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The story of the hatter and the agile methods course: Gamification and game thinking in education

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This is the story of a course in higher education that, over a period of ten years, went from being one of the most popular courses, among both students and teachers, to becoming one of the more problematic. Students and teachers felt that the course had many problems that needed to be addressed. For the course round of 2022, the decision was taken to redesign the course using gamification. Research on gamification in education is widespread and many have studied its effectiveness, with varying results. Most of the existing studies have a narrow view of gamification, which both limits its potential and is a risk for counterproductivity. Gamification in education requires careful planning and a game-thinking approach to the design of the learning environment. In this paper, I show how this can be done and what the outcomes may be. In the work, I draw upon motivation theory and gamification literature. Empirical insights are gained through analysing the course over the years and the outcome of the redesign. In this analysis, I make use of course evaluations, the results of a Kahoot quiz and student feedback. The contribution to research and practice is to show how courses can be redesigned into a gamified design that is good for both the students and the teachers.

Keywords: Gamification; Game thinking; Higher education; Storytelling; Motivation; Course design

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1. Introduction

Gamification has generally been described as the use of game design elements in non-game contexts (Domínguez et al., 2013; Deterding et al., 2011; Kusuma et al., 2018; Ofosu-Ampong, 2020; Seaborn & Fels, 2015; Werbach, 2014). In economic terms, video games comprise the most powerful entertainment industry (Domínguez et al., 2013), and Clark et al. (2018) speak about the rise of a gameful world because of the expanding presence of games. A total of 97% of teens aged 12 to 17 play computer, web, portable or console games, and of them, 50% do so daily (Clark et al., 2018). Video games provide challenges and goals, involving users in an interactive learning process to master the game mechanics (Koster, 2013). This has caused interest among educational researchers to find out what makes video games so appealing, and how this can be used in education to improve student motivation and engagement (Domínguez et al., 2013). This has given rise to the phenomenon and research field *gamification in education*.

Gamification had its breakthrough in the early 2010s and was quickly picked up in education (Swacha, 2021). In 2012, Kapp wrote that traditional methods of learning are losing favour because they are considered boring to people who have grown up playing video games. According to him, learning must therefore be engaging and goal-oriented and a focus on gamification increases engagement: "Learning professionals must understand the growing trend of applying game-based sensibilities to the development of instruction through creating time-based activities, leveling up of learning experiences, storytelling, avatars, and other techniques" (Kapp, 2012, p. 22). In his prediction, this trend gained momentum and acceptance and therefore "learning and development professionals must follow that trend or be left behind" (Kapp, 2012, p. 22). The first part of this prediction has proved true. Since then, there has been a dramatic increase in scientific output on gamification in education (Swacha, 2021). Research on gamification in education is widespread. Researchers from all over the world, from all educational levels and from various subjects contribute to the body of work, and the area of research is quickly developing (Swacha, 2021). However, many of the early studies focused on the potential of implementing gamification in education, not addressing the effectiveness of implemented gamification approaches (Dicheva et al., 2015; Mohammed & Ozdamli, 2021; van Roy & Zaman, 2018). In the current research, the effectiveness is examined, though with varying results (van Roy & Zaman, 2018).

For example, Çakıroğlu et al. (2017) showed that using a combination of gamification elements provides quite a positive motivational impact on engagement. Moreover, according to Jovanovic and Matejevic (2014), existing studies on gamification in education suggest that rewards have a positive impact on students' learning motivation. Additionally, Majuri et al. (2018) stated that gamification has been used with success in several subjects. Furthermore, Sun and Hsieh (2018) examined the effects of gamification on motivation, engagement and student attention. They found that gamification improved students' levels of motivation as well as overall and emotional engagement.

Buckley and Doyle (2017), however, state that effectiveness depends on individual attributes. Gamification seems to suit students with an active learning style best – students who are disadvantaged by traditional learning techniques such as reading assignments and essays. They therefore conclude that gamification must be carefully integrated into the learning context to not discriminate against particular learning styles (Buckley & Doyle, 2017). Additionally, Homer et al. (2018) implemented gamification components in elementary school and their study showed that it improved student learning in Grades 3 and 4 but not in Grade 1. Individual attributes may be an explanation, another may be that Homer et al. (2018) only implemented digital badges and points. To leave out important elements of gamification, such as storytelling, could explain their results. Another possible explanation, provided by psychologists who are experts in human resource management, is that rewards can be counterproductive because they undermine the motivation which comes from the feeling that a task is enjoyable (Bénabou & Tirole, 2003, p. 516).

Because of the varying results concerning effectiveness, and the complexity of many variables, Huang et al. (2020) undertook a meta-analysis of existing research to study the effectiveness of different game elements in education. They found that a majority only implement leaderboards, badges and points. According to Kapp (2012), these are the least exciting and least useful elements of games. The real power lies in the other elements of games: engagement, storytelling, visualisation of characters and problem-solving (Kapp, 2012). Consequently, it is a problem that these are not the most frequently implemented. It is also a problem, as Huang et al. (2020) found, that studies not using leaderboards resulted in a higher statistically significant effect size than those studies that did use them. Huang et al. (2020) concluded, therefore, that there is a need for research that considers gamification design elements beyond the use of points.

The aim of this paper is to address the identified research need through showing why it is important, with a focus on game thinking instead of game elements, and what the outcome may be of a gamified course design. The case studied is the redesign of an agile methods course in higher education. In the course, the practice of agile software development is key. Agile practices include

requirements discovery and solution improvement through the collaborative effort of self-organising and cross-functional teams. Close collaboration is important, which requires that the teachers interact to a large degree with the students during the course. The course has received criticism from the students, and one of the reasons for the students' critique was levels of interaction that were too low. To address this critique, as well as other problems, a redesign was necessary. In this work, gamification was used. The research question asked is: What is the result of redesigning a system development methods course using gamification? Two sub-questions will also be answered: 1) Can a gamified course design be the solution to existing problems in the course? and 2) Is a gamified course design appreciated by the students?

2. Gamification in Education

As described in the introduction, a commonly used definition is that gamification is the use of game design elements in non-game contexts. This definition was proposed by Deterding et al. (2011). An interpretation of this definition is that gamification is the implementation of game elements like badges, points and rewards (Kapp, 2012, p. 12). These elements are indeed part of an implementation, but they alone are not gamification (Kapp, 2012, p. 12). The reason is that such a narrow view limits the potential of gamification, as the real power of game-based thinking is in the other elements of a game: engagement, storytelling, visualisation of characters and problem-solving. Those are, consequently, the foundation upon which gamification needs to be built (Kapp, 2012, p. 12). To understand what gamification is, a useful start is a definition of a game: "A game is a system in which players engage in an abstract challenge, defined by rules, interactivity, and feedback, that results in a quantifiable outcome often eliciting an emotional reaction" (Kapp, 2012, p. 7). Important elements mentioned here are a system, players, an abstract challenge, rules, interactivity, feedback, a quantifiable outcome and an emotional reaction. A system is a set of interconnected elements in which a score is given, and this score is related to behaviours and activities. The system aspect is the idea that each part of a game impacts and is integrated with other parts of the game. Scores are linked to actions, and actions are limited by rules. Players take part in the game, which involves an abstraction of reality. The game usually takes place in a narrow game space that contains elements of a realistic situation without being an exact replica. Additionally, the game must also contain challenges that contest players to achieve goals and outcomes that are not straightforward but has rules that define what is fair and what is not. The outcome should be quantifiable and it should be clear to a player when he or she has won or lost; scores should be given along the way. The game should also cause an emotional reaction, the feeling of playing and completing a game, which can be frustration, fun, thrill, agony, etc. (Kapp, 2012, pp. 7–9).

Another definition of gamification is that presented by Kapp (2012, p. 10): "Gamification is using game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems". As described, a focus on easily recognised game elements such as points, rewards and leaderboards has been interpreted as gamification. Kapp (2012, p. 13) clearly states that this is not gamification and that learning professionals, who have been adding 'real' game elements to learning, such as interactivity, storytelling and problem-solving, need to take back the word gamification and use it for themselves. He says that the best approach is to consider the entire experience of the learner and not just one or two elements. When storytelling comes into play, so do the motivational aspects of learning (Kapp, 2012).

