Feedback Through Games - Research, Design and Evaluation of Online Survey Gamification

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HCI Specialization

Summary

Dette er et specialeprojekt, med specialeretning "Human Computer Interaction" med emnet gamification af spørgeskemaer. Dette 10. semester projekt er en fortsættelse af et 9. semester projekt med samme fokusområde. Projektet er lavet i kontekst af Aalborg Universitet, med samarbejde fra Datalogisk Institut.

Det er et problem at folk modtager en masse spørgeskemaer, uden meget motivation for at svare på dem. Dette fører til generelt lave svarrater eller lav svar kvalitet, eksempelvis gennem at deltagere svarer spørgsmål forhastet eller tilfældigt. Dette problem kan opstå af flere forskellige grunde, nogle af de oftest nævnte grunde er "survey fatigue", effekten af at deltagere føler sig overvældet og udmattet af mængden af spørgeskemaer, hvilket resulterer i at deltagere ikke har lyst til at svare.

I løbet af dette projekt er der forsøgt at øge folks motivation og lyst til at svare på spørgeskemaer ved at anvende gamification, et koncept hvor man benytter spil-elementer til at øge folks interesse og nydelse af ikke spilrelaterede aktiviteter. Der blev udarbejdet et IT artefakt i form af et spil, der kan spilles på PC, med en integreret spørgeskema del, som tillader spillere at svare på et spørgeskema, som en del af spillet.

Emnet er undersøgt gennem en Action Design Research tilgang, hvor der blev gennemgået i alt 3 Build-Intervene-Evaluate cyklusser. Hver cyklus indebærer en udviklingsfase, hvor produktet udvikles og arbejdes på. Dette er efterfulgt af en 'intervention' fase, hvor produktet aftestes på den kontekst som den forventes at bruges i. Til sidst evalueres der på resultaterne fundet i interventionen, hvorpå der reflekteres over hvad der er blevet lært, samt hvilke ændringer der skal arbejdes på til næste cyklus.

I første cyklus blev der udviklet det generelle fundament for et spil, hvor spillere ved at styre en karakter på skærmen skal skiftevis skyde monstre og svare på spørgeskema spørgsmål. Interventionen foregik med studerende som blev inviteret til individuelle spil sessioner, efterfulgt af semi-strukturerede interviews om deres spiloplevelse. Den resulterende feedback var at det spil-baserede spørgeskema var sjovere og mere interessant end traditionelle spørgeskemaer, men selve spørgeskema besvarelsen, bør føles mere som en del af spillet, og give en mere spil-lignende oplevelse.

Anden cyklus involverede en udvidelse af spørgeskema delen af spillet, hvor selve det at svare på spørgsmålene blev gjort til en mere integreret og udfordrene del af spillet. Dette blev igen evalueret gennem individuelle spilsessions og interviews. Den resulterende feedback

her var fokuseret på mange specifikke detaljer omkring spillet og mulige tilføjelser, samt at spillere ønskede mere variation i deres spil, men det spilbaserede spørgeskema blev generelt anset som et mere interessant alternativ til traditionelle spørgeskemaer.

Tredje cyklus involverede to større interventioner af systemet, hvor det blev gjort muligt at dele spillet med deltagere gennem et link, samt gemme deres svar, således at der kunne samles svar fra mange individuelle deltagere. Første test blev udført til en semesterevalueringssession, hvor studerende blev inviteret til at samlet svare på et semester evalueringsskema. De der deltog blev inviteret til efterfølgende at afprøve det gamificerede spørgeskema. Den anden test i denne cyklus involverede at det gamificerede spørgeskema blev sendt ud via e-mail til alle studerende på 6. semester af Software uddannelsen, hvorpå 41 ud af 101 studerende som minimum afprøvede spørgeskemaet. Resultaterne fra disse interventioner og evalueringer tyder på, at selvom spil-baserede spørgeskemaer er et sjovt alternativ for nogen, vil der også være flere som foretrækker det traditionelle spørgeskema. Derudover kan leveringsmetoden også betyde en del, da det tyder på at mange af dem som spillet er udsendt til ikke engang har åbnet det gamificerede spørgeskema.
Det endelige resultat er 5 designprincipper som fremtidige forskere og designere kan anvende som praktisk basis til at gamify spørgeskemaer.

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Abstract:

Surveys are a common tool to quickly and easily gather information from groups of people. A lot of people are used to getting surveys often, from multiple sources in multiple contexts. It is common for recipients of surveys to not be interested in the surveys they receive, or be fatigued by the number of surveys one receives on a regular basis, making it difficult for the surveyors to get a satisfying number of answers. At the Computer Science department at Aalborg University, semester evaluation surveys are sent out each semester to get the students' feedback on the current state of the study program. The answer rates are considered unsatisfying, however. This report describes a project, which attempts to alleviate this problem through the use of gamification of survey. Action-Design Research was applied in order to develop an IT artefact in the form of gamified survey as an alternative to the traditional semester survey. Through three iterations, this gamified survey was refined based on data and feedback. The intended primary contribution is a set of design principles, which can help guide future attempts to gamify surveys.

Preface

This report was formed by 10th semester group cs-23-hci-10-14 of the AAU Computer Science department.

The theme of this report acts as a continuation of this groups former project work, centred around gamification of surveys to increase motivation and response rates. The project focused on improving the survey experience for the Computer Science department of Aalborg University, who reported the overall survey participation rate was less than desired, forcing the department to maintain the status quo, as there is not enough feedback to evaluate. The goal of the project was to design and develop an alternative survey medium that uses elements of gamification in order to entice and motivate students to submit feedback on their study experiences, issues or approval. [1]

The initial project was conducted using Action Design Research in order to progressively iterate upon a collection of design principles that serve as the founding basis for an effective gamified survey. Over the course of two design iterations and prototypes, a set of design principles was proposed but remained unrefined and untested in the desired context of the study department.

This report uses the AMA citation method. Sources are categorised in a bibliography at the end of the report, with in-line citations made with a digit encapsulated in square brackets, representing its entry in the bibliography:

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A huge thanks to our project supervisor John Stouby Persson for his guidance for this project, as well as to Ulrik Nyman, head of study for the Computer Science Department at Aalborg University, for his assistance throughout the project.

Contents

1. Introduction

Within the field of research, data collection and data processing are vital to form foundations and conclusions. The information acquired from examinations, tests and experiments broaden our knowledge of the world.

One of the most challenging research fields is analysing and examining people. With every person being physically, psychologically and personally unique, it is nearly impossible to assert claims that are true for everyone.

A field-tested method of obtaining personal experiences and information directly from people is through surveys. Surveys allow for quantitative information gathering on many individual people, as they are easy to distribute and gather. Depending on the method of distribution, one may be able to collect information on millions of people. Many organisations use surveys to gather knowledge about their employees' well being, as well as work environment, such that they can improve it. Researchers may also use surveys to gather relevant feedback or investigate peoples' opinions on relevant areas.

Surveys have some limitations that can affect their effectiveness. Some limitations of surveys are that the survey is restricted to its content, and so it is challenging to deduce additional data from the static questions and answers in the survey.

Another limitation is the desire or incentive to complete surveys. People are generally disinterested in participating in surveys, for various reasons. This can drastically impact how much information can be gathered by distributing surveys. Incentivising people to complete surveys can be a way to alleviate this, such as promising rewards for completing them.

Having an incentive or motivation to do tasks is an important aspect of many areas, such as learning or working. One way to generate motivation is through 'Gamification', the act of incorporating game-rules or elements into non-game activities. Practical examples include granting points, achievements or badges when performing tasks, or to formulate a theme or story within the activity. Gamification seeks to make a task or activity more entertaining, in order to motivate its users to perform or complete them.

This report takes a different approach to encourage survey participation. By presenting the survey through a game, it can potentially motivate more people into participating in the survey. This is formulated as the initial question of this report:

How can gamification increase the motivation to participate in surveys?

2. Theory

This chapter presents and details the knowledge that forms the theoretical basis for the themes of the project.

