Relatability	5	5 (3.9 %)	17.1 Familiarity	4
				17.2 Connection to reality	1
18	Meaning	4	4 (3.1 %)	18.1 Meaning/purpose	4
19	Smaller milestones	3	3 (2.3 %)	19.1 Smaller milestones	3

NoI-T: Number of utterances pointing to a theme. Total utterances =321.
NoI-ST: Number of utterances pointing to a subtheme. Total utterances= 321.
NoP (%): number and percentage of participants who mentioned terms/phrases related to the theme.

The categories as well as subcategories are not mutually exclusive, with certain responses suggesting multiple factors. However, all subcategories within a category are mutually exclusive, as is the requirement of content analysis. Hence, these responses were labelled under more than one category/subcategory, for example, a "variation in the degree of difficulty" indicates that the participant prefers a suitable level of challenge or difficulty but also that it keeps changing as the game progresses. This response was, therefore, listed under 'suitable challenge' as well as 'change factor'.

The results of game characteristics presented in table 7 were divided into three different subsections based on their degree of preference, shown by the number of instances a theme or subtheme occurs. Table 8 shows the cut-off criteria used to present the results in the following sub-sections.

Table 8

Cut-off criteria for high, medium and low preference of game features

S. No.	Level of preference	Cut-off criteria
1	Highly preferred game features	Broad themes with frequency>50
		Subthemes with frequency>20
2	Game features with medium preference	Themes with frequency 11-49
		Subthemes with frequency 10-20
3	Game features with low preference	Themes with frequency < 11
		Subthemes with frequency <10

3.2.1   Highly preferred game characteristics

This section consists of themes reported in more than 50 responses as well as the subthemes that contain game features reported in more than 20 responses.

I found 76 utterances related to *achievement* and 50 utterances related to *challenge,* the two forming themes with the highest number of listed instances. Most participants prefer some form of achievement and challenge for them to enjoy the game and sustain interest in it.

'*Achievement*', in this analysis, includes **achievement of goals, rewards, new skills, new levels of progression as well as small and large wins in the game**. For example, responses like "Continuing the opportunity to get ahead and win something more" (P41) or "the game in which one succeeds" (P81) point to the participants preference of success or winning opportunity in a game. A significantly high number of participants need a way to progress in the game, either through "advancement to the next level" (P124), "seeing your avatar evolving" (P25) or "increasing standards" (P117). Some participants state the desirability of progression more explicitly— "There is a lot of fun when the game gets to make progress and rise to a higher level." (P7) Preferences for achievement of rewards and goals were seen through responses such as "such a game where you can win prizes" (P127, P43) and "games having an objective/objective to be achieved" (P49) respectively. While as many as 17 participants go for rewards, a smaller number (n=10) prefer to learn new skills, as evident in the following response: "Good intuitive gameplay with [a] learning curve. That motivates. I think the

constant learning and building up my skill in action motivates me more than other rewards" (P114) (see table 7).

Challenge in the game was found to be a highly desirable factor, after achievement, including a suitable level of difficulty, challenge in the form of solving a problem or using strategic thinking skills to progress in the game. Preference of a suitable level of difficulty was indicated very similarly across responses by student teachers by often mentioning phrases like "sufficient degree of difficulty" (P9), "not too easy, not too hard" (P44), "enough but not too challenging" (P50), "sufficiently challenging" (P112) etc. I clubbed problem solving and use of strategic thinking skills under the same theme since solving problems can be considered as a challenge and using strategic thinking is a challenging task. The latter was placed after much careful consideration since it is also closely related to 'learning and development'. Some participants mentioned use of *strategy* or *thinking skills* as opposed to "pure luck" (P82) or "good luck" (P119). For instance, one participant reported, "End result depends on your actions/knowledge/skill [instead of] good luck" (P119), and others expressed an inclination towards the use of "your brain" (P52), "your thinking" (P70), "reasoning skills" (P81) and "logic" (P100).

Subthemes with the highest frequencies (>20) were found to be 'suitable challenge/difficulty', 'progression' and 'looks of the game'. 'Suitable challenge', which occurred 36 times in the responses, means that these participants want the game to be appropriately challenging, so they find it just difficult enough to engage. Progression in the game through levels and other means of visualizing progress was mentioned 25 times, forming the second most listed subtheme. The third most listed subtheme was the appearance, looks or visual design of the game indicated in as many as 23 utterances through phrases such as "colourfulness and good graphics" (P6), "beautiful landscape" (P74), "visually appealing games" (P104) etc.