3. Different Types of Motivation

Gamification in education was developed in the hope that it is possible to transfer the motivational effects of games to education. Hence, gamification relates strongly to motivation (Buckley & Doyle, 2014; Dicheva et al., 2015; Razali et al., 2020; Sun & Hsieh, 2018; Tu & Yen, 2015). According to Ryan and Deci (2000, p. 54), "To be motivated means to be moved to do something. A person who feels no impetus or inspiration to act is thus characterized as unmotivated, whereas someone who

is energized or activated toward an end is considered motivated".

Motivation has for long been divided into a dichotomy of intrinsic and extrinsic motivation (Locke & Schattke, 2019; Reiss, 2012; Ryan & Deci, 2020), where it has not been clear exactly what is referred to by these concepts. Locke and Schattke (2019) therefore provided a clarification as well as an expansion. A third type of motivation was added, achievement motivation, as well as the suggestion that intrinsic motivation should only refer to the pleasure of doing something. Intrinsic motivation should thereby be separated from other elements which instead should be regarded as achievement motivation. Achievement motivation is explained as motivation gained when there is competition against some standard of excellence, thus, wanting to do well. The motive for this separation is, according to Locke and Schattke (2019), that it is possible to like to do something without caring about how well it is done. Contrariwise, it is possible to want to do something well without liking to do it.

Further, regarding extrinsic motivation, there is a need for clarification. Extrinsic motivation has historically been connected to a monetary incentive, which is too narrow. Instead, it should be more generally regarded as doing something as a means to an end (Locke & Schattke, 2019).

The three types can be separated and discussed individually but they can also be interrelated. For example, Locke and Schattke (2019) asked which type of motivation is best, and their answer was a combination of all three: "What could be better than loving the work (and other things) that you are doing, doing it well by a rational, personally relevant standard, and gaining long term life benefits as a result of your efforts and choices?" (Locke & Schattke, 2019, p. 18).

In the example above, the three types are integrated. However, intrinsic motivation does not guarantee achievement, but it may contribute to it (Locke & Schattke, 2019). In turn, achievement motivation may facilitate intrinsic motivation because people tend to like doing things that they are good at. It may also facilitate extrinsic motivation because if you are good at something you are likely to succeed. But all three do not have to be present at the same time. For example, a person can be good at their job and be successful without liking their job. On the other hand, people can have a job they like doing and therefore accept less achievement and a lower salary (Locke & Schattke, 2019).

As described, motivation means to be moved to do something, it is related to some form of action. A common perception is that incentives promote effort and performance (Bénabou & Tirole, 2003). This perception is, however, not always valid. Incentives can also be counterproductive. For example, rewards may impair performance and the same goes for competition. Additionally, some incentives can work well in some contexts but appear counterproductive in others (Bénabou & Tirole, 2003).

The question of motivation and incentives is thus not an easy one. Psychologists, as well as sociologists, have long emphasised the importance of intrinsic motivation because explicit incentive schemes may sometimes backfire (Bénabou & Tirole, 2003, p. 516). This is true, especially in the long run, since they can undermine people's confidence in their abilities or in the value of the rewarded task. They can also be counterproductive because they may undermine intrinsic motivation (Bénabou & Tirole, 2003). On the other hand, if rewards make people strive to achieve something (i.e., achievement motivation), that could facilitate intrinsic motivation.

4. The Agile Methods Course

The course studied in this paper is a five-week full-time course in agile system development methods given annually at a Swedish university. The course builds on problem-based and active learning. Throughout the entire course, the students work on a system development project. In the project, they learn agile methods by practicing them while developing an information system. Hence, the students must take responsibility for their own learning in the project (but with assistance from the teachers). My first contact with the course was ten years ago, in 2012. The course has, however, been given earlier than this. In 2012, the course was easy and fun to teach, and it was appreciated by the students. At that time there were 44 students taking the course and it

was easy to interact with them because they were also divided between my colleague and I. This particular course requires extensive interaction as the teacher's role is to act as the client and customer of an information system that the students develop during the course.

However, the number of students taking the course has increased over the years. Many have been interested in taking the systems analysis programme, in which the course is offered. In the spring semester of 2013, we had 70 students, the following year we had 95 students. It was still possible to interact with them, but it was more difficult. Although the teachers received more hours for giving the course, interaction suffered because there were more projects, and it was also hard not to confuse them and their different progressions. As a teacher acting as a customer for each group, it is important to remember and keep track of where in the process the groups are. That was possible when there were few students (groups), but when there were more, it became difficult. One solution was to increase the number of students in the groups, which had the implication that we had to develop a new and more complex case. This more complex case resulted in the students complaining that the focus was too much on the programming of the system and too little focus on the agile methods. To solve this, we added a task whereby the students had to write a group report focusing on their method use. Hence, in an attempt to solve problems, different solutions were developed. However, these did not really solve the problems; instead, new ones were created in the process.

Over the years, the course has become more and more difficult to give, and the students' view of it has also changed. Every year from 2011 to 2015, the students rated the course as four on average in the course evaluation, on a scale from one to five (where five is the highest grade). From 2016 to 2021, the rating has varied with the changes made (between two and four).

In 2022, a decision was made that something more extensive has to be done. This time, it was important to avoid doing something on the spur of the moment, rather, it required a well-grounded holistic view of the entire course based on a detailed analysis. It was considered important, however, that the essence of the course should not be changed because there is indeed good thinking behind the course structure, which has been present since the course first was created, long before the problems occurred.

The first course week is dedicated to both project work and course meetings. Between 2011 to 2016, the course meetings consisted of lectures. These received criticism for not providing enough guidance, and in response to this the course meetings were divided into two parts instead: a lecture component and a workshop component. The purpose of the lectures was to give the students the basic knowledge they need to start the project, and the purpose of the workshops was to help the students in the beginning of the project and to prepare them. For example, one workshop guides the students step by step through the process of setting up the development environment for their project, another guides them in how they should choose and adapt method components to create their own system development method. These workshops were intended to solve problems related to version management in the system development and create a stronger focus on the use of methods, as well as a deeper understanding of agile methods.

In the first week, the different groups also meet their customer (one of the teachers) to gather functional and non-functional requirements. The remaining four weeks are dedicated to the development phase of the project. The students work with the development of their system practicing agile methods. The development phase is divided into sprints (a short, time-boxed period when the groups (teams) work to complete a set amount of work) and each sprint starts with a meeting with the customer in which the sprint is planned. In the last week of the course, the students present their projects, and to pass the course, they should have developed a system containing the requirements prioritised by the customer (teacher). Role play has thus always been the foundation of the course. For an overview of the course structure, see Figure 1.

Figure 1
Course structure and timeline

Week	Project preparations		Development phase, divided into sprints			
	1		2	3	4	5
	• Customer meeting		• Sprint meetings with customer (teacher)			• Project presentations

5. Method

To examine the problems present in the course, and the student's critique, as well as their general view of the course over the years, course evaluations were used. Empirical data has been collected for two purposes: data collection for the redesign of the course and data collection for the evaluation of the redesign.

5.1. Data Collection for the Redesign

In the first data collection, course evaluations for the years 2011–2021 were used to identify the problems that needed to be addressed. The course evaluations were analysed both quantitatively and qualitatively. Quantitative analysis was used to compare how the students graded the course (overall) throughout the years in order to see how it has been perceived (Table 4, section 7). The free text sections in the course evaluations were analysed qualitatively. All the problems raised by the students were analysed and categorised. For example, problems concerning the project were grouped under the label 'The case', as the case guides the project. Problems related to the course's different examinations were grouped under the label 'Examinations'. As described, during the period, different problems have been raised that have to do with the content of the lectures and the course material, hence this also became a category. For the different categories identified, see Table 1 in 6.1. The reason for the categorisation was to identify problem areas that had to be dealt with in the redesign of the course. A total of 17 problem areas were identified. Some problems were mentioned regularly through the years, others only once. The most important ones to address were thus the ones raised most frequently. The number of participants in this data collection was 204 students; see Table 4 for an overview of the number of participants each year.