2.1 Surveys

One of the main focal points of this project is surveys. A survey is a list of questions with the goal of collecting data from individuals. A series of compiled questions are distributed to target audiences in order to obtain personal experiences and opinions. One of the most well-established methods to collect primarily quantitative data is through surveys. [2]

The response rates for a survey, are an important factor for determining the value of the findings of the survey. If the response rates are too low, the risk of getting biases in the results is high, although any level of non-response for a survey, can cause problems. Research disagrees as to what exactly the ideal response rate would be, although, numbers in the range of 60-80% have been suggested. A study looking into response rates of several surveys, suggests an average response rate on surveys, aimed at individuals, such as employees, managers and the general population at 52.7%. [3] The rest of this section will discuss problems with surveys, and what might cause low answer rates, as well as approaches taken to try and alleviate them.

2.1.1 Survey 'Speeding'

Speeding, closely related to *straightlining*[1], is a term that refers to the act of hastily and heedlessly fulfilling survey questions with little to no consideration of the content. Speeding can negatively, and subtly, affect the overall quality of the survey results, as the answers become disingenuous and imprecise. Speeding can be hard to detect, as it requires active observation of the participant fulfilling the survey, and some participants may simply answer faster or slower, even if they fully consider the survey content. There is no guaranteed method to eliminate speeding, but some precautions can be taken, such as reducing the number of questions per page to reduce fatigue or alerting participants if they are answering very fast. Some research suggests that certain characterised groups, such as younger participants, are more likely to speed in surveys. [4, 5]

[1] The act of selecting identical answers in a matrix of survey questions.

2.1.2 Survey Fatigue

One phenomenon which can lead to low response rates is survey fatigue. Survey fatigue is when survey respondents become disinterested in answering surveys, due to too many questions, questions being too long, or the participants feeling overburdened by surveys. Survey fatigue can lead to unanswered or only partially fulfilled surveys, or surveys with lower quality answers, as respondents who are fatigued are likely to start speeding, straightlining, or similar behaviour [6]. There can be multiple reasons for survey fatigue, and ways to combat it.

Participant Salience

One reason participants are likely to experience survey fatigue, is if they feel there is insufficient relevance in the surveys presented to them. Often, time is cited as a reason why participants are not answering surveys. Participants are less likely to want to find time to answer the survey, if they do not feel like the survey is interesting, or relevant to them. [6]

Reminding Participants

Studies suggest that reminding participants to do surveys, can help with the response rates. Sending direct reminders to intended participants, through multiple different channels have proven to increase response rates. [7]

Incentives

Offering incentives to participants have also been proven to be effective. The most effective seems to be offering a direct, monetary reward is the most effective, however, offering lottery tickets also has an effect. [8]

Micro Surveys

One attempt at solving survey fatigue, is to use micro surveys. Micro surveys are very short surveys, generally one to two questions. Micro surveys also has the advantage of being low cost to create as it is not necessary to create as many questions as with a larger questionnaire. One case of micro surveys being used, is with Google Consumer Surveys **(GCS)**, a system which allows researchers to design and distribute micro surveys from twelve different question templates.

Question Type	Usage	Completion Rate
Multiple answers	62.04%	20.56%
Single answer	21.71%	39.37%
Open ended	4.62%	27.03%
Rating	3.81%	34.19%
Numeric open ended	1.60%	25.30%
Rating with text	1.50%	34.09%
Rating with image	1.30%	27.20%
Large image choice	0.99%	28.49%
Side-by-side images	0.92%	29.37%
Image with menu	0.82%	36.57%
Open ended with image	0.68%	27.29%
Two choices with image	–	–

Table 2.1: Question types from GCS and their completion rate

Table 2.1 shows statistics for usage and completion rate for the different types of questions offered in GCS. Notable in this table, is that despite *multiple-* and *single answer*-question types making up over 80% of question-type usage, *multiple answer* questions still has the lowest overall completion rate. Single answer questions has the highest completion rate. [9]

2.1.3 The Psychology of Survey Response

There has been a lot of research into how people perceive surveys and interact with them. One of these is Cannell's process theory, which states that a respondent goes through four cognitive stages when interacting and answering a question in a survey. These cognitive stages are:

- **Comprehension**: involves understanding the survey questions and the context in which they are asked
- **Retrieval**: involves retrieving the required information from the respondent's memory.
- **Judgement**: involves deciding how to answer the questions and formulating a response.
- **Response**: involves providing an answer to the survey questions.

Understanding these four stages of survey response is essential for creating surveys that result in accurate and engaging answers. [10]

2.2 Motivation

A big part of what causes survey fatigue and disinterest in surveys is a lack of motivation and incentive. Motivation is a process to stimulate entities to behave or act in certain ways.

It can be interpreted as energised behaviour towards action and change [11]. Motivation is a 'force' that inherently compels one to accomplish and improve.

John W. Atkinson describes achievement motivation, a motivational drive to overcome challenges and achieve goals, as a factor between the following concepts:

- **Success Approach** - a tendency to approach and pursue successes, with consideration of success probability
- **Failure Avoidance** - an aversion to avoid failures and negative outcomes, with consideration of failure probability

This, combined with a positive extrinsic tendency to perform a given activity, makes up the overall motivational factor for accomplishing achievements [12][13].

While motivation can be defined in many ways, it can be generally categorised under two overall types, shown in table 2.2.

Intrinsic	Extrinsic
Motivation driven by enjoyment, challenge and self-interest.	Motivation driven by external factors such as rewards or punishment for (not) completing an activity.

Table 2.2: Types of Motivation[14]

Being intrinsically motivated means that the inherent challenge and/or fun in a given activity drives one to act or continue. Meanwhile, being extrinsically motivated means that some form of reward is expected for completing an activity, or potentially a punishment for not completing it [14]. Universally, there is no common source of motivation, as individuals have unique aspirations and motivational factors, and people may be more motivated by one type of motivation than the other.

2.3 Gamification

Gamification is the act of enhancing activities, services, tasks, etc., by applying game-elements, such as rules, goals, challenges and feedback to these experiences. The express goal is to create or add entertainment and enjoyment, which leads to increased motivation towards the given experience.
Gamification can be achieved through various means. Well-known examples are incorporating concepts such as competition through leaderboards, personalisation through avatars and badges, or engagement through story and narrative. The extent of gamification is very diverse, and nearly any level of implementation of game- elements or mechanics can be considered gamification. [15] A distinction is made between an experience or activity with

game-elements incorporated, called "Soft Gamification", and games that incorporate the activity or experience directly within the game, known as "Hard Gamification" [16]. Generally, there are many different ways of defining gamification, its categories and variations, and the exact definition and terminology varies from instance to instance. This section presents different definitions and terminologies relevant to the subject.

Gamification is often applied in educational contexts, where the learning outcome is essential. Schools can use gamification in the classroom to increase student motivation and interest in given topics. [17]

2.3.1 Serious / Applied Games

Serious- or **Applied Games** are games that have express purposes beyond entertainment. Clark C. Abt describes the concept of Serious Games as "games which have an explicit and carefully thought-out educational purpose and are not intended primarily for amusement." [18]. Essentially, it is the idea of turning an activity with an practical outcome into a game. For this project, 'Hard Gamification' is used as a synonym for Serious Games.

Games as a medium for education and learning can be powerful, as they innately provide entertainment for the user. A well-designed game can captivate players and gain their full attention [19]. This, in optimal situations, can lead to users unintentionally reaching the intended learning outcome without even realising it. Serious games see applications in a variety of contexts. Examples include profession training, Virtual Reality, cognitive training and language teaching. [20]

A direct example of a serious game is *Minecraft: Education Edition*. This altered version of the popular sandbox game incorporates the learning of traditional school subjects, like chemistry and math, as well as systems to aid in the inclusion of the class students, through the use of virtual classrooms. Their goal with this game is to teach standard subjects through a digital medium where students can expand their capability of problem solving and critical thinking. [21]

2.4 Gamification Applications

Gamification sees applications within many fields, as their potential effects are appealing and powerful. The following section details practical applications of gamification in various areas.