3.2.2 Game characteristics with medium preference

The game characteristics with 'medium preference' refer to themes with frequencies 11-49 and the subthemes under those. These themes can be looked up in

table 7. In the rest of this section, I present some descriptions, examples and peculiarities related to these themes and subthemes.

I used the term 'game story' (n=25) for the presence of a narrative, plot or characters in a game. A respondent, in their response, indicated the desire of an intricately crafted story in the phrase "carefully planned plot with subplots" (P123). Participants also showed that their gaming experience was positively impacted by "funny" (P32), "cute" (74), "interesting" (83) and "[their] own" (110) characters in a story. The participants equally value the 'social dimension' (n=23) in games, i.e., games that have a "possibility of grouping" (P42) or "sense of community" (P118) or similar. Not all responses under the 'social dimension' category prefer teams or groups, some merely need a form of social interaction, indicated in responses like "getting acquainted with other participants" (P33) or "interactivity in the game" (P78) (see table 7).

Amongst participants who listed 'competition' (n=18), many clarified that they would only like it provided certain conditions. "Competitive games are fun if everyone else is going too hard" (P75), a participant expressed conditional preference for competition, as otherwise they prefer playing games where "the environment is easy going and you know people won't get hurt if they lose" (P75). Similar conditional preferences were seen in responses like "Competing against others is motivating also, with the provision that the game must receive the same level of players" (P55). An equal number of participants wanted their games to be "whimsical" (P76), "playful" (P34) "fun and exciting at all times" (P69), "those that make people laugh easily" (P86), indicating their inclinations towards humour, fun and excitement in the game, which was clubbed under 'entertainment value' (n=18) of the game.

Some of the lesser stated preferences, within the range mentioned at the beginning of the section, include 'clarity' (n=16) of rules, instructions, main idea and objectives in a game. The 'convenience' (n=15) of playing a game was also seen as a factor that impacted student teachers' gaming experience. Convenience factor of a game entails less complication or ease, its adaptability in varied settings including settings with limited resources and its "functionality" (P49, P60). The following answer indicated clarity, convenience and entertainment value in

a game: "A game that can be played, for example, with just one other person and does not require several players every time. [The game has] clear rules and the idea of the game is fun" (P14).

In other interesting examples, three participants asked for their games to be "addictive" (P48, P98, P112). Similarly, preferred game characteristics include the variety of elements in the game or diversity in the way of playing. A related factor of finding novelty or constant change in the game was mentioned by multiple participants. These factors are listed under 'versatility and dynamism' (n=14) in the table. Few participants pointed out the role of 'player's agency' (n=12) and 'creativity' (n=11) in the game as motivating and fun factors. "Fun game is when I can create and control the flow of the game" (P2), "games that let you explore" (P75), "a game should not be too narrow progressive and have room for creativity" (P9) are some examples of quotes from these participants.

3.2.3   Least preferred game characteristics

The least preferred characteristics were mentioned in 10 or less than 10 instances in the participants' responses — 'surprise element' (n=6), 'fast pace' (n=6), 'positive game environment' (n=5), 'relatability' (n=5), 'meaning' (n=4) and 'smaller milestones' (n=3). The game that includes "an element of surprise" (P55, P72), "unexpected turns" (P71) or a "twist to get the players interested" (P94) is worth playing, as mentioned in six instances (see table 7). Others expressed a liking for games that are "fast-paced" (P73, P78, P81) or "fast moving" (P52) and some also found relatability or familiarity of the game aspects to one's daily life or hobbies having an impact on how enjoyable they find a game, for example utterances such as "familiar theme" (P40). Games that offer "purpose" (P23), "meaningfulness" (P18) or the "ability to fulfil oneself" (P44) were found to be likeable by four participants. The theme 'sportsmanship and positive game environment' was created from responses that demonstrated a preference for an "easy-going environment" (P75) where "people don't get hurt if they lose" (P75) or which "does not make most of the time people angry" (P82). Even though not widely

mentioned, these are all worth noting as all of them were listed by multiple participants but have found limited or no place in literature so far.

4   DISCUSSION

4.1   Associations with existing studies

Having investigated the user types and preferences of specific characteristics in games amongst student teachers, this research has shed light on the potential of gamification as a part of curriculum design and implementation in teacher education programs. This section will discuss the findings outlined in the previous section and compare them to previous research in different contexts, pointing out the peculiarities in student teachers' context.