5.2. Data Collection for the Evaluation

Data collection for the evaluation of the redesign was gathered through the 2022 course evaluation. In the 2022 course evaluation, questions that addressed the changes made to the course were added. Hence, it was not just the ordinary standard evaluation, but an extended version. In the ordinary course evaluation survey, there are five Likert scale questions and three free-text sections. The aim of this design is to gather the students' overall impression of the course. This survey was extended with nine more Likert scale questions: 1) My assessment of the first week's course meetings, 2) My overall assessment of the project task, 3) The course meetings were relevant for the project work, 4) It was clear what was expected of me during the course, 5) The performance requirements in the course were reasonable, 6) The course developed my understanding of agile methods, 7) The teachers made an effort to make the subject interesting for us, 8) My assessment of the method seminar and 9) My experience of the visit by Integration Company Sweden AB.

These questions correlated to identified problems and changes made. Since the course was redesigned with a gamified design, it was important to gather the students' opinions of how this design was perceived. Therefore, questions related to the actual content were asked (1, 2, 3, 8). It was also important to know if they thought that instructions were clear (4), since this was one of the identified problems. Their actual learning was, of course, interesting to examine (6), as well as the interaction with the teachers (7). Further, how they experienced the workload was important for us to know (5). The last question (9) investigated how the students experienced a visit from a local company working with agile practices. This question is related to a problem raised over the years, namely that the course should have a stronger connection to real-life practice. The course evaluation survey was answered by 14 students, which is a low response rate (15%).

Additionally, a Kahoot (a game-based learning platform, used as educational technology) quiz was arranged in the final week of the course to also gather data. From experience, I know that it is hard to get students to answer course evaluations; very few take the time regardless of how many reminders they receive and regardless of how often the teacher impresses upon the students the importance of doing so. Therefore, I wanted to try another way of getting data. A total of 43 out of 93 students participated in the Kahoot (i.e. 46%). Two things were most important to evaluate: their learning and whether they experienced the course as entertaining. The design of this data collection was therefore to first create a quiz so as to test the students' learning, and to have two poll questions after the quiz: 1) The course has been fun (this question does not affect the score in the quiz), and 2) I have learned a lot during the course (this question does not affect the score in the quiz). It was important to state that the poll questions did not affect the score in the quiz to encourage the students to answer these questions honestly. Answer options for the first poll question were: very fun, fun, boring, and very boring. Answer options for the second poll question were: very much, much, little, and very little. Data to evaluate their learning was hence gathered in two ways, first through the quiz and thereafter through their self-reporting in the answer to the second poll question. There were ten questions in the quiz. The setup was to ask a question and provide two to four alternatives. When formulating the alternatives to the questions with four alternatives, the strategy was to make them sound as likely as the correct answer to make the questions challenging (see Appendix).

5.3. The Role of the Researcher

During the studied period, 2011-2022, I was a teacher in the course for all years except one, and the course manager for four years. As I was the course manager in 2022, I carried out the redesign work. It was done in collaboration with colleagues usually involved in the course. It was important to include them in the work to make sure that they shared both the view of the problems and the solutions to be implemented. This was done by keeping them up to date during the process of the work carried out and by asking them for feedback.

As this paper builds on the experiences of a redesign of a course and its outcome, both the work carried out and the outcome are results of this paper. The work carried out shows how a gamified redesign of a course can be created, and the evaluation shows what the outcome may be.

5.4. A Framework for the Gamified Redesign

The theoretical base for this study is gamification and motivation theory. For gamification theory I have to a large extent relied on the book "The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education" written by Kapp in 2012. This book is a key resource when trying to understand gamification in education. The book is based on solid research, including results from many peer-reviewed studies. For motivation theory, the key resource used is the paper by Locke and Schattke (2019). Besides this, the current state of knowledge of gamification in education has been retrieved through analysing existing research (empirical research, conceptual research and reviews). All this literature provided the foundation for the development of the gamification in education framework, which was used to guide the redesign of the course (Figure 2 in 6.2).

6. Implementation of Gamification

This section starts with presenting the list of the identified problem areas over the years (Table 1), as solving them was one of the purposes of the redesign. Another was to get the students to appreciate the course again. After this, the implementation of gamification is presented. A holistic game thinking (according to Figure 2) was applied in the design of all changes carried out. In this section, I present the design of the changes and how these changes were intended to solve the problems raised by the students. In the next section (7), the actual outcome is presented (the evaluation of the redesign).

6.1. The Identified Problems Areas

In Table 1, the identified problem areas are presented. The far-right column sums up the number of years in which the students have raised problems related to the identified problem area. The last row of the table sums up the number of problems raised for each year. The number of problem areas addressed each year has varied from four to ten. That does not, however, necessarily mean that years with a lower number have had more satisfied students. It could be the case that they experienced a specific problem more severely and therefore focused on that problem, not addressing other more minor problems in relation. The problem areas addressed most times over the years are Examinations, Version management and Content in lectures/course materials. Important here is that how the course has been given has slightly varied over the years as intended solutions to problems were developed and tested, but it is clear that for many of the problem areas, the indented solutions have not solved the problems.

The problem areas are interrelated. Several problem areas will therefore be discussed together, with a focus on the problem areas addressed most times over the years. For example, there are several problems related to the problem area of Examinations, what is assessed and graded in the course. The focus of the course is on agile methods, however students practice them while developing an information system. The system development is only assessed on a two-level scale, pass or fail, but in reality, few projects fail. This has created a sense of meaninglessness related to the system development part of the project. Some students spend a lot of time on developing the system and therefore become disappointed when they realise that it does not affect the grade of the course in relation to the effort put in. Others spend little time on the project because they do not see the point in spending their energy on it, as they do not feel that it affects the grade of the course. This has been a problem as long as the course has been held, but it increased when the teacher interactions during the project decreased. Less interaction had the implication of more focus on programming and less focus on method use, creating even more frustration related to this design of the project examination.

Additionally, the students also express that there are too many examinations in the course and that the different examinations are unclear regarding what is being examined. There are examinations related to the project and since the project meetings are mandatory, they have their own examination. Further, the project artefacts (documentation in the form of backlogs, for example) must be handed in, hence they also have their own examination. On top of this is the group report (in which the students reflect on their method use) and the final exam of the course. The students have said that it is difficult to understand the mix of examinations and their different implications on their grades. They also think that the instructions are unclear. A consequence of this is that the first sprint meeting usually never becomes a sprint meeting as the students have not really understood how a sprint meeting should be carried out. A sprint meeting should be managed by the development team (the students), who should be in control of the process, not the customer (the teacher). This has been a problem for as long as the course has been held. There has been too much information to absorb and therefore the students have missed instructions. The teacher has had to act as a teacher and not a customer at the beginning of the meeting, explaining how a sprint meeting should be carried out.

Moreover, in the written exam, the students reflect on their project work and since project work varies in the different groups, the students have said that the exam does not take place under equal conditions for all students. Questions asking the students to reflect on how they have handled, for example, changing requirements have appeared in the exams. How this has been managed in the interaction with their customer (one of the teachers) has varied. Some groups have had to implement more functionality than others. This was a side effect of changing the case in 2016 and making it too difficult for some groups. To handle this, teachers adjusted to the situation, not adding more work to groups already in a difficult situation.

Table 1
Identified problem areas

Problem area	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Sum
Examinations		X	X	X	X	X	X	X	X		X	9
Version management	X	X	X	X	X		X	X	X		X	9
Content in lectures/course materials	X		X	X	X	X	X		X	X	X	9
Groupwork/ student ambitions	X	X		X	X		X		X	X	X	8
Instructions (unclear)			X	X	X	X	X	X	X	X	X	9
Course focus (programming instead of methods)	X	X			X			X	X	X	X	7
Interactions (with teachers)	X	X		X					X	X	X	6
The case	X	X			X			X	X			5
Course literature		X	X		X				X			4
Connection to (real-life) practice					X	X	X					3
Changing requirements	X	X										2
Length of the course					X							1
Group rooms	X											1
Demands on the students		X										1
Support											X	1
Group contract											X	1
No of sprints									X			1
The Scrum master role			X									1
# of problems	8	9	7	6	10	4	6	5	10	5	10	

The number of sprints in the course has also varied over the years. This is related to the Easter holiday and how it affects the schedule of the course. It is also related to teacher resources. When there were fewer students in the course, three sprints were always held; when there were more students, the number of sprints were reduced to two. The teacher participates in the sprint meetings, acting as a customer, which is time consuming when there are many groups.

From 2011 to 2016 there were three sprints. From 2017 to 2021, there were two sprints. As previously described, a sprint is a short, time-boxed period when the groups (teams) work to complete a set amount of work. Each sprint starts with a planning session, a sprint meeting. With only two periods (sprints), it is difficult to change the requirements. More sprints give more room for planning and replanning.