2.4.1 Gamification of Online Surveys

This section describes several applications of gamification within online surveys.

Framework for Gamifiying Surveys

Harms et al. [22] has researched several approaches to gamify the online survey experience. In one study, they propose a process framework around gamifying surveys, using the Mechanics-Dynamics-Aesthetics **(MDA)** framework which is used to analyse games [23]. This is done by combining the MDA framework with the form design layers of *Relationship*, concerning the users, tasks, context and the form schema, *Conversation*, a user's interaction with the survey or questionnaire, and *Appearance*, the visual appearance of the interface. The goal is to provide a well-structured process plan for gamifying an online survey.

In a second study, they validated the effectiveness of this framework by creating a gamified survey centred around sports, using this design process. The game was a virtual environment where a participant could create an avatar and freely select an activity that would contain a given survey question. The activities consisted of mini-games which served as the method of response to a related question. For instance, a football mini-game had the player kick a ball onto their desired single-choice answer. Another instance would have the player throw a javelin to provide an answer on the Likert scale[2]. The results on N = 60 participants showed that players reported increased enjoyment and time spent on average on the experiment, but had a lower overall response rate, compared to a conventional survey. [24]

Issues in Gamified Surveys - Literature Review

Keusch and Zhang [25] performed a systematic review of various gamification implementations used in surveys. They also utilise the terms Hard- and Soft Gamification to differentiate between an activity presented as a game, and an activity with embedded game mechanics. Their review of existing research finds several repeating design elements within gamified surveys.

1. Clear rules and goals for the respondents during the activities
2. Narrative screenplay and/or story to act as motivation
3. Tasks or challenges to assess the respondents skill, effort or luck
4. Feedback and rewards to the respondent's actions
5. Attractive aesthetic designs, through sound and visuals

For the gamified surveys that were analysed, they noted several metrics that could potentially be affected by levels of gamification. These include *Validity*, *Nonresponse error* and *Measurement Error*.

- *Validity* is an estimate of the legitimacy of answers provided to questions, which may be rephrased in order to gamify them. They found that rephrasing questions has the most influence on validity.

[2]Questions characterised by a scale between very negative and very positive, usually with 3 or 5 options.

- *Nonresponse error* is a function of both non-respondents (those who do not participate in the survey), and the difference in statistics between participants who responded and those who were invited to respond. Some studies they found had a slightly higher 'break-off' rate (i.e. respondents stopped playing before the survey was complete) when they incorporated a theme, backstory or narrative. Their hypothesis is that a disconnect between survey topic and game theme may affect the break-off rate.
- *Measurement error* varied from study to study, as each measured different metrics. Some of these include **Response time**, the time it takes for participants to complete the survey, **Open-ended responses**, the responses given to an open-ended question, **Straightlining**, whether or not participants 'rushed' through the survey with little consideration, and **Survey estimates**, the overall distribution of results from a survey.

Low-Cost Gamification

Harms et al. [26] have studied low-cost approaches to gamifying surveys. In this study, achievement badges were implemented in online surveys. They indicate problems with online surveys as they are dull and unengaging, which results in a series of negative behaviours from responses. They implemented a series of **challenges** from the Harms MDA-based framework [22], with the hope of motivating users to interact with surveys, which resulted in ten **achievements** that could be earned by users. A total of 126 participants were tested, with 66 of them trying the gamified survey and 60 of them trying a normal survey. They used an I-PANAS-SF test [27] pre- and post-test of the questionnaires. The results showed that there were no changes to users' behaviour, but they found it to be more attractive and stimulating. This means that implementing achievements into online surveys has produced better psychological outcomes in the form of positive qualitative feedback and more engaged participants. [26]

Conjoint Experiment with Gamified Surveys

Brownell et al. [28] performed a controlled experiment to evaluate gamification and its effectiveness in motivating participants. The experiment was conducted through conjoint surveys, which require many responses from participants to draw relevant conclusions, often leading to demotivation among survey participants.

The researchers designed and implemented four gamified surveys based on six factors: Fantastical scenario, Autonomy of the participant, Novelty, Feedback and scoring system, Progress, and Time pressure. The overall gameplay of the gamified survey involved participants acting as salespeople, fulfilling customer needs during their workday, and earning rewards for providing services. Four prototypes were created, each with varying levels of gamification. Approximately 100 participants were randomly assigned to one of the prototypes upon joining the experiment.

The experiment evaluated the impact of gamification on five factors: drop-off rates, self-reported enjoyment from participants, proportion of minimum effort, and time spent on the gamified survey. The results showed that drop-off rates were not affected by the different levels of gamification, with an overall drop-off rate of 40%, slightly higher than that of a normal survey. The amount of time participants spent on the gamified survey was not influenced by the level of gamification. There was no significant increase in enjoyment or motivation among participants to complete any of the four gamified surveys. However, the next highest-level gamified survey did indicate an increased interest in the subject of the survey. Some participants expressed statements such as "fun" and "I love games. I was quite excited to do this one," while others did not like or found it uninteresting. The lowest level of gamified survey had the lowest completion rate for the minimum number of tasks.

The researchers concluded that there were no improvements in engagement or motivation, and the drop-off rate was similar regardless of the level of gamification. In addition, the gamified survey had no measurable improvement over the non-gamified approach. They also highlighted that the various levels of gamification did not affect participants' willingness to answer questions. They proposed that future gamification research should investigate meaningful framing and its impact on participants.

2.4.2 Gamified Market Research Surveys

To increase the engagement and motivation of users, a research experiment demonstrated three apps with various levels of gamification, which were tested on 591 participants. These apps were made as market research surveys for brand recognition. The levels of gamification were built using a selection of the following elements: **Core Task, Game Mechanic, Theme, Reward, Challenge** and **Progress.** The participants were split into three groups, where each group interacted with one of the apps. Each app had 36 questions and these were used to measure the participant's motivations in the form of answered questions. This study shows that an increase in game mechanics will increase the motivation of the participants, regardless of their age, gender, panel tenure, and gaming experience. This remained the case with both partial games, where they only implemented a specified Game Mechanic to the task, and full games, where all the additional described elements of Theme, Reward, Challenge and Progress were applied. However, they also noted that the motivational effect of gamification would diminish as the task progressed. They also note a break in the flow of the experience for the participants, between the transition of questions, due to the design. For their future work, they would like to try gamified surveys in additional fields of study as well as study the long-term effects of it. They would also like to explore new ways of delivering the questions. Furthermore, they will investigate the trade-off between time pressure and delivering the questions. [29]

2.4.3 Effects of Reward Systems in Gamification

Mekler et al. [30] looked into the effects of reward elements in gamification in comparison to providing a context and motivation for a given task. Participants were tasked with assigning a set of images with tags that described said image. Participants were categorised with a unique motivational factor. One group would be informed of a fictive purpose to the experiment, saying that their results would advance science forward, by claiming it would assist computerised image categorisation. Another group would receive points for each tag they assigned, these points had no meaningful purpose or value, it was simply a number displayed on the screen based on the amount of images they had tagged. A third group would receive both. After completing the tagging task, the participants would be asked how motivated they were, and the quality of the tags they had assigned was examined.

The study found that having a purpose explained for the task, made participants consider it more meaningful and important, and lead to better quality tags. Having points assigned made the users tag significantly more images. When assigned both points and a purpose to the task, subjects spent more time with each tag. Overall the combination of the two provided better results for all metrics. The researchers raise the point that the effectiveness of points, and thus gamification is most likely based on the fact that people respond to direct feedback to tasks they are doing and have a need to complete tasks on which they are given performance information. [30]

2.4.4 Summary

Gamification has seen widespread application in many fields with various degrees of implementation. What prior research has shown, is that surveys are an ideal topic to attempt and gamify, as increasing motivation, the goal of gamification in general, can assist in improving the rate of responses for a survey.

2.5 Theory of Game Design

This section will describe some approaches to games and game design, as well as some game elements which may be effective for player motivation.