The results of predominant user types in this study are somewhat comparable to that conducted by Tondello et al. (2016) with a different sample of graduate and undergraduate students from University of Waterloo in Canada, who also found Philanthropist to be the most common user type followed by Achiever, Free Spirit, Player, Socializer and Disruptor respectively. Interestingly, the order in of predominance of user types in this study is Philanthropist, Socializer, Free Spirit, Achiever, Player and Disruptor. The comparatively higher prevalence of the Socializer user type amongst student teachers in this study as compared to a mixed group of university students in Tondello et al.'s (2016) research is worth noting here. Moreover, much lower scores for the Disruptor user type plus the complete absence of the disruptor user type as the prime user type amongst student teachers (as compared to 1 percent in Tondello et al.'s, 2016, study) point to the student teachers' general inclination towards socialization as well as a respect for rules and structures (the opposite of Disruptor user type characteristics). A significantly lesser proportion of the sample was found to have Achiever and Player as their prime user types as compared to 24 percent and 10 percent in Tondello et al.'s (2016) study, indicating that student teachers are motivated by purpose and relatability more than by competence and rewards (Marckzewski, 2015). Identification of these preferred motivation factors amongst student teachers can have significant implications for learning and instructional design within in-service teacher education. Looking at these results, the study also brings out the need of further research on exploring the potential

of gamification focusing on Socializer and Philanthropist user types as well as investigating purpose and relatability as motivation factors in learning for in course designs for student teachers.

Building on Özdener's (2018) suggestion of changing the gamification design to make it more collaborative and/or personalized, the results of game characteristic preferences by student teachers from this study can be used to include elements of challenge, achievement, game narrative and audio-visuals to improve gamification designs for student teachers. To elaborate more, maintaining an appropriate level of difficulty through the game alongside making the progression of the player in the game visible can increase the chances of a successful gamification as well as learning experience of student teachers, provided the game is designed with a focus on learning objectives rather than game features (Grey et al., 2017). These two highly rated game characteristics, when combined with desirable audio-visuals, game story and socialization in the game have a potential to increase learner engagement, as seen in the preferences brought out in this study.

All game characteristics that emerged in this study are in accord with Deterding's (2013) findings of visible progress, clear short- and long-term goals, player choice and autonomy, freedom to fail, competition and cooperation as game features that have shown to improve the achievement of learning outcomes. Bharati et al. (2016) found points, avatars, challenges, virtual goods, competition, boss fights, teams and leader boards to be a few (among others) that increased the probability of a game to be successful (Bharathi et al., p. 369). The results of this study are comparable with Deterding's (2013) and Bharati et al.'s (2016) findings with differing terminology across studies but similar indication towards the potential of certain game elements, features or characteristics to enhance learner experience when included. Table 9 compares these findings to the results from this study.

Table 9

Comparison of desirable game characteristics from previous studies to this study (compare to table 7)

Preferred game characteristics from this study	Similar corresponding game element/s from previous studies
Progression (subtheme 1.1)	Visible progress (Deterding, 2013) Leaderboards, levels (Werbach & Hunter, 2012; Bharathi et al., 2016) Progression (Marczewski, 2015)
Challenge (theme 2)	Challenges (Werbach & Hunter, 2012; Bharathi et al., 2016; Marczewski, 2015)
Goal Orientation (subtheme 1.3) Clarity of objectives (subtheme 8.2)	Clear short- and long-term goals (Deterding, 2013)
Player agency (theme 12)	Player choice and autonomy, freedom to fail (Deterding, 2013) Exploration, customization (Marczewski, 2015)
Competition (theme 6)	Competition (Deterding, 2013; Werbach & Hunter, 2012; Bharathi et al., 2016)
Social dimension (theme 5)	Cooperation (Deterding et al., 2013) Teams (Bharathi et al., 2016) Teams, Social network, social discovery, social status (Marczewski, 2015)
Rewards (subtheme 1.2)	Resource acquisition, rewards, badges, points (Werbach & Hunter, 2012) Points, avatars, virtual goods (Bharathi et al., 2016) Points, rewards, badges, certificates (Marczweski, 2015)

In addition the familiar game features, this study also brought out new features that have not been discussed in previous studies related to gamification and characteristics of gameful designs. The new features of gameful design brought out in this study are:

Audio-visuals — include the looks, graphics, sounds and background music

Convenience — ease of playing and handling the functions in a game

Versatility and dynamism — requires that the game has a variety of components that the player and explore and that game components keep changing instead of staying static for the duration of the play

Fast pace — need that the game moves fast

Positive game environment — game environment where participants do not experience emotions like sadness, embarrassment or anger

Smaller milestones — milestones that appear small and easy to achieve and not too far-fetched

Amongst these, 'audio-visuals' has a high preference, 'convenience' and 'versatility and dynamism' both have medium preferences, and 'fast pace', 'positive game environment' and 'smaller milestones' have a low preference in this study. It is important to note that no single game design feature alone is enough to predict effectiveness of a game or engagement of people in the game. Hence, a combination of these game characteristics should be incorporated in a gaming experience for student teachers in order to maximize engagement and learning.