When the project groups were enlarged to address the increasing number of students in the course, the project needed to be adapted to this circumstance. Bigger project groups required a more comprehensive task. However, the more complex assignment turned out to be better suited to students who have read the continuation level and therefore disadvantaged the students who have only read the basic level. Our systems analysis programme does not have a fixed path and we accept students in both spring and fall semesters. This has been a challenge for the course as half of the students have more programming skills than the others. Also, the students' interest in and focus on the agile methods have decreased throughout the project. This is due to a complex task, requiring the students to focus on solving it, and the lack of an interactive learning process. In the early years of the course, the teachers visited the groups between the meetings, but when students and time spent on assessment increased, this was no longer doable as the teachers simply did not have the time for it. Hence, the visits must be replaced with some other events.

The complex task had a purpose: the students should experience some problems in the projects to be forced to use the methods to handle them. When a problem arises, the team should handle it according to an agile practice. However, with an assignment which is too complex, the focus on the methods decreased as the students became too absorbed with just solving problems, usually through searching for solutions on the Internet. They also raised the need for programming support. Since programming should not be the focus of the course, the teachers had no time to provide support, which caused frustration among the students.

Furthermore, the students also expressed that there were uneven efforts in the groups. Some students work more while some students work less. There could be many reasons for this, including of course programming skills, diverse levels of ambition or different interests and motivations. This has caused frustration among the students who make a large effort, and they have complained in the course evaluations that some students only tag along in the project and that it does not affect the grade. What the students do during the weeks has become more unknown to teachers; when visits ceased insight into the group work decreased.

A solution was to develop a group contract that the students had to sign. This, however, had no effect on the problem and only caused more critique. Some students suggested that one the students in the teams should, instead, report to the teachers each week. This was not implemented as it would have put pressure on a student to evaluate and discuss their peers. Additionally, over the years, students have raised critique towards the content of the lectures and course materials, stating that it does not provide them with the knowledge and guidance needed.

These were the identified problems that needed to be solved in the redesign of the course. All students should have the same conditions based on the project work. Changing requirements must be the same regardless of the teacher and regardless of how the work proceeds in the project. It also must become clear what is examined and on what grounds (what is expected). The number of examinations also needs to be considered: whether there is a better way of handling them and a possibility to reduce them. The course needs to have three sprints to make it easier to implement changing requirements. Furthermore, the case needs to be replaced with another case that suits students at both the continuation level and the basic level. The case should be complex, but not too complex, and it should also be interesting so as to inspire students to work with it. Additionally,

some form of teacher interaction between the meetings during the development process is necessary to keep up interest in the practice of methods. Insight into the group work is difficult, but a better follow-up at meetings is, at least, part of a solution. Regarding content in course meetings, I believe the workshops are useful but that more can be done and in the redesign of the course the content of the lectures and course materials needs to be updated.

6.2. A Gamification in Education Framework

In Figure 2, an illustration of how gamification can be implemented in education is presented. It is based on the gamification and motivation theory presented. Important when implementing gamification in education is a focus on game thinking instead of individual game elements. It is essential to create a game space containing a story and characters, as well as an abstract challenge consisting of continuous activities guided by rules, feedback and scores (Kapp, 2012). These activities should address problem-solving and give the possibility to level up and, ultimately, to finish the game (Kapp, 2012). In the figure, all categories related to motivation are presented. Intrinsic motivation is very important and so is achievement motivation, as it is the fun and challenging aspects of gamification that should mainly be transferred to the learning situation.

Extrinsic motivation, in the form of rewards, is also important but should be handled more carefully according to both gamification and motivation theory. According to gamification theory, the real power of game-based thinking is in the other elements of a game (Kapp, 2012, p. 12). According to motivation theory, rewards can make people strive to achieve something, but they can also backfire (Bénabou & Tirole, 2003). Hence, an emphasis on intrinsic motivation rather than extrinsic is important. Nevertheless, all three should be included as a combination of all three is what is considered the best motivation.

Figure 2 guided the work of designing the needed changes and creating a gamified design for the course. In the following section, details of the implementation are presented, as well as how the developed solutions are intended to solve the problems and make the course more entertaining and thus more appreciated by the students. The design of the changes is presented in relation to the three categories of motivation, starting with intrinsic motivation.

Figure 2
Gamification in education in relation to all three types of motivation
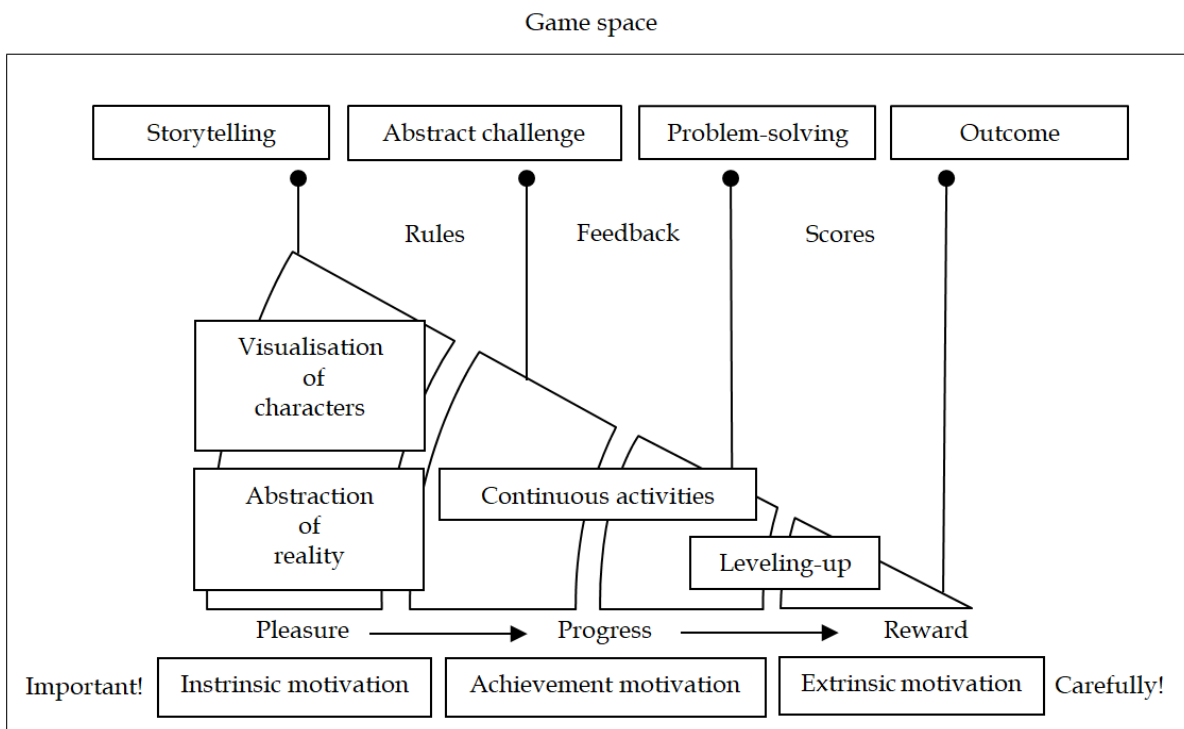
6.3. Intrinsic Motivation: Storytelling and Visualisation of Characters

Game components essential for creating a fun and engaging game are, as previously described, storytelling, visualisation of characters, making the characters come alive through role play, creating a game space that contains elements of a realistic situation and an abstract challenge.

Previously in the course, the students were handed a specification of the information system to develop. This specification listed, vaguely, what was needed and the problems to solve. The purpose of the specification was to provide a start, so the students knew what they needed to ask and discuss with the customer at the customer meeting. A part of agile system development is the collection of requirements together with the customer. In this process, the customer is asked to explain and talk about their needs and the development team asks the customer questions to find out more. The development team and the customer list and priorities requirements together, but the process is driven by the development team. The old specification developed in 2016 was vague on purpose, because if too much information is provided to the students, then they do not need to ask questions and discuss with the customer to the extent that is required. Therefore, the old specification was not really needed, which was good, because it caused a lot of problems. For the course round of 2022, I created a new case for the project, and to implement gamification I instead wrote a story.