2.5.1 Elemental Tetrad

One way of breaking down what elements make up a game, is through The Elemental Tetrad. The Elemental Tetrad consists of four elements; *mechanics*, *story*, *technology* and *aesthetics*. Each element is considered essential for designing a game, and all elements affect each other [31, pp. 41-43]. This model is similar to the MDA framework as they have elements such as mechanics in common. This further supports that these elements are generally relevant when designing games. The elements of the Elemental Tetrad are described as such:

- Mechanics, similar to what is described in the MDA framework, describes the rules and procedures of a game. It describes what the goal is and how the player can achieve it.
- Story describes the events that happen in the game. It can be linear and scripted, or branching and emergent.
- Aesthetics is the element most apparent to the player. It describes how the game looks and feels as well as the overall theme of the presentation.
- Technology is any technology or tool necessary to play the game. It can be the technological device the game is played on, but can also describe paper and pencil or any other tool a player might need to fully engage the game.

2.5.2 Taxonomy of Game Pleasures

It has been proposed that there are eight game pleasures, which players can experience. [31, pp. 108-110]

- Fantasy is the pleasure of being in an imaginary world, being something you are not.
- Narrative is some dramatic unfolding of events, it does not necessarily have to be some detailed, scripted story.
- Challenge is usually one of the cores elements of any game, as most games present some sort of challenge which the player is meant to overcome. For some players, just having challenge in a game is enough.
- Fellowship involves friendship, cooperation and community.
- Discovery means discovering new parts of the game, it can be both discovering a new part of the game world, or discovering some new strategy or secret.
- Expression is a more modern pleasure, and involves allowing the player to express themselves through their character or through building things in the game world. Expression can often be very separate from the goal of the game.
- Submission is about the player "leaving the real world" and entering into the fantasy world of the game. All games involve submission in some sense, as the player is meant to step into the rules and meaning of the game.

Some players will enjoy different pleasures, and it can be helpful to consider what players a specific game will have, and what pleasures they enjoy, when designing a game.

These aspects are useful in obtaining player attention and focus, which in turn helps generate motivation for players. This makes them appealing to incorporate in a gamified survey.

2.5.3 Flow

One aspect which can be very helpful for having players continuously play and enjoy a game, is the concept of flow. **Flow** is the idea of a sustained, intense state of focus and enjoyment, where everything but the current activity is seemingly unimportant, and the participant's focus lies solely in the activity. Flow is not limited to games and individuals can experience flow in many experiences. Having players achieve this state of flow when playing a game creates player enjoyment and entices them to play the game more. In essence, creating flow is about keeping the player challenged but not frustrated, as well as comfortable, but not bored. Often this is done through a continuous loop of "tense and release", where the player is put in a situation which challenges them, causing tension, and then offering a reward when they beat the challenge, offering release. As a player's skill improves, so should the challenge, to keep up the tension of the loop. [31, pp. 118-119]

The key components to achieving flow during an activity are, for instance [31, pp. 118-119]:

- Clear goals, if the goals are clear it is easier to get and keep focus.
- No distractions.
- Direct feedback, if the player has to wait to get feedback when they take an action, it is harder to maintain focus.
- Continuously challenging, closely relating to the mentioned tense and release loop. Humans love challenges, but if the challenge is too much, frustration arises, while if there is a lack of challenge, boredom occurs. Thus the activity must strike a balance between these challenge levels.

2.5.4 Randomness

Randomness is an element that is often used in games. Depending on the type of randomness it can contribute to the challenge of the game. Most people also enjoy some amount of surprise in their game, which randomness can offer in games [31, p. 169]. Randomness and uncertainty in games are generally connected with player enjoyment and motivation for further play. [32]

2.5.5 Rewards

One good way to motivate players is through rewards. People tend to enjoy getting recognised for what they have done. In games, this is done through rewards. There are many ways to reward players, some examples are:

- Praise: The simplest type of reward, often accomplished by the activity acknowledging the player's skills and effort in some way.

- Points: Allowing the player to feel as though they are doing well by earning points. Points are often either used to compare to other players or as gateways to other rewards.
- Spectacle: Having visual and auditory spectacle, celebrating the player doing well.
- Expression: Allowing the player to express themselves through their actions or through avatar personalisation.
- Powers: Becoming more powerful feels good to players, so allowing players to become more powerful is a good way to engage them.
- Completion: Concluding an activity in a fulfilling manner can invoke a sense of satisfaction and closure. [31, pp. 189 - 190]

3. Research Approach

This chapter details the work process for this project. A detailed explanation of the applied research and development process is provided, alongside how collaborations were made with Aalborg University and a description of their problem with a low response rate.

3.1 Research Area

This section will briefly lay out the wider problem this project deals with before the specific instance through which a solution will be proposed is described. Survey gamification has been researched by several authors detailed in Chapter 2, most notably Harms et al., as well as Keusch and Zhang, whom all have either proposed systems to formally establish gamification of surveys, or have performed systematic analyses of different implementations of gamification within surveys and questionnaires. Based on the problems and gaps in knowledge presented by these studies, the following problem areas have been chosen as the focus of this project [24, 25]:

Response Rates

Gamified surveys often showed a lower overall response rate when compared to conventional surveys. Potential factors include the novelty of the gamified survey, the theme applied to the survey, or the apparent disconnect between survey and applied game-elements (theme and narrative, interface, rewards, etc.)

Result Validity

When comparing answers between survey types, the answers may be different. Potential factors affecting this could be the rewording of questions, the interface to which participants answer, or the gamified survey itself affecting the participants' mood and altering their behaviour.

Participant Experience

Though many participants reported a higher level of enjoyment and survey satisfaction from participating in a gamified survey, some results also show that this enjoyment is not persistent across subsequent 'plays'. Some participants also report reduced confidence when answering through a gamified survey.

Beyond these issues, there are many other aspects to analyse and research in gamifying

surveys. These studies generally conclude with diverse results or warrant future investigations. Because many of the methods used to gamify surveys alter the way they present the questions, answers or the survey itself, it then becomes inherently problematic to compare them to ordinary physical or online surveys. To that end, it makes sense to try and further the research by looking into concrete applications of survey gamification and the outcomes of implementing it.

From the personal interest of the authors, as well as the potential for a transformative expansion of the survey experience, the approach to be taken for this project is aligned with the 'Hard Gamification' approach. The goal is to create a more enjoyable survey experience for the participants. The product will consist of a game that is structured around a survey and its contained questions, where participants answer by playing and progressing through the game.

3.2 Aalborg University Computer Science Department

In order to specify the knowledge to a practical case, it will be essential to specify the problem in a given context. This section details an instance of the problem within an isolated context.

To investigate an instance of the problem with low answer rates for surveys, a collaboration was established with the **Aalborg University** (AAU), specifically its **Computer Science** (CS) department. The department contains five bachelor programmes and six master programmes.
They experience the problem of a low response rate from the semester evaluation survey, which is performed each semester on students.

AAU CS are using two types of surveys in its evaluation process. Approximately halfway through a given semester, they will send students both types of surveys at the same time. A quantitative survey, sent to each individual student, and a qualitative survey, meant to be answered by project groups. The results of these surveys are aggregated into a summary that the study board uses to make informed decisions on the department and for the next semester and current semester. The study board of the AAU CS are a board of members of the department that are responsible for the structure of the available programmes for the department, as well as the quality of said programmes.

The primary problem stated by the CS department is that the rate of responses for the quantitative survey is lower than desired. Even though the qualitative survey has low response rates, it is not as severe, as qualitative feedback provides good insight into the group experience of the study. The average response rate for recent semesters of all programmes, for both types of surveys can be seen in table 3.1. AAU CS highlighted that some semesters are better than others at submitting their feedback. But in general, there are many semesters

with a low answer rate for the quantitative survey. A lack of responses makes it difficult for the study board to make changes that benefit the study quality and well-being of students.