4.2   Demographic influences

In order to design effective learning experiences for student teachers through gamification, mere acknowledging of the predominant user types and their preferences would not suffice, since existing research has shown a clear difference in the way people of different genders and ages prefer game-playing. It is worth noting that a majority of participants in this study are females (83.3% females)

which might be a factor influencing the predominant user type/s of the group. Most game designs acknowledge the differences in gender, and some are even targeted for a particular gender (Reijmersdal et al., 2013). A few research studies focusing on the relationships between game characteristics and traits of the users have also considered the influence of gender. For example, in a study on undergraduate university students, Reijmersdal et al. (2013) found that women enjoy badges more than men and also found a negative correlation between the perceived playfulness of men and their enjoyment of progress bars. In another interesting study conducted by Toda et al. (2019), they found that men consider competition, collaboration and social pressure more relevant in games than women.

Tondello et al. (2019) investigated into the distribution of user types by gender through two different studies that used different data collection techniques. Their findings appear to somewhat correspond to those of Reijmersdal et al. (2013) and Toda et al. (2019) in that women scored statistically higher on socializing, philanthropy and achievement in one study and on philanthropy, socialization and autonomy in the second study. However, this study presents contrary findings in that the user type Achiever (motivated by progress) as well as Player (motivated by rewards) are both predominating among males than females (table 6). Like already mentioned, these results are to be read with caution because of a skewed female to male ratio amongst the participants of the study. As can be seen from table 6, men scored significantly high on disruption (difference of 3 in the median scores when the total score is 28) in this study which is a finding very much in line with Tondello et al.'s finding on disruption scores of men which were found to be significantly higher than of women in both their studies.

In Hamari and Koivisto's (2014) research on "demographic differences in perceived benefits from gamification", they revealed that women perceive the social aspects of games more positively than men, who value the social communities formed in the process of gaming less than women. They also draw attention to the reducing ease of use of games with increasing age. Although these findings do not directly relate with the findings of this study, it is to be kept in mind that the distinctly skewed male to female ratio (1:5.7) of the participants in this study could have majorly influenced the overall findings.

4.3   Game elements and learning outcomes

A major challenge with identifying game attributes that impact specific learning outcomes, identified by Bedwell et al. (2012), is that changing a game attribute in a controlled experimental design is not easily possible without altering other attributes at the same time. This paradox makes it complicated to assess the effects of including the game characteristics on learning outcomes of the target group, hence, it was considered beyond the scope of this study. However, Bedwell et al. (2012) created a taxonomy of game design features that can be independently manipulated. These attributes included assessment or feedback given to the player at various levels of play, conflict/challenge, control, game fiction, game environment, human interaction and immersion. Bedwell et al.'s (2012) claim is further supported by Sailer and Homner (2020) who, in their meta-analysis, presented social interaction and game fiction as significantly influencing the impact of gamification on behavioral learning outcomes. In addition, they found that collaborative competition also moderately impacted the effect on motivational learning outcomes. From the definitions of the attributes presented in Bedwell et al. (2012), they can be said to be related to 'progress', 'suitable challenge', 'player agency', 'game story', 'audio-visuals', 'social dimension' and 'engagement' from this study respectively. Hence, an implication for further study could be to identify the connections of these game elements to learning outcomes, advancing on Bedwell et al.'s (2012) recommendations on isolating these attributes in order for other attributes to not interfere with measurement of a change in related learning outcomes.

4.4   Limitations of the study

Since gamification is a comparatively recent concept, the availability of literature is limited, especially in the context of teacher education. Hence, it was a challenge to find reliable similar studies and theory related to game characteristics as well as user types. The study might be seen to have a gender bias since a majority of participants were females. However, considering that most students who study

to be teachers have been found to be females all over the world (Johnston, McKeown & McEwen, 1999; King, 1993; Frey & Gore, 2018;), the participants' sample in this study could be considered somewhat representative of the student teacher population. Apart from the limited time that was available to carry out the analysis and writing, this study is limited in the way game elements are presented without a connection to how they can impact the learning behaviors, motivation or outcomes of student teachers. Related challenges were posed by the wording of the questions in the questionnaire that did not make any direct connections to learning. Further research can focus on how the game features identified in this study relate to such learning attributes as there is still a major dearth of literature on this connection.