I started the story with a scenario, and this scenario was pretty much the information provided to the students except for some details in the end (also part of the story). I kept the story short, at one page, to give the students just the situation and the context. Writing a story instead of a specification was expected to solve several of the problems and have several benefits. As previously described, one problem in the course was that the project presented in the previous specification was better suited to students who had read the continuation level, and it therefore disadvantaged the students who had only read the basic level. By writing a story instead of a system specification, no specific *tasks* were mentioned. Instead, it was up to the students in their groups to interpret and create a solution to the *needs* presented, thus giving them the possibility to adjust to their circumstances.

Previously, the scope of the project was also a problem. It was a challenge to create a system specification that was adequately comprehensive to keep all the students busy throughout the course without being too stressful for the groups of students with less programming experience. Through writing a story, it becomes possible for the students to self-decide on the scope of their project and adapt it to their process, i.e., it is an abstract challenge. Of course, there are mandatory requirements that all groups should develop. The developed system should address the needs raised in the story and in the conversation with the customer. So, it is not completely up to the students to decide the scope, but it does leave more room for adjusting the scope than the previous specification.

The story also creates the game space needed. It contains elements of a realistic situation but in a clearly defined space:

> It was an ordinary day for hatmaker Otto. He was sitting in his and his business partner Judith's sewing studio, working on the latest hat ordered by his loyal customer Kurt Lupton. He thought how lucky he was to have such loyal customers who always come back to him as soon as they need a new hat. This time the hat was to be for a promotion ceremony, and it required great concentration to get every single detail to the absolute highest quality. Suddenly, the door to the sewing shop opens with a crash and the small bell on the frame, which normally announces a ping to alert him that a customer is on their way in, now instead falls to the floor out of sheer terror with both a ping and a donk. In comes Otto's grandson, noticeably excited.

The task is to build an information system for a hatter. Through the story, a world is created, together with characters, and it is possible to make the characters come alive:

> - Grandpa!
> Otto looks up in horror and almost pricks his finger on the sewing needle. He shakes his head.
> - What a fuzz! Haven't you learned to take it easy yet? You almost scared the crap out of me.

- Yes, but I have absolutely incredible news! Wait, wait until you hear this!

In the rest of the story, the grandson presents a new market resulting in the need for a different handling of orders and the need for a new business system:

> Excitedly, Otto's grandson talks about his latest hobby, cosplay, and the convention he recently attended. All his life he has had to try on different hats and thus developed a great interest in costuming, and he has finally found his like-minded people. He also says that the hat he wore at the convention attracted a lot of attention.
>
> - Usually, most people order their costumes via online shopping, but the quality is always so poor. Your hat, however… everyone was so fascinated.
> Otto's grandson says that he has received several requests.
> - You must craft these now!
> - They asked me how they can order, but it doesn't work at all, does it?
> Otto's grandson points to Otto's old desktop computer that stands in a corner of the sewing studio.
> - Do you even have an e-mail, Grandpa?

This part leads up to the new needs that should be addressed in the business system developed by the students during the course:

> Otto has always only made hats for his loyal clientele and for people who come into his atelier. This is something completely new, a completely new market. However, his grandson convinces him that it will be very big and that he must bet on this. Otto calls his accountant to find out what concerns this new market brings. It turns out that he needs a business system to be able to save information about stocked models, to be able to pick up requests for special productions, place material orders, calculate prices and be able to print out shipping notes, contents, value, product codes for customs declaration, etc. Since the hats will now be sent to the customers, there needs to be a system to keep track of which hat goes to whom, who placed which order, etc. Just making notes on a pad inside the studio will no longer work.
>
> Otto's grandson has googled and recommended that Otto contact a reputable development team for help with his new system.
>
> - You just have to tell them about your hats, and they will do the rest!
>
> Otto consults with his business partner Judith and together they agree that it is clear that they should invest in this. It's time to contact the developers.

Role play has always been part of the course, as the teachers act as customers ordering a system. However, none of us teachers have, throughout the years of giving the course, done this in any other way than just acting as a customer. This year, to visualise the characters, I brought a collection of hats to the customer meeting. It is, of course, not necessary to have this, but props make it easier to get into the role.

The story was kept alive through the different meetings in the course: the customer meeting, the three sprint meetings, etc. However, there also had to be some twists, and some happenings between the meetings to make it a more interactive process. Previously, when there were no twists, the result was decreased motivation for the use of methods during the project work. Changing requirements are necessary, and to make them motivating and fun, they were connected to the story, the characters and the role play. The hatmaker sent out the changing requirements through email. This also made it possible to handle this in the same way for all groups. Previously, when they were communicated at the sprint meetings, the teacher adapted to the situation. This had the consequence that all the students did not receive exactly the same changes, while for some students already struggling with the assignment, there were no changing requirements at all. The result was an unequal handling of the students, which could be avoided through the emails. They were the same for all students and they were sent out at the same time. It was also another opportunity for keeping the story going, for visualisation of characters, and for entertainment. The emails were written as if a person with limited experience in working with computers sent them (use of caps lock for example):

HI, OUR AUDITOR CALLED. HE SAYS WE NEED TO BE ABLE TO TAKE A COMPOSITION OF VAT ON PURCHASES AND SALES OUT OF THE SYSTEM. HE SAID THERE ARE NO DIFFICULTIES, IT SHOULD JUST BE POSSIBLE TO EXPORT THIS INFORMATION SO HE CAN CALCULATE WHETHER WE NEED TO PAY VAT OR NOT. HE WAS TALKING ABOUT A FILE, XML, OR TEXT HE SAID, THAT SHOULD BE SENT TO HIM AND THEN HE DOES THE REST. CAN WE GET THAT DATA OUT?

The message was supposed to be confusing, forcing the students to handle it according to agile practices. This addressed several problems. It created an interactive learning process through contact with the customer during the sprint and as such it also reminded the students of the task, so that if they were caught up in programming they would be reminded about the use of the methods to handle the changing requirements according.

The reason why groups were previously treated differently was because different teams are on different levels, some progress faster and others slower. Therefore, it was thought that the teacher should have the possibility to decide what to require from different groups. Hence, the idea was to make it fairer, but the outcome in practice was the opposite. Some had the opportunity to learn more than others. For the teams struggling with the assignment, the teacher did not present any changing requirements. This is a problem as changing requirements are a very important part of agile development – it should be agile, and the students should learn to embrace change and be prepared to go in any direction.

6.4 Achievement Motivation: Progress during the Game, Rules, Scores and Feedback

Achievement motivation relates to progress, to level up. Hence, it also has to be possible and clear how to move between different levels during the abstract challenge. In the course, the different meetings are assessed, the students must be present at the meetings and they have to actively participate. However, it was previously not clear what was considered active participation, how they were expected to participate or if they actually failed or passed a meeting. This relates to the problem that the students do not know how to perform a sprint meeting and is something that the teachers have experienced since they first gave the course. The previous solution was to address this issue in lectures, but that did not have the intended effect. Hence, instructions have to be clearer and there has to be rules and feedback for the meetings. To implement this, I developed a matrix (Table 2), and also wrote some example scenarios: this is how a meeting could be performed, and this is what is expected. The matrix contains all the meetings to be held during the course, and in it the students' performance at the meetings can be assessed with plus, ok or minus according to the following criteria:

+ : Well prepared, follows the process well and acts independently and professionally. Have a dialogue with the customer and are in control of the process.
ok : The students are essentially in control of the process and the meeting can be carried out without the customer needing to act (too much) as a teacher.
- : The students do not understand the process and are not prepared, the teacher has to act as a teacher and cannot focus on being a customer.

Table 2

Assessment of meetings

Meeting	Assessment (+/-/ok)
Customer meeting	+
Sprint meeting 1	+
Sprint meeting 2	+
Sprint meeting 3	+
Presentation of the business system	+

For the students to pass, they had to have at least ok for all meetings. One minus can be offset by a plus, but there may not be several minuses. It is how well the students follow the process according to the methods and examples that is assessed. The same is done for all artefacts that

need to be turned in during the project (Table 3). They are assessed according to the following criteria:

+ : Follows what is prescribed according to the methods exemplary.
ok : Mainly follows what is prescribed according to the methods with some occasional exceptions.
- : Does not follow what is prescribed according to the methods.

This made the progress throughout the project clear, as the students could see that they had passed a level and moved on to another. It also provided them with feedback and scores.