Semester	F20	E20	F21	E21	F22
Group Survey Answer Rate	60%	50%	40%	56%	47%
Individual Survey Answer Rate	37%	37%	40%	34%	37%

Table 3.1: Response rate for AAU students for each semester from spring 2020 to spring 2022

The AAU CS department has attempted to motivate the students to complete the surveys, which has either been insufficient or not sustainable long term. Methods to motivate include reminding the students of the survey by mail, or by encouraging them to fulfill the evaluation survey during their lectures. This lecture encouragement is an approach attempted during the fall semester of 2022, with promising results but at a higher cost than the normal approach. While AAU has stated that this approach is an improvement to the situation, it is not a long-term solution, as not all students may be present for a lecture, and the approach has a higher cost compared to a simple distribution, in terms of time and effort.

The collaboration with AAU was informally arranged followed by roles and responsibilities being mapped out for internal project management. We would be responsible for the development of prototypes, finding test participants, as well as evaluating the prototype. Ulrik Nyman, the current head of study, became the intermediary between us and AAU. The head of study is responsible for applying students' feedback in his work to improve the study process. He would provide us with the opportunity to see current and previous survey data, as well as talk to students, semester coordinators and their survey planners. In addition to that, they would allow us to distribute e-mails to students of certain programmes, such that we could emulate the current distribution method, for a larger test if necessary.

3.3 Choosing a Research Approach

In this section, we outline our considerations for choosing a relevant research approach for this project and the reasons for choosing it.

For the initial problem stated in chapter 1, we decided to define this problem as a complex problem, which is difficult to solve using a simple and straightforward solution. Proposed solutions were described in chapter 2, but none of them has been an optimal solution for the problem. Therefore, we will look into a new approach to solve this problem, or a step towards a solution.

3.3.1 Action Design Research

Action Design Research (ADR) was found to be a good candidate for a research approach. ADR focuses on interaction with a real problem and the practitioners who are interacting with the problem in an organisational setting. The problem is refined during the development of an artefact, over multiple development cycles. During the different cycles, more knowledge is generated about the context, the problem and the people interacting with it. ADR accentuates that the definition of the problem is updated, as researchers get a better understanding of the problem as well as relevant factors and their effects. This approach underlines cooperation between the practitioner(s), organisation and research group, which provides new or better insight into the problem, as they interact with it in the real world. In addition to that, this would allow for progressive iteration of solution proposals, as ADR stresses the continuous development of an artefact to address the given problem. Using ADR provides clear feedback on what effect the solution may have on the problem through extensive interaction in the organisational setting. There is a chance that a final solution or understanding of the problem can not be reached. Because it is an iterative approach, the focus is on always finding new steps toward a solution, which often takes the form of **Design Principles**, a set of propositions that serve as fundamental guidelines to solving instances of the problem. [33]

Action Design Research was chosen as our research approach, as it provides an instance of the problem within a confined scope. Since this approach emphasises interaction with the problem in a practical scenario instead of a theoretical approach, it was found to be more fitting for the project. Iterative approaches were also more familiar to the authors, due to prior experience with Agile development. In addition to that, there was found a good opportunity to work together with AAU, as they experience this problem with a low answer rate on surveys.

It seems most research into gamification and gamified surveys, focuses on a more general, framework based approach, such as MDA [23]. Thus, using ADR as the research method, focusing on a solution to a specific instance of the problem, could offer a new perspective and a different contribution to the general class of problems. The focus on design principles in ADR also adds to the contribution of this project, as it focuses on more specific details of a practical implementation.

Since ADR focuses on shaping IT artefacts through a specific organisational context, it fits well with the planned collaboration with AAU.

The cost of using ADR is a high learning curve, in adapting the method for the project. This adds to the problem of ADR being considered time and effort consuming, due to its iterative nature, and the fact that you have to consider the organisational context.
The method also does not guarantee a single objective solution, as feedback used in adjusting

the solution will come from multiple sources.
Design proposals- and solutions are also not guaranteed to work in a generalised context. Since they are iterated and evaluated in a specific organisation or environment, the knowledge generated may not always apply outside of that organisation
ADR also lacks theoretical bases for the research process, due to the more practical approach of iterating within the context.

3.4 Research Method - Action Design Research

This section describes the implementation of the ADR method in this project and how it has been used to interact with the context of AAU.

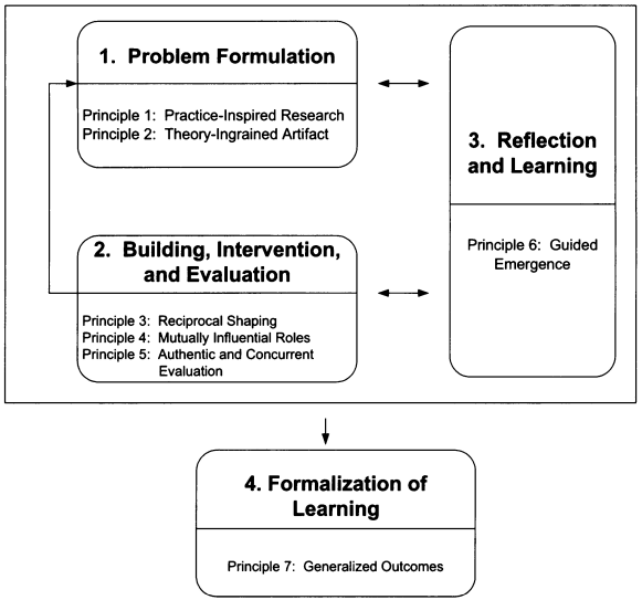

Figure 3.1: Illustration of the Action Design Research structure[33]

The ADR-process is characterised by 4 distinct stages, which are illustrated on figure 3.1:

1. Problem Formulation
2. Building, Intervention and Evaluation (shortened to **BIE**)
3. Reflection and Learning
4. Formalisation of Learning

While this method has a focus on stages, it is an iterative process, which is accomplished by repeating stages 1, 2, and 3 stage multiple times. The knowledge gained from reiterating is applied and tested through the practical application of the related IT artefact, which is developed alongside the acquired knowledge. At the end of the project, we will go to the fourth stage and generalise the knowledge made such that it can be used in a broader context.

Stage 1: Problem Formulation

In this stage, we describe how we formalise our research questions, establish collaboration with Aalborg University, and find relevant knowledge within our field of research.

Formulate research question

Based on our earlier work with ADR, the initial interaction with AAU CS and their students, as well as the knowledge documented in chapter 2, we formulated our research question (**RQ**):

RQ: How can a gamified survey system be designed, which motivates students to submit feedback?

By answering this question, or by finding a step towards an answer, a new approach to surveys can be developed within AAU in order to provide its students with a more enjoyable survey experience. The goal will be to increase student motivation, such that they will be more willing to provide their feedback to AAU in the future.

The research question is very broad and describes the overall problem in AAU CS department. Fully solving it would result in a meaningful and measurable improvement to the status quo. To facilitate the answering of this question, it will be split up into a series of smaller questions. Each of these questions represents a subset of the RQ, so the answer to the RQ can be found by answering these sub-questions.

Q1: Which design elements create enjoyment and avoid frustration for students in a gamified survey?

Our first sub-question focuses on what it takes to create enjoyment in a gamified survey for students. Many individual students attend the CS department studies. This means we will need to generalise the knowledge made such that we can create enjoyment for most of the students at the same time. There is a good chance for students to find enjoyment in varied factors, as they represent a diverse demographic. This will provide insight into how gamified surveys can be developed and which parts of it are most important, such that other developers can draw upon this knowledge.

Q2: Does increased enjoyment lead to an increased desire to answer the gamified survey?

Our second sub-question focuses on answering whether a gamified survey experience leads to a higher answer rate, as our assumption is that entertainment leads to a better survey experience. Therefore, it is important to find out if increased enjoyment can lead to better interaction with a survey, or if there are other factors which can be used to motivate students to answer a survey.

Q3: To which extent does a gamified survey provide an alternative to a traditional survey?

Our final sub-question aims to answer whether a gamified survey can be an alternative to a traditional survey. Since gamified surveys offer a new way for surveyors to interact with participants, it is interesting to investigate to which degree a gamified survey can act as a viable alternative option to a conventional survey. We can compare gamified surveys with traditional surveys to see what can be learned from them, and if gamified surveys offer any inconveniences or benefits traditional surveys does not.