Even though the likelihood of precision increases with increased sample size in quantitative research (Bryman, 2012), keeping time, cost and feasibility constraints in mind, the sample size was limited at 130 participants. Moreover, convenience sampling has been criticized for making is less possible to generalize findings (Bryman, 2012). The sample of participants in this research is representative of both Finnish as well as English speaking students, master as well as bachelor level students, and the type of sampling and sample size used in this research serves the purpose of the study well since the study was based on creating an experience of gamification for the students in order for them to fill the questionnaires. A larger or random sample here would not have been possible since the research design required participants to be a part of the ICT in education course. The focus of the research being on teacher students also limits the heterogeneity of the larger population in focus and hence reduces the need for a larger sample (Bryman, 2012). The overall methodology used in the research might not have revealed findings generalizable to a larger general population, but they do provide avenues and direction for further research and forge strong connections with existing findings in the field.

4.5   Conclusive comments

This research study aimed to find pre-dominant user types as well as preferred game features amongst student teachers within the context of gamification of learning. The study's findings indicated that most student teachers' predominant as well as prime user types were 'philanthropist' and 'socializer' and their most preferred game features fell under the themes of 'achievement' and 'challenge'. In addition, there was a significantly high focus on suitability in the level of difficulty, progress and development in the game as well as the aesthetics or looks of the game. Looking at these results, the study brings out the need of further research on exploring the potential of gamification focusing on socializer and philanthropist user types as well as investigating purpose and relatability as motivation factors in learning when considering course designs for student teachers. I also recommend focusing on making the gamified learning platforms suitably challenging, containing visible progress, having appealing visual designs and intricate game stories for student teachers. Since no single game design feature alone is enough to predict effectiveness of a gamified lesson, a combination of these game characteristics should be incorporated in a gaming experience for student teachers in order to maximize engagement and learning. This research also opens up the possibility of a follow up study where the learning platform would be modified using the results of this study to assess any changes in the achievement of desired learning outcomes, strengthening the connection of gamification to learning. Furthermore, the preferences brought out in this study could also be taken in to account in designing learning tasks for students even if they are not gamified as such. In the end, I would like to remind that addition of these game elements to a learning activity, lesson, course or program that is being gamified only supports to the content to achieve the desired learning outcomes, and hence should not become outcomes in themselves.

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APPENDICES

Appendix 1 Initial questionnaire

ADeAPTIVE Pilot Survey

During this course, you are using a Moodle environment with some game-like elements. The game elements are part of a pilot related to an Erasmus+ project called ADeAPTIVE, aiming to explore what kinds of gamification elements work in different course contexts and for different users. For this purpose, we kindly ask you to answer this brief survey.

Background questions

1. Name

Names will only be used to link participants' survey responses to their respective Moodle usage data. Immediately after this, names will be replaced with anonymous identifier codes.

First name _____

Last name _____

2. Age

○ under 20
○ 20-24
○ 25-29
○ 30 or over

3. Gender

○ Female
○ Male
○ Other
○ Don't want to tell

4. How often do you play digital or non-digital games?

○ Never or almost never
○ A few times a year
○ Monthly
○ Weekly
○ Daily or almost daily

5. Before this course, how familiar were you with online learning platforms (such as Moodle, Peda.net etc.)?

○ I had never used them.
○ I had tried one but never studied a whole course using any of them.
○ I had studied one or two courses using an online platform.
○ I had studied several courses using an online platform.