Moreover, this addressed the problem that the students were disappointed that the time spent on the project did not seem to matter. It has always been part of the examination, but it has not been clear what is assessed and how, and there has been no direct feedback, which has probably caused such feelings. It is the practice of methods, the development of artefacts and the implementation that is assessed, but due to unclearness related to the different examinations, the students got the impression that only the written exam counted. Feedback for the other parts was not visible enough. The developed assessment system was expected to solve this and make progress clear through the given scores. All "scores" (+, ok, -) were kept in a scoreboard for each group.

Table 3
Assessment of artefacts

Artefact	Assessment (+/-/ok)
Product backlog (PB)	+
Sprint backlog 1 (SB1)	+
Sprint backlog 2 (SB2)	+
Sprint backlog 3 (SB3)	+
Burndown chart 1 (BC1)	+
Burndown chart 2 (BC2)	+
Burndown chart 3 (BC3)	+
Implementation of prioritized requirements	+

Another problem raised was that there was too much information about the course, resulting in students missing instructions. The implemented changes address this, but there was also a need for an overview of the course in its entirety. Games usually solve this by using a map. Consequently, a map for the course was developed (Figure 3). The map also made it possible to cut a lot of text in the course instructions.

Figure 3
A course map of how to progress throughout the course
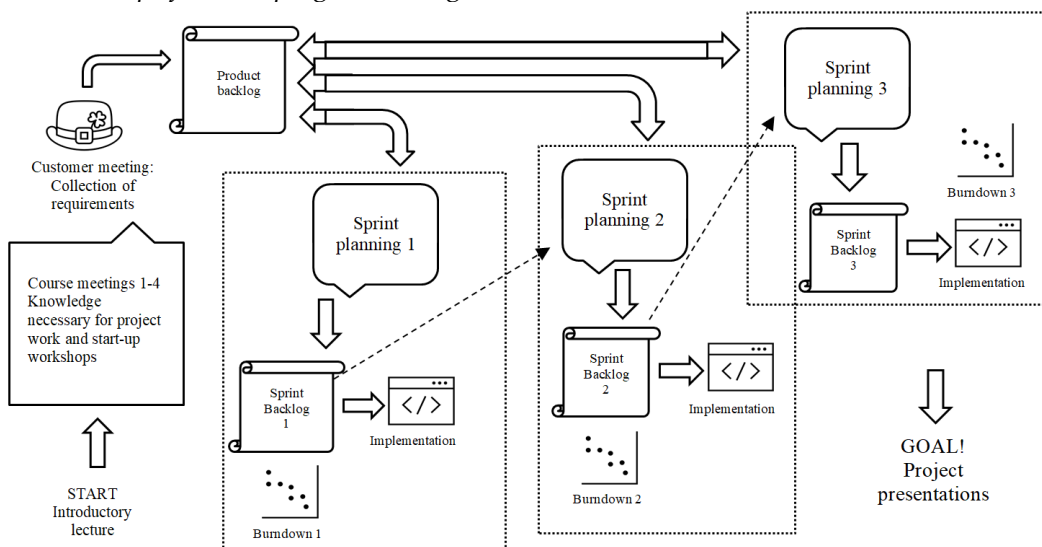
6.5. Extrinsic Motivation

Extrinsic motivation relates to finishing something and getting a reward. When implementing gamification in the course, I wanted to also implement a reward. However, that was not possible. I wanted to be able to assess the project work on the basis of the completed goals and the gathered "score". For example, if the majority of the meetings and artefacts were assessed with a plus, the project grade should be pass with distinction, or if the majority of the meetings and artefacts were assessed with an ok, the project grade should be pass, i.e., to let the gathered "scores" influence the project grade. However, this could not be implemented this year as it required a course plan change. According to the existing course plan for the course round of 2022, it was only possible to pass or fail the project. Hence, I could not implement any reward in the form of a higher project grade this year. For the course round of spring 2023, it will be possible, since the necessary course plan changes have now been implemented.

7. Evaluation of Implementation

In the previous section, the implementation of gamification was presented and discussed in relation to the identified problems and the expected results. The question to answer now is, did it work? Were the problems solved? In the course evaluations automatically sent out to students in the last week of the course there is always a question about how the students rate the course (overall) on a scale from one (very bad) to five (very good). Table 4 shows how the students rated the course in the evaluations from the year 2011 to the year 2022. In the last row of the table is this year's evaluation.

Table 4
Student's rate of the course 2011–2022

Year	n	# of students	Response rate	1	2	3	4	5	Median
2011	18	55	32.7%	0%	0%	5.6%	72.2%	22.2%	4
2012	16	44	36.4%	0%	6.3%	18.8%	50%	25%	4
2013	15	70	21.4%	6.7%	0%	40%	46.7%	6.7%	4
2014	25	95	26.3%	0%	4%	24%	28%	44%	4
2015	27	81	33.3%	14.8%	11.1%	22.2%	40.7%	11.1%	4
2016	12	65	18.5%	33.3%	25%	0%	33.3%	8.3%	2
2017	24	88	27.3%	4.2%	12.5%	16.7%	62.5%	4.2%	4
2018	12	90	13.3%	0%	0%	50%	41.7%	8.3%	3.5
2019	19	134	14.2%	0%	0%	15.8%	52.6%	31.6%	4
2020	15	122	12.3%	6.7%	26.7%	33.3%	26.7%	6.7%	3
2021	21	114	18.4%	9.5%	23.8%	23.8%	28.6%	14.3%	3
2022	14	93	15.1%	0%	7.1%	7.1%	28.6%	57.1%	5

As can be seen in the table, the response rate is very low for most years and especially for the last few years. Therefore, these figures can only be considered indicative of how students experience the course. Additionally, during this period, changes have been made and it has therefore not been exactly the same course throughout the years; different teachers have been involved, assignments have been modified, etc. In essence it is the same course, but with slight modifications. The figures in the table should be read with this in mind and conclusions should be drawn sparingly from these data. Nevertheless, it is quite clear that the course was appreciated in 2022. Together, rating four and five represent 85.7% of the students who answered the course evaluation survey. That is a high figure. This is also reflected in the median of five in 2022. Previous, it has varied from two to four. In the early years, the course usually had a median of four, while in the later years (before 2022) the median varied. The year 2022 has the highest scores of all. None of the students rated the course as one and the majority rated it as five.

Year 2016 stand out. In 2016, we implemented an individual assignment to address the problem of uneven workload in the project teams, i.e., that some students do less and others more. This

assignment received heavy critique for not being well thought through, which is a possible explanation for the low grade. The 2018 median is 3.5. This value, and all other values, are taken directly from the course evaluation. It is strange that it is not an integer, but this is the number given in the course evaluation.

7.1. Feedback and Outcome in 2022

The course evaluation for 2022 had more questions than the usual course evaluation survey. Besides grading the course, the students also rated the project assignment (the story and its characters) (see Table 5).

Table 5
Results of the 2022 course evaluation

Question	1	2	3	4	5	Median
To what extent do you feel that the course as a whole enabled you to meet the course's goals?	0%	0%	23.1%	23.1%%	53.8	5
How do you rate the course as a whole?	0%	7.1%	7.1%	28.6%	57.1%	5
How do you perceive the workload during the course in relation to the number of higher education credits?	0%	14.3%	35.7%	35.7%	14.3%	3.5
How has the interactivity between teachers and students worked during the course?	7.1%	7.1%	7.1%	7.1%	71.4%	5
How has the interactivity between students worked during the course?	0%	7.1%	14.3%	7.1%	71.4%	5
My assessment of the first week's course meetings	0%	7.7%	23.1%	30.8%	38.5%	4
My overall assessment of the project task	0%	0%	7.1%	28.6%	64.3%	5
The course meetings were relevant to the project work	0%	14.3%	14.3%	21.4%	50%	4.5
It was clear what was expected of me during the course	0%	14.3%	14.3%	14.3%	57.1%	5
The performance requirements in the course were reasonable	7.1%	0%	14.3%	42.9%	35.7%	4
The course developed my understanding of agile methods	0%	0%	7.1%	21.4%	71.4%	5
The teachers made an effort to make the subject interesting for us	7.1%	0%	0%	21.4%	71.4%	5
My assessment of the method seminar	14.3%	7.1%	35.7%	28.6%	14.3%	3
My experience of the visit by Integration Company Sweden AB	0%	0%	7.1%	42.9%	50%	4.5

For the question of how rewarding the students thought that the project assignment was, 64.3% rated it as five, which represents very rewarding. It is, consequently, clear that those who answered the survey appreciated the project. The majority of the students also thought that it was clear what was expected of them during the course. A total of 57.1% answered five to this question, which represents that they completely agree that the expectations were clear. None answered one, which represents completely disagree. Most of the students agreed that the course developed their understanding of agile methods, as 71.4% answered five to the question, which represents completely agree. For the question of how the interaction between the students and the teachers was, the majority (71.4%) of the students answered five. The course meetings can still be improved, as well as the method seminar. The median for the course meetings is four and for the method seminar three. Questions with the highest ranking are marked. As seen, these are questions related to interactivity and learning, both important concepts related to gamification.