Identify contributing theoretical bases and prior technology advances

It is important to look into what is already made within the field of research, as this provides us with a foundation for future development. This is also one of the primary steps in ADR. To accomplish this, existing studies are examined for their findings in order to form a knowledge basis within surveys and gamification. To expand this knowledge, further subjects such as game design and motivation are explored. By using ADR, we provide practical knowledge to a field of study of gamification of surveys, as we have not found anyone who has used ADR to research this area before. The content of this step is documented in chapter 2.

Stage 2: Building, Intervention, and Evaluation

Stage two of ADR consists of three different phases. In the first phase, Building, we identify a series of problems and apply a series of design principles in order to build an IT artefact, which attempts to solve the problems. In the second phase, Intervention, we plan and execute our intervention, a practical application of the artefact within the given context in order to see the effects of its use. For the last phase, Evaluation, we evaluate the results of the intervention as well as our IT artefact, such that we improved our understanding of the problems and our IT artefact. [33, p. 41]

Select or customise BIE form

There are two loci of innovation in ADR, the first one comes from the **organization-dominant BIE**, Where the main knowledge is derived from interaction with the organisation. The other type of locus of innovation is **IT-dominant BIE**, where the knowledge is generated from an IT artefact. [33, p. 42]

IT-dominant BIE was chosen, as it would provide a foundation for the interaction with AAU CS students. This put the focus on developing a solution which can improve the problem. In addition to this, the IT artefact can be used to facilitate discussion around a concrete solution.

Execute BIE cycle(s)

Each cycle consists of: The most relevant problems found within gamified surveys in our context, how different design principles were applied to them and a description of the im-

plemented solution. In addition to that is a description of how the intervention is executed and an evaluation of the data collected from it.

Stage 3: Reflection and Learning

Following a BIE iteration, the resulting evaluation leads to a reflection of the knowledge gathered through the given cycle.

Evaluation of planning for next cycle

The reflection of the cycle starts with an evaluation of the IT artefact's current state, using the knowledge gained from the Intervene and Evaluation steps. This knowledge is used to identify new relevant problems. These problems are used in the next cycle for future development of the product. In addition to that is an evaluation of our methods and the intervention, with a description of what we have learned from it, as well as our consideration and which changes it led to. [33, p. 41]

Design principles

One of the goals of ADR is to generate knowledge about a class of problems. This knowledge is presented as design principles.
One definition of design principles is: "... knowledge about creating other instances of artefacts that belong to the same class" [33, p 39]. We are aware of other existing definitions of what constitutes a design principle and while this definition encapsulates the concept, it is very broad and general which makes it hard to use. For this project, a new definition is made, in order to match our knowledge of what a design principle is, and to keep the description more concrete. This definition of a design principle is "*A key consideration which can help a practitioner to design an implementation that can solve an instance of a class of problems in a given context*". Each design principle presents key knowledge about a topic for a solution and what value it will provide to a general practitioner. An ideal implementation would consist of all proposed design principles.

Evaluating Design principles

At the end of each cycle, the design principles are evaluated. Each principle is analysed in retrospect to see how well we understood them during development, as well as measure their perceived value when implemented in the IT artefact. Following this, the evaluation phase of the cycle is reflected upon, to see what we learn from the process and consider if any changes to the phase should be made. This marks the end of the cycle. A new BIE iterative cycle begins, and the stages repeat.

Stage 4: Formalisation of Learning

This stage culminates the knowledge gathered from all the BIE iterations and reflections, in order to summarise it into a conclusive formalisation. [33, p. 44]

Finalisation of the design principles

The design principles are re-evaluated using a formal method proposed by Iivari et al. [34], with the goal of ensuring they are well-crafted. We also provide a description of the value each design principle brings to the context of gamification and motivation.

Answering the research questions

After the design principles have been fully formalised, there is a consideration of the research questions and the knowledge gained about them. Based on this is an answer to, or a discussion of, the different areas of the research they cover.

4. Build-Intervene-Evaluate Cycle 1

This chapter details the first iterative design cycle of the project. Each of the BIE steps are detailed as they transpired, covering the process detailed in chapter 3. The design of the IT artefact is based on the following design principles. These design principles originate from the previous project by the authors.

Design Principle	Description
Submission dictated by player behaviour	The period between questions and when exactly the player answers should be customised to each player, this can be done by letting the player directly influence when to answer.
Long term goals	The game should contain persistent, lasting elements for playing the game, such as high scores, in game currency or medals.
Informative Progress	The player should be informed of their current progress in their game session, as well as their total progress for the game and surveys.
Intentional Feedback	It should be clear to the player when they are about to submit feedback, and no game elements should conflict with the submission process, making them able to give exactly the feedback they intend to.
Ease of Access	The game's objectives and controls should be immediately understandable and obvious, without requiring extensive learning or practice.
Accommodating to diverse player abilities	The game should be able to accommodate players of various skill and competence, such that both beginner and advanced players can enjoy it.

Table 4.1: The final set of Design Principles from the prior project

4.1 Build - Problem Identification & Designing

This section details the initial design of the gamified survey, which is formulated as a game that contains survey questions the participants answer by playing the game naturally.

According to the problem formulation detailed in section 3.4, the gamified system developed in the BIE cycles, should help motivate students to complete surveys. Based on the problem formulation and previous work on getting students to interact with gamified surveys, three key problems were identified within the field of gamified surveys. The following sections will dive into these problems and describe what a possible solution would look like.

All design principles were considered during the design process, although only the design principles directly relevant for solving the main problems of the cycle are detailed in how they were used in the implementation.

Problem 1 - Player Engagement

As described, the CS department at AAU has problems getting students to engage with the surveys. Surveys are often hard to incentivise since they are trivial in nature, demand little attention, and can feel irrelevant for the survey taker, yet their content is still deemed important by the surveyors.

Gamified surveys have been shown to potentially improve a participant's overall experience in surveys [22, 26]. However, if the incorporated game mechanics are not engaging enough, the motivation to keep playing will start to diminish. Engaging a player or survey participant is very subjective and the survey experiences may differ from person to person making it difficult to create generally engaging game.

Implementation

None of the design principles that the implementation follows, directly addresses this issue, so instead, much of the implementation meant to improve player engagement is based on the theory of **Flow**, as described in section 2.5.3. Designing around Flow is one way to attempt to capture player engagement. A 'flowful' experience aims to keep the participant captivated by providing challenges aligned with their capabilities. Using a tense-and-release loop, players can approach the game's challenge in a controlled fashion. Several implementations were decided based on the way they could potentially capture participant engagement.

To distinguish the gamified survey from the trivial nature related to surveys as well as tap into using the 'Fantasy' Game Pleasure, the overall theme of the game has been designed around a fantasy theme, incorporating elements such as dungeons and mythical monsters. Figure 4.1 shows the first playable version of the game. The gamified survey draws gameplay elements from existing games. The game is played from a top-down perspective, inspired by games such as '*The Legend of Zelda*' and '*The Binding of Isaac*'. The game's tension and release can be seen in the overall design of the progression through the game. In the game, the player travels through a series of rooms, alternating between defeating monsters, offering tension, and getting a reward followed by a room answering a question, offering the release. The player can obtain experience points to increase their strength in various ways, drawn from many existing RPG-style games.