6. What were your expectations regarding studying on an online platform?

○ Very negative
○ Somewhat negative
○ Neither negative nor positive
○ Somewhat positive
○ Very positive

Player types and motivation

7. Please indicate to what degree the following statements apply to you.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
7.1 If the reward is sufficient I will put in the effort.	○	○	○	○	○	○	○
7.2 I like mastering difficult tasks.	○	○	○	○	○	○	○
7.3 I like overcoming obstacles.	○	○	○	○	○	○	○
7.4 Return of investment is important to me.	○	○	○	○	○	○	○
7.5 It makes me happy if I am able to help others.	○	○	○	○	○	○	○
7.6 I enjoy emerging victorious out of difficult circumstances.	○	○	○	○	○	○	○
7.7 I like being part of a team.	○	○	○	○	○	○	○
7.8 I often let my curiosity guide me.	○	○	○	○	○	○	○
7.9 I enjoy group activities.	○	○	○	○	○	○	○
7.10 I like to provoke.	○	○	○	○	○	○	○
7.11 It is important to me to continuously improve my skills.	○	○	○	○	○	○	○
7.12 It is important to me to feel like I am part of a community.	○	○	○	○	○	○	○
7.13 I like competitions where a prize can be won.	○	○	○	○	○	○	○
7.14 I like helping others to orient themselves in new situations.	○	○	○	○	○	○	○
7.15 Interacting with others is important to me.	○	○	○	○	○	○	○
7.16 It is important to me to follow my own path.	○	○	○	○	○	○	○
7.17 The well-being of others	○	○	○	○	○	○	○

8. What, in your opinion, makes a game fun? Please describe briefly in Finnish or in English.

9. In your studies, what kinds of assignments/tasks/exercises motivate you the most? Please describe briefly in Finnish or in English.

Thank you for your responses!

Appendix 2 Game Characteristics Categories and Subcategories with utterances from the data

1. Versatility and dynamism	**1.1 Variety** multiple possible endings/can be played in different ways (P1) diverse tasks (P5) variety of elements (P7) versatility (P19) Versatility (P46) Versatility (P73) Variety of tasks (P87) sufficiently diverse (P104) **1.2 Change factor/novelty** different activity and dynamism to the brain (P21) New and different things (P44) Change of story (P74) Enough changing factors (P91) Variation in the degree of difficulty (P121) Strategic variation (P130)
2. Player agency	**2.1 Abillity to drive the game/control** create and control the flow of the game (P2) opportunity to influence their own gaming (P11) you can be a part of the story (P32) player themself can affect the story by playing (P38) opportunity to influence own and others' game (P91) your own character/influence (P110) **2.2 Freedom to explore/free choice** possibilities for their own choices (P5) open-world/choices (P30) Open worlds, my own choices matter (P74) games that let you explore (P75) moving around the game world (P110) Freedom (C114)

3. Competition	**3. Competition** competitive games (P2) competition with others (P8) playing against others (P9) fun to beat your opponent (P20) Competitive (P31) a little bit of competition (P39) little competitive spirit (P45) conventional competition (P52) everyone wants to win in good sport (P53) competing but with the same level of players (P55) Competititve games are fun if everyone else is going too hard (P75) Competition (97) competing against others (P105) Raise the competitive spirit (P107) Contestability (P113) Competition viewpoint (P115) Some kind of ploy or race situation (P116) Competition (P125)
4. Audio-visuals	**4.1 Look** look and the graphics (P4) good graphics (P5) colorfulness and good graphics (P6) graphically clear/beautiful (P11) visual well made (P16) game graphics (P22) looks good (C35) colors (P49) great graphics (P59) Nice graphics (P66) beautiful landscapes (P74) Visuality (P87) Good graphics (P95) Visuality (P96) Fun graphics (P100) Good graphics (P102) Visualy appealilng (P104) Visual appearance (P106) Visuals (P108) Visuals (P110) Great graphics (P113) Colors (P117) Visually intersting (P128) **4.2 Background music** good background music (P22)

5. Achievement	**5.1 Succeeding/winning opportunity** possibility to complete the game (P5) winning (P28) do not like the game in which you fail too easily (P34) sense of accomplishment (P36) opportunity to get ahead AND win something more (P41) everyone wants to win (P53) Winning (P67) achieving affairs, result (P70) Achievements (P74) Opportunity to succeed in playing well (P78) Game in which one succeeds (P80) **5.2 Progression** opportunity to advance the achievement of various objectives (P6) make progress, rise to a higher level (P7) get better results (P20) get forward in the game/see your avatar evolving (P25) rise levels (P27) progress, development (P28) reward should scale with difficulty of the task (P36) proceeds from level to level (P40) game can develop in some way (P55) game progression (P62) Progress, achieving affairs, result (P70) Game in which one can see one's own progress (P80) challenge increases as the game progresses (P84) Progress in the game (P85) Progressively challenging, continuity (P87) suitable amount of progress (P88) Progresses more difficult (P95) Trekking (P97) Being able to see your progress (P111) Standards increase/progress of the game (P117) Advancement to the next level (P124) Suitable ratio between new and challengin progression (P126) Levels can get ahead (P127) Running to the next level (P128) Game progress can be shown (P129) **5.3 Learning/Improvement/development** Learn new skills (P12) games that develop you (P23) development (P28) Encourages the improvement of performance (P65) Possibility of development (P73) You have to grind to understand or learn (P75) Opportunity to develop (P84) It's important for the game "to teach" (P88) A chance to develop or advance (P89)