What the numbers one to five represent varies for the questions; the statements match the formulation of the question. For example, for the first question, one represents "To a very low extent", and five represents "To a very high extent". The negative responses are always on the left side and the positive always on the right. Hence, a high number is good for most questions. One exception is the question related to the workload. On the left side, the statement is "very low" and on the right side the statement is "very high". Ideally, this should have a value around three. The median here is 3.5, thus the students experienced the course to have a reasonable workload. Given the low respondent rate, the numbers are indicative, however they are supported by feedback that the teachers received from the students during the course. Several of the students expressed, at the course meetings, that they were happy with the course. Additionally, in the free text of the course evaluation, there was overall positive feedback, for example:

> "I think it has been a very fun and educational course. Feels like it was a good balance between building the system itself and following the principles of Scrum and XP."

> "Fun course where you practiced the methods studied, which was useful. A good balance between the different parts."

> "Really fun and rewarding course where you got to learn a little about how it really works in working life. I thought it was really fun and useful to work in a larger development group with eight other students and it was also instructive to follow the agile system development approach."

> "Incredibly fun course, the funniest so far on the program. The only 'negative' thing I have to say is that, in my opinion, either the exam or the report would have been enough. It felt a bit too much to write a report in the middle of the project. However, I understand that it has a purpose."

As can be seen in the quotes above, the students are happy with the course, and clearly most problems seem to have been solved. The last student quote, however, states that an assignment in the middle of the project work is too much. Regarding previous criticism and problems raised, no one complained about the project this year. There was still one comment saying that some students tag along, hence this problem still exists, and it is really difficult to address. There was also a comment that it is bad that it is not possible to get pass with distinction on the project, but this will be implemented in 2023. Otherwise, there was no criticism related to the other problem areas presented in Table 1 (see 6.1) and the comments were overall positive. To be very clear, two problems still exist and if updating Table 1 with this year's outcome, two areas would have to be marked: Examinations and Groupwork/student ambitions.

As described in the Method section, in the last week of the course, the students were asked to participate in a Kahoot quiz. This was not in a course meeting since the last week of the course only has one, and it is dedicated to project presentations. Hence, they were asked to voluntarily show up to play a Kahoot together, and many did. Out of 93 students, 43 participated. This says a lot. Games are usually a free activity, people play them because they like doing so. This was also a free activity, and many participated. They were asked to take a quiz, which can be seen as an extra exam, but they did not seem to perceive it that way, they rather treated it as a fun activity.

In the quiz, there were first ten questions aiming to test their knowledge of agile practices (for more information, see Appendix). Of the 43 students who came, the quiz was completed by 34 players. Together, the 34 students had 68.8% total correct answers. This gives some more feedback about their learning. Table 6 shows the students' results. The most common result was to get eight questions right, which nine of the 34 students did. One student got all the questions right. The reason for the high average score values is how Kahoot works. The participants have to answer the question within a time frame and the faster they answer the more points they receive.

Besides solving the problems in the course, the aim of the redesign was that the students should experience the course as fun and learn a lot. Two poll questions were therefore asked to see if these goals were fulfilled. In the first poll question, the students were asked if they thought that the course was fun. Half of the participating students answered very fun, 44% answered fun and 6% answered very boring. None answered boring. In the next poll question, they were asked if they had learned a lot throughout the course. A total of 21% answered very much, 50% answered much,

Table 6
Student scores in Kahoot

Correct answers	# of players	Average score
10	1	8467
9	3	7675
8	9	7065
7	8	6160
6	6	5214
5	5	4272
4	2	3469
3	0	-
2	0	-
1	0	-
0	0	-

18% answered little and 12% answered very little. However, it is really difficult to draw any conclusions. As stated, from the start, 43 showed up for the Kahoot, but nine did not finish the quiz. This shows that 79% wanted to take part in the quiz to the end. Hence, students seem to like quizzes. To answer polls is another matter. Table 4 clearly shows that the students are not interested in answering course evaluations, as very few do so. In the Kahoot, when the first poll question was asked, half of the students did not participate. Consequently, the first poll question was answered by 17 students. The second poll question was answered by only 7 students, i.e., 16% of the students who were present. This is interesting. I believe it strengthens the view that students do not participate if they do not think it is fun.

My experience as a teacher is that there was a major change in 2022 compared to previous course rounds. The meetings were much more prepared, the students played along in the role play and the quality of the developed systems was high. I share this view with my colleagues. Here is a quote from one of the other teachers: "You did a marvellous job with the course; it was really fun to teach it this time".

One of the student groups also handed in an invoice to one of the teachers at the end of the course, which shows that they participated in the role play. It reflected costs for the system development and it was addressed to Otto and Judith and looked very realistic. The amount? 611,754 SEK.

8. Discussion

As presented, the agile methods course became more and more difficult for us teachers to give over the years. There were several reasons for this, including the increasing number of students and the ad hoc solutions implemented. This was reflected in the students' view of the course. In the first years, they recognised that there were problems but they liked the course despite this. At the end of the studied period, the course declined in popularity, generating diverse ratings in the course evaluations.

When redesigning the course, it was very important to avoid ad hoc solutions and instead have a careful and well thought through process. Gamification helped with this. According to Kapp (2012), every part of a game is connected. The system aspect builds on the idea that each part impacts and is integrated with other parts of the game. Scores are linked to actions, and actions are limited by rules. It is a whole, not separate parts. Hence, gamification made me look at the course's different parts as parts of a gamified system, so instead of focusing on solving individual problems I developed a cohesive design. Storytelling provided the frame, the case and the characters, and it aided the necessary role play. Furthermore, it made the course fun and inspiring, both for teachers and students. The focus on happenings during the "game" created the increased interactivity needed, and hence contributed to addressing much of the critique. That there were events between the sprint meetings also made it clear to the students that the teachers were committed and

engaged. The necessary clarity related to the examinations and the course structure was achieved through the developed scoreboard (the matrices). It is thus not possible to say that the most important part was one or another. It was the parts together, and how they fit together, that made the difference. Gamification was of help in that sense when developing the design.

Using gamification emphasised the importance of fun, entertainment, progress, fairness and clarity. All of which are very important aspects of course design. According to Kapp (2012, p. 12), "Gamification can be used to promote learning because many of the elements of gamification are based on educational psychology and are techniques that designers of instruction, teachers, and professors have been using for years. […] The difference is that gamification provides another layer of interest and a new way of weaving together those elements into an engaging game space that both motivates and educates learners".

I completely agree. It is evident that both the students and the teachers appreciated the changes made to the course. It is important to reflect upon what would have been the result of the redesign if gamification had not been used? The answer is impossible to know, but the question can be reflected upon. A lot of effort was put in to writing a new case (a story), rewriting the project description, rewriting the study guide, developing scenarios, assessment criteria, etc. If the same amount of effort would have been put in without using gamification, it would probably have had a positive impact as well. However, gamification provided guidance in the design of all changes. Gamification is a creative way of working with course design. Games have an emphasis on human motivation and a long history of learning to master motivation and engagement. There is thus a lot to learn from games that can benefit education.

The potential is big but could be limited with the wrong interpretation of gamification. Huang et al., (2020, p. 1893) wanted to find out "which gamification design features work and under which circumstances". I think this is not the right way of looking at gamification in education. Gamification should be used to guide the creation of a whole rather than contributing with mere parts. According to Mora et al. (2015a), "many gamification-based solutions fail because, mostly, they have been created on a whim, or mixing bits and pieces from game components, without a clear and formal design process". Furthermore, "a big effort is required from the very design to the implementation and deployment of the experience" (Mora et al., 2015b). In this study, this was evident; the contribution of using gamification in the redesign was the connectedness, not the parts but the system aspect.