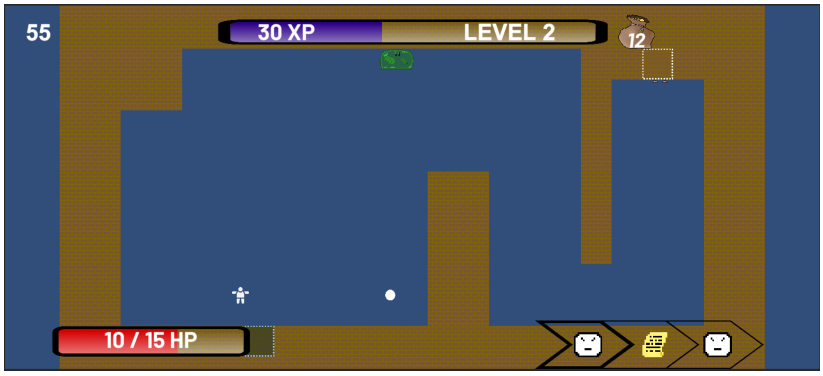

Figure 4.1: Screenshot of the first iteration of the product

On the screen, information on the player is visible. These elements are detailed in the next section. This includes

- Health bar that displays the player's current and maximum health; Bottom Left
- Experience bar that shows the players current experience and level; Top Center
- Gold that player receives from enemies, used as currency in a shop; Top Right
- Progress bar that displays the type of room the player is in, as well as the two next rooms; Bottom Right
- Player score, which is increased by defeating enemies; Top Left

The goal of these elements is to captivate participants, with the intent that they become 'distracted' from the survey and fulfill them without actively thinking about it.

Problem 2 - Purpose with surveys

Currently, students at AAU do not feel motivated to submit surveys, or find it relevant to them, which can be deduced from the published answer rates for different semesters. Despite this, surveys are issued regularly throughout the semester with the intent of improving the study environment. What was expressed by Nyman, as well as by some students during testing of the previous project, is that systematic change, made as a result of survey data, has little or no perceived impact on those who submitted the feedback. This creates little incentive to provide feedback since students sometimes will not experience those changes themselves. [1]

Implementation

Some form of reward or effect for participating in the surveys was desired by students. The design principle "Long Term Goals" is suitable to alleviate this. During the design, it was realised that the "Long Term Goals" design principle was too restrictive, as it deems all features related to goals for the player must be persistent across multiple play sessions. Because of

this, some implemented features are not compliant with this design principle, as they would limit the design space of the gamified survey in a way which prevents potentially positive features.

Within the game, the following game elements have been incorporated

- **Levelling System**
  - When the player defeats enemies in the game they are awarded with experience points. When they have been awarded enough experience their character 'levels up' allowing them to select one of several random upgrades, which lasts for the rest of the current game. This can be done endlessly, letting the player increase their strength progressively throughout the game.
- **Gold & Shop System**
  - Alongside experience points, the player may be awarded gold coins for defeating enemies, which they keep for the current game. At certain points during play, a shop appears where the player can spend their gold to increase their experience points, increase their maximum health or restore their health.
- **Scoring System**
  - In the game, the player's actions award them points, a value that is visible to them. When the game concludes, their score is saved on a scoreboard. The highest scores are displayed in order to promote competition with other participants.

These systems are designed to provide goals to the players as they play. The levelling and gold system allows them to continuously empower their avatar, creating a form of 'power fantasy' in the game. The scoring system is meant to facilitate a social aspect of submitting a survey, letting them compete against each other.

Problem 3 - Interaction with questions in a game

When attempting to combine a survey and a game, a balance between both parts is crucial, most notably when it comes to applying a level of difficulty to the game. If providing answers becomes too challenging, it may deter people from continuing, and accomplishing the goal of fulfilling and submitting the incorporated survey. On the other hand, if the game is too trivial, it may have no beneficial impact on their survey experience.

Implementation

While the gameplay can be designed in various ways that are engaging and interesting on its own, interaction with the survey should be simple, intuitive and intentional, first and foremost. The Design Principles 'Intentional Feedback' and 'Submission dictated by player

behaviour' align with this philosophy. As such the entire survey part of the game is designed with as little challenge and interruption as possible to the survey process.

The design for survey questioning are shown in figure 4.2. In this variant, the player enters a room containing a survey question, paired with a set of answers they can select from. By moving their player avatar onto an answer field, which appears as an orange button, the game highlights it as their selected answer. Selecting another answer will deselect their previous answer, if they want to switch. A player can only progress to the next room if they have an answer selected. Once the player leaves the room, their answer is stored. This is made to fit with AAU's current question format in their surveys. This design is also supported by the GCS survey data, which details that single answer multiple choice questions have the highest completion rate, which were illustrated on table 2.1.

The simplicity of the room, with no potential obstacles or dangers, was designed to let the player focus on the survey. It also serves as a break from the normally higher pace action of the regular gameplay. The simple design allows for further additions or modifications, which will be derived from feedback of the intervention.

Figure 4.2: Survey Component, present in BIE cycle 1 iteration

4.2 Intervention - Playtesting Session

This section details the intervention phase of the cycle, and its goal with the evaluation of the current IT artefact 'Action Dungeon'.

Five students were selected for a playtesting session. Each student was invited to play the game in a closed environment. They were permitted to play for as long as they wanted to. Following this, they were asked an arrangement of prepared questions about their experiences as part of a semi-structured interview. The specifics of the intervention are detailed

in appendix A.1. This was done to obtain qualitative feedback from users, where they could be directly questioned about their experiences. Since this was early in the development of the game, the desired feedback was both the qualitative feedback from interviews, but also the knowledge gained from watching the participants play the game. To make watching the gameplay as well as facilitating the conversation easier, the participants played the game and gave feedback individually, instead of with their study group. The goal was to have at least five test participants partake in the intervention. A test participant count of five has been shown in user evaluations to detect ∼80% of the total usability problems. [35]

There are three areas that were inspected during this evaluation-session, which mirror the three problem fields highlighted in section 4.1. To summarise, the areas are

1. *how they interact with the Action Dungeon*
2. *what purpose they see in Action Dungeon*
3. *how they interact with the survey-component part of the game.*

In addition to these areas, there will be a discussion with the students concerning their overall experiences with gamified surveys and their opinions towards this artefact, in particular with regards to their motivation in answering surveys.

The planned questions are shown in appendix A.2.

4.3 Evaluation - Review of Feedback

This section covers the evaluation part of this cycle. The overall goal was to explore the users' genuine experience of interacting with the IT artefact and what can be learned from it. This evaluation looks into how the artefact has affected the problems, which were conceived in section 4.1, in addition to how it improved our understanding of gamified surveys. The five students were chosen to be fairly representative of users within the context. All participants were male students from the CS department, their semesters ranging from between the 4. to 10. It is to be noted, that one of the students had participated in one of the tests from the previous project. Since it was a different game, it was believed it would not have too much of an effect on the evaluation. Of the five students who participated in the testing session:

- 3 of them fulfilled the 15 question survey.
- One participant ended their session after 7 questions
- One participant ended their session after 4 questions, with them citing their previous experience with the former project as their reason for stopping early.

Evaluation on Player Engagement

Most participants seemed to reach some level of flow, as they all had part of the gameplay session where they turned more quiet, and seemed to be very focused on the game. When

asked about it during the interview, it was stated by multiple participants that the game did not have any major factors breaking the flow. In terms of the implementation of tense and release loop, participants seemed to enjoy the tension created in the rooms containing enemies, but when they completed them, the 'release' segment lasted for too long, as the question rooms did not provide enough interaction. Even though multiple players stated that there were no obvious flow breaks, some did comment on the question rooms feeling very separate from the rest of the game. This feeling was shared by most users, when further inquired about the feeling of answering questions through the game.

The observations and participant feedback concerning flow indicates that implementing features which are likely to support flow can be effective, as players seemingly start to focus more on enjoying the game, instead of the negative feelings of having to answer a survey or any minor problems the game may have. Some participants noted that the experience of the game could be unexpectedly broken if their avatar levelled up while they were being chased by a monster, as a menu for choosing an upgrade would appear and pause the game. When they picked an upgrade it would unpause, making it difficult to avoid incoming damage. A similar problem occurred occasionally when entering a new room, where an enemy could appear in very close proximity to the player at the door. These experiences all compromised the flow for the players, contributing negatively to player engagement.

While the overall experiences regarding player levels and upgrades were positive, certain upgrades did not function as the participant would expect, which caused some confusion during play. Participants who played further also noted that it became hard to discern attack projectiles from each other.

Overall, the participants had a good experience, and actually desired more varied content, such as more room layouts, choice in upgrades, types of enemies and their AI logic.