	Learning curve/constant learning/building up my skill (P114)
	5.4 Rewards
	prizes (P9)
	get coins to buy things for your avatar (P25)
	rewards (P27)
	reward you for putting the effort (P31)
	reward for doing task (P36)
	games where you can win prizes (P43)
	good prize (P57)
	Rewards (P66)
	Interesting prize (P71)
	Trophies (P74)
	Rewarding (P77)
	Achievement of Prizes (P88)
	Achievable rewards (98)
	follow the success of any prize (P105)
	Awards (P108)
	Instant rewards (P123)
	can win some prizes (P127)
	5.5 Goal orientation
	Clear goal (P7)
	precise targets (P16)
	Some goal or solution (P29)
	Having an objective to be achieved (P49)
	Clear end point (P52)
	A goal that must be achieved (P59)
	A goal or solution you have to reach (P64)
	Fun to achieve the objective (P72)
	Goal-orientation (P73)
	Clear goal (P103)
	Providing Outcome (P109)
	Possible common goal (118)
	The game has an aim/goal (P127)

6. Difficulty resolution	**6.1 Suitable challenge/difficulty** **Appropriate level of difficulty (P6)** **becomes suitably more difficult (P8)** **Challenges/sufficient degree fo difficulty (P9)** **Enough of challenge (P15)** **must be a challenge (P18)** **suitable challenges (P19)** **enough challenge (P22)** **challengreg enough (P24)** **high skill ceiling (P31)** **challenge (P36)** **enough of a challenge (P38)** **suitable challenge (P41)** **not too easy or too hard (P44)** **game is a challenge (P48)** **enough but not too challenging (P50)** **suitable level of challenge (P58)** **enough challenge (P62)** **Suitable level of difficulty (P71)** **Not too challenging, not too easy (P72)** **Suitably difficult (P76)** **A little bit of challenge (P80)** **Certain degree of difficulty (82)** **Challenges are surmountable, increasing as the game progresses (P84)** **Progressively challenging (P87)** **Challenge (P89)** **Appropriate level of challenge (P91)** **enough challenging (P92)** **Progresses more difficult (P95)** **Challenges (P96)** **Optimal challenge (P103)** **Suitably challenging (P105)** **Enogh of a challenge (P106)** **Sufficiently challenging (P112)** **Variation in the degree of difficulty (P121)** **Suitable ratio between new and challengin progression (P126)** **Challenge (P129)** **6.2 Problem solution** **Have some solution (P29)** **Problem solving (P31)** **A goal or solution you have to reach (P64)** **6.3 Brain strategy/Use of thinking skills** **dynamism to the brain (P21)** **Need to use your brain (P52)** **thinking (P63)** **Use your thinking (P70)** **skill-based (P75)** **Use fo reasoning skills (P81)** **Games where you have to think about strategies (P90)** **Logic is very important (P100)** **Skills/knowledge should determine the winner (P103)** **Fulfilled by your effort (P109)** **End result depends on your actions/knowledge/skill [instead of] good luck (P119)**

7. Creativity/Originality (combine 7 and 11)	room for creativity/not be too narrow progressive (P9) Ingenious (P13) being able to be creative (P30) out of the box thinking, creativity (P31) creativity (P42) ability to create (P44) Creativity (P57) creativity (P70) Creative (P93) Authenticity (P110) Creative (P120)
8. Game story	**8.1 Story-base** **Story Telling (P1)** **Game story (P11)** **narrative games (P17)** **when there is a plot (P47)** **story that leads the game forward (P51)** **Touching stories, change the story (P74)** **Have a story (P75)** **Some kind of story (P100)** **Story behind the game (P123)** **Narrative base (130)** **8.2 Good Plot/theme** **Interesting plot (P11)** **Good background idea (P13)** **Interesting theme (P26)** **Overall theme of the game (P30)** **theme is familiar or interesting (P40)** **Game idea/plot (P67)** **Good plot (P83)** **Interesting background story (P87)** **Good plot (98)** **game idea and its suitability to affect the enjoyment of the game (P111)** **Carefully planned plot with sub-plots (P123)** **8.3 Good Characters** **Funny characters (P32)** **Cute characters (P74)** **Interesting characters (P83)** **your own character (P110)**