Gamification relates strongly to motivation and the best motivation is a combination of all three types of motivation: intrinsic, achievement and extrinsic motivation. Those will not come from the implementation of individual game elements. The reason for the focus on elements likely relates to the commonly used definition: gamification is the use of game design elements in non-game contexts. Does that definition work for gamification in education? For gamification with a business scope in mind, for example in app development, it is probably a useful definition, but not for education. Kapp (2012) has proposed a different definition: "Gamification is using game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems". This definition has, however, not had a wide uptake in research. I believe that it may be too long and complicated. I suggest a new definition: *gamification in education is the use of game thinking in the design of learning environments*. The proposed definition highlights the need for game thinking instead of a focus on game elements, and it also places an emphasis on the need for design, to carefully think things through. The framework developed in this paper can be used to guide the design of the learning environment (Figure 2 in 6.2).

It is interesting to elaborate further on Huang et al.'s (2020) study. It is a recent study that says something about how gamification is looked upon in current research. There seems to be a focus on trying to reach some sort of consensus regarding effectiveness in different circumstances. I believe this is problematic. There are so many variables involved: diverse academic subjects and courses, various levels of education, diverse implementations (narrow, broad, well-designed, poorly implemented), unique students with different learning styles and unique teachers with

different teaching styles. How should you know which factor has an impact? This problem has been recognised when previously trying to evaluate effectiveness in other learning situations. According to de Freitas (2017), defining efficacy in an educational context can be challenging because of the range of variables involved. The fact that studies focusing on the effectiveness of gamification show contradictory results is thus not strange. Focusing on a general effectiveness of gamification limits the potential. Importantly, Huang et al. (2020) are not alone. Many researchers have called for studies examining whether gamification in education is effective or not (Dicheva et al., 2015; Huang et al., 2020; Mohammed & Ozdamli, 2021; van Roy & Zaman, 2018). Effective in what sense? Again, the biggest contribution of gamification in this study was the guidance in creating a design that was cohesive, not fragmented. That, and the creativity, was the major gain.

According to Kapp (2012), "Learning professionals must understand the growing trend of applying game-based sensibilities to the development of instruction through creating time-based activities, leveling up of learning experiences, storytelling, avatars, and other techniques […] learning and development professionals must follow that trend or be left behind". I both agree and disagree with the last statement. Learning professionals must be responsive. Learning professionals need to have a variety of tools, a large toolbox, and a sense of which tool to use in which situation. A hammer will never do a good job of sawing, and a saw is not very good when you want to hammer in nails. There are no silver bullets that work in every situation. There are tools that can be used, which may be beneficial if they are right for the situation and used in a good way. Gamification is one such tool.

The course in which gamification was implemented in this paper is ideal for it and it therefore worked. There must be a fit, a natural way to integrate gamification, a place for storytelling, a place for role-play, for challenges, etc., because gamification should be regarded as a concept rather than a collection of game elements.

Gamification in education has received attention because of the wish to transfer the motivational effects of games to the learning situation. The best motivation comes from a combination of all three: intrinsic, achievement and extrinsic motivation. Important though is to avoid a too strong focus on extrinsic motivation. This has also been raised as a critique of gamification, as some critics argue that gamification can be manipulative and that it can exploit people's desire for rewards (Werbach, 2014). Others argue that gamification can be superficial and that it can fail to address the underlying causes of a problem (Hung, 2017). Furthermore, if gamification relies on simple rewards and points systems, it can be effective in the short term but lose appeal over time (Hung, 2017). As presented in the introduction, a strong focus on rewards can result in counterproductivity. In this study, gamification was carefully implemented in relation to extrinsic motivation. Another aspect is that a focus on points can distract from the task at hand. In the planning of the redesign of the course, I thought of an individual bonus system handled by the teams themselves. However, I dismissed this idea as I realised that it could create a distraction from the real task. Critics of gamification have also said that gamification can be seen as a distraction. Adding game elements to a task can make it fun and engaging, but it can also be distracting and take people's attention away from the task at hand (Kim & Werbach, 2016).

8.1. Contributions and Limitations

The contributions and limitations of this study are related to the same aspect. This study and the redesign of the course have laid the foundation for future work and research. The study could be criticised for looking too much at the whole and thus not analysing the outcome in greater depth. Course evaluations answered by relatively few students were used for the analysis. It is, of course, a shortcoming. The response rate varies over the years. Therefore, what the students express in the course evaluations, and how the students rate the course, is based on a relatively small sample of the students taking the course. Consequently, one very optimistic student has quite a large impact as well as one very negative. A further thought is that students who have strong opinions are also the ones who express their opinions. This should be considered when reading the results. It is

important to acknowledge what the data can be used for, as well as what the data cannot be used for. Statistical analyses are not possible, as the response rate is too low and the course has not been given exactly the same way since its inception; it is not really comparable in that sense.

This is not the purpose of this study either. The purpose is to show the development of a course over a long period, the problems raised during this period, what could be done to address these problems, and how a redesign can be carried out with the guidance of gamification. For that, the data can be used. Analysis of course evaluations help us to get a picture of the outcome on the whole. In future studies, it would of course be interesting to follow up the results in more depth through, for example, interviews. However, the contribution of this study is not to say 'do this and you will get this outcome'. On the contrary, it is intended to be inspirational, to show that it is possible to bring about major changes with a well thought through course design. The developed gamification in an education framework (Figure 2) can be used to guide the design of the learning environment, and the proposed new definition can be used to guide the view of gamification in education.

Hence, the contribution to research and practice is to show how gamification can be used to redesign courses, creating a gamified design that is good both for the students and the teachers. This year it was easy and fun to be a teacher in this course, something that is probably reflected in the course evaluation as well.

9. Conclusions

The research question asked is: What is the result of redesigning a system development methods course using gamification? The answer is a course that the students experienced as fun and educational, a course that received the highest marks from the majority of students in the course evaluation, as seen in the survey responses to most of the questions. Hence, previous problems were solved and students seemed to be much more motivated.

Gamification is a creative way of working with course design, it is a way of thinking outside of the box and finding new solutions to problems that have previously been difficult to solve. Gamification, interpreted correctly, also highlights the need for a holistic approach rather than looking at individually selected parts. This is achieved through the important system aspect. The contribution of this study is an example of an implementation of gamification in education using game thinking instead of a focus on game elements. It is also an example of an implementation addressing all three levels of motivation. Motivation is important in education: it is the foundation of learning. The developed framework, the presentation of the implementation and its evaluation provide an example that can be used as inspiration. A limitation of the study is that it is comprehensive, and thus focuses more on the whole than on studying details in greater depth. However, that was also the aim of the study. Future gamification studies should have a broader outlook and implement, evaluate and present lessons learned, because there can never be too much inspiration or insights.

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Appendix. The questions asked in the Kahoot quiz

What is a sprint planning meeting?
- A meeting where you plan how many sprints you will have in the project
- A meeting where you and the customer plan the upcoming sprint
- A meeting where the planning of the upcoming sprint is presented to the customer
- A meeting where it is decided how to carry out sprints during the project

Planning poker is used for time estimation?
- True
- False

Who can make changes in a sprint backlog?
- Only the team
- The team and the customer
- The team and the product owner
- The team, the customer, and the product owner

Velocity is measured in how many story points are managed during a sprint?
- True
- False

What should be prepared for a sprint planning meeting?
- The scrum master should have decided the goal for the sprint
- The team must have calculated how much time they have for the sprint
- The team must have selected user stories to be included
- The scrum master must have selected the user stories to be included

Developing 40 hours a week is ideal?
- True
- False

Continuous integration is important to?
- Continuous integration of new members in the team (grow)
- Regular integration of code, only one code base
- Regular social activities to integrate customer and team
- Regular integration between different product backlogs

A daily scrum is ideally a 30 minutes long meeting?
- True
- False

What does it mean to be "buried in sand" in an agile context?
- To take a necessary break (parable, the beach)
- Too many demands at once
- That the tasks are too big, weighs down
- That the tasks are far too small and too many

It is enough to only demonstrate the system during a sprint review?
- True
- False