Evaluation on purpose with surveys

All participants had positive feedback regarding the scoring system. They all commented on the high score listed on the main menu and would like to compare and compete with other students, their study group and even the rest of the university. They noted they wanted increased feedback on their score while playing the game, as some did not notice score element on screen or what elements of the game awarded points to the player. A similar problem occurred with the gold system, as obtaining and spending of gold was not immediately clear.

Most of the participants discussed the upgrades they had chosen and planned around which upgrades would be optimal. It can be presumed that the upgrade system creates an incentive for playing the game repeatedly.

Some participants would like more customisation elements within the game, noting the de-

sire for persistent elements that would stay between game sessions and possibly between semesters, such that there is a reason to continuously play and progress. Other gamification components were also suggested, such as achievements or medals for completing challenges in the game.

Evaluation on Interaction with questions in a game

Participants highlighted different elements which made the gamified survey less enjoyable. A common aspect, highlighted by every test participant, was that the survey felt too separated from the gameplay. The survey rooms were immediately commented as being less interesting than the ordinary gameplay. The survey part had some problems such as:

- The question took up too much space on the screen.
- The player avatar would continue to fire their weapons while inside, which was distracting, as it could draw focus from the survey.
- Certain survey questions had their answer ranges reversed[1]
- Participants found survey rooms to be boring, due to a lack of interaction, which prompted some participants to 'speed' through with little to no deliberate thought.
- Some of the participants were expecting a reward for completing a survey room.

These problems highlight the fact that the participants would like for the survey-component of the game to be integrated more with the gameplay itself.

The interval between questions was stated to be fine by the participants, as long they were made aware of the survey aspect, before starting play. Some of them were interested in an alternative variant of the game, which involved only survey rooms, such that there is no threats or dangers hindering them in completing the survey.

All participants were asked whether they wanted feedback in regard to their overall progress in the survey, some wanted it and others did not. However, no participant considered it to be a purely negative feature, so keeping participants informed of their survey progress would overall provide value.

4.4 Reflection & Learning of Cycle 1

The reflections of this BIE cycle is detailed in this section. Elements that were cause for consideration and what may have been learned from them.

[1]Some answer ranges were 'Very Negative' <-> 'Very Positive', while others were the other way around

4.4.1 Intervention Method

The ideal intervention scenario is to recreate the use of the IT artefact within the given context scenario as closely as possible. In this case that would mean sending out surveys through mail to students, where they then have the opportunity to answer it in their group rooms or at any point when they have time. For this intervention, however, a more closed approach was taken, where a few individuals were invited to engage with the artefact in a private setting.

The primary case for this approach is that this iteration of the IT artefact was a new concept, so before more significant work was spent on developing, qualitative feedback on the current design was desired. This would be in the form of both the interview and watching the play session. By having participants play the survey game while observing them, it was possible to discuss different topics with them and let them ask questions as they arose.

Although it was a considerably limited intervention of only five participants, the feedback received was very instructive, as they could express their experiences, both positive and negative, very openly. This also opened up the possibility for discussions on emerging topics, where new ideas could be generated. The usage of a smaller intervention with qualitative feedback worked well, generating crucial feedback on elements before developing too much on them.

4.4.2 Interpretation of feedback

Some feedback received pertains mostly to the gameplay itself, such as having more diversity in existing content, like more enemies and upgrade choices. This feedback, while still valuable, was already acknowledged, as assembling a baseline for the IT artefact was deemed more important than adding additional variation to existing content.

As a result, this feedback was less prioritised than feedback more closely related to the understanding of the overall problem.

4.4.3 Considering Individuals

When performing evaluations of any kind, it is important to account for the type of individual that is evaluating. Preferences and tastes affect the type of feedback one may provide.

For this evaluation, some of the feedback received is harder to process in the context of the IT artefact. For instance, some test participants noted some elements, like the scoring system, to be powerful in driving their motivation to play, while others said it did not affect them at all. Another example is that not all people enjoy video games, and so the IT artefact overall has a lesser effect on them. This does not necessarily mean that a given element or design is a poor design, but that it may not immediately appeal to every user, thus the

IT artefact design needs to accommodate to as many users as possible. To attempt this, knowledge from the intervention was taken into account in the creation and evaluation of design principles, if it indicated it would give value to a majority of users, without negatively impacting the value for others.

4.4.4 Informative Progress

In the game, a progress bar was implemented, to show players what kind of room the next room would be, so it would be clear to them that the game alternates between monster rooms and question rooms. The idea was to test the degree to which the Informative Progress design principle is necessary, as implementing proper flow in the game could possibly cause players to be less concerned with where they are in the survey. The feedback from users indicates that the exact scope of Informative Progress might be unclear. Some users indicated that it was important to be made aware of the gamified survey being a survey and not just a game in advance. Some did not care about their progress in their survey or the information given in advance. As such, subsequent BIE cycles will attempt to further evaluate the necessity and scope of the design principle.

4.4.5 Revision of Design Principles

Based on the evaluation of BIE cycle 1, the design principles the IT artefact was based on, have been revised. The new revision of design principles is shown in table 4.2. Green indicates a new design principle, yellow designates a changed or modified design principle and red indicates a design principle that has been removed.

Design Principle	Description
Informative Progress	The player should be informed of their current progress in their game session, as well as their total progress for the game and surveys.
Intentional Feedback	It should be clear to the player when they are about to submit feedback, and no game elements should conflict with the submission process, making them able to give exactly the feedback they intend to.
Ease of Access	The game's objectives and controls should be immediately understandable and obvious, without requiring extensive learning or practice.
Attain Flow	The game should aim/seek to provide players with Flow, a state of intense focus and enjoyment, such as through using a Tense and Release loop.
Clear Goals	The game should contain elements that promote long-term play, such as a score-system or in-game currency.
Accommodating to diverse player abilities	The game should be able to accommodate players of various skill and competence, such that both beginner and advanced players can enjoy it.
Submission dictated by player behaviour	The period between questions and when exactly the player answers should be customised to each player, this can be done by letting the player directly influence when to answer.

Table 4.2: Revised design principles

New - Attain Flow

A design principle has been added, saying the game should help players achieve a state of flow. The idea of gamifying surveys, is to attempt to make the surveys a more enjoyable experience. If their focus is on simply enjoying the game, instead of how inconvenient, annoying or uninteresting they find surveys, the chance of them completing the questions in the game, and finding the experience more enjoyable seems to go up. Focusing more on creating a state of flow for the player, shifts focus away from some of the problems other design principles were meant to address, such as having a customised period between each question.

Updated - Clear goals

The design principle, 'Long Term Goals', has been renamed and altered. As it was discovered in our Build phase, the design principle was unnecessarily restrictive. It is important to provide something for the players to work towards, outside of just completing the survey. Instead of focusing on it being long term, the evaluation indicated that it being a constant, clear, tangible goal is more important. This also fits well with the concept of flow, as one way to help achieve flow, is by providing clear goals.

Removed - Accommodating to diverse player abilities

'Accommodating to diverse player abilities' has been removed as a design principle, as during the design process, it was found that this was trivially obtainable, a part of good game design in general, and had a large overlap with the ease of access and attain flow design principles. In essence, this design principle was meant to help minimise player frustration, by avoiding frustration when starting out, and by keeping it difficult enough to be entertaining as a player gets better or has more experience with the type of game. This should be achieved by following the design principles of ease of access and attain flow.

Removed - Submission dictated by player behaviour

This principle has been removed as well. This principle was meant to be used to avoid overwhelming players by forcing them to answer too many questions too quickly, or having them feel as if the game is drawn out by having too far between each question. It was discovered during evaluation that if flow in the game is prioritised, players will care less about the period between questions, as they are simply focused on playing the game. In terms of overwhelming the players, the design principle of intentional feedback already covers making it clear when players should answer, and not having elements which pressure participants to submit an unintended answer. This also covers giving them enough time to answer.

5. Build-Intervene-Evaluate Cycle 2

This chapter details the second cycle of the artefact iteration. Feedback from the previous cycle