9. Playing with people (combines 9 & 20)	**9.1 Team play** Teamwork (P8) can play it with friends (P12) accompanied by friends playing (P15) playmates that are fun and motivated (P18) rather play in a group (P25) Working together (P33) Team Work (P38) Possibility of grouping (P42) can play as a team together (P47) when you get to play with others (P56) communality (P63) can be played with friends (P68) Something people can do together (P82) Teamwork (P94) can be played together with others (P105) hat you can play together with others/require cooperatio Playing together (P111) Sense of community/playing with friends (P118) Everyone participates (P122) **9.2 Social Interaction** Getting acquainted with other participants (C33) Interactivity (78) Interactive (P86) Social Interaction (P118)
10. Convenience (12, 15 & 23)	**10.1 Ease** simple and easy to play (P4) certain type of ease (P18) not too hard (P24) Simple (P93) easily learned (P104) Not such complicated rules and mechanism (P106) **10.2 Adaptability** th one other person and does not require several players Suitability for various group sizes (P64) chance to try again (P65) needs fewer internet or technology (P86) **10.3 Functionality** game play and mechanics (P4) Works smoothly (P35) Functionality (P49) functionality (P60) Works properly (P66)

11. Clarity	**11.1 Clarity of rules** **Clear rules (P14)** **Clear rules (P42)** **Clear rules (P45)** **Clear rules (P96)** **Not such complicated rules (P106)** **Clear rules (P108)** **11.2 Clarity of instructions** **Easily accessible instructions (P88)** **Clear instructions (P102)** **11.3 Clarity of idea and structure** **Good/clear idea of the game (P24)** **Clear idea and structure (P37)** **11.4 Clarity of objectives/goals** **Clear goal (P7)** **precise targets (P16)** **Clear end point (P52)** **Clear goal (P103)**
12. Meaning	Meaningfulness (P18) game has a purpose (P23) ability to fulfill oneself (P44) important to oneself (P73)
13. Engagement (combines 22, 26 and parts of 18)	**13.1 Interesting/Interest** **Interesting (P25)** **topic of the game is interesting (P35)** **Maintains the player's interest (P38)** **Intriguing (P50)** **Interesting work (P68)** **Interesting (P77)** **Interesting core idea (P95)** **topic of interest (P110)** **Interesting and captivating (P130)** **13.2 Immersive/immersion** **you can immerse yourself (P34)** **engaging (P93)** **Interesting and captivating (P130)** **13.3 Addictive/addiction** **game is addictive (P48)** **addictive game (98)** **addictive game (P112)**

14. Surprise Element (Originally 21)	Fun surprise (P34) Element of surprise (P55) unexpected turns (P71) Element of surprise (P72) Twist to get the players interested (P94) Something surprises (P98)
15. Relatability (Combines 24 & 33)	**15.1 Familiarity** **Theme is familiar or interesting (P40)** **Closely related to one's hobbies (P73)** **Tightly applealing to target audience (P77)** **Intuitive gameplay (P114)** **15.2 Connection to reality** **Realistic (P79)**
16. Entertainment Value(Combines 25 & 29)	**16.1 Playfulness/Fun** **Fun (P14)** **Fun (P19)** **Excitement (P26)** **Playfulness (P34)** **playfulness, don't have to be taken so seriously (P45)** **excitement (P57)** **excitement (P58)** **entertainment value of the game (P68)** **Fun and exciting at all times (P69)** **Whimsical (P76)** **Entertainment value (P84)** **having a good time/excitement of playing (P94)** **kind of excitement (P99)** **game idea and its suitability to affect the enjoyment of the game (P111)** **16.2 Humour** **Funny characters (P32)** **Humour (P67)** **whimsical (P76)** **Makes people laugh asily (P86)** **Humour (P110)**
17. Fast pace (Originally 28)	fast moving (P52) Fast pace (P73) Fast-paced (P78) Fast paced (P81) Not too slow paced (P112) Action based games (P130)
18. Smaller milestones (originally 31)	Not too long term (P64) One small step at a time (P72) Small milestones (P101)

19. Sportsmanship and positive game environment	Everyone want to win but in good sport (53) gamesmanship (P63) Environment is easy going, people don't get hurt if they lose (P75) Does not make most of the times people angry (P82) Everyone participates/good atmosphere (P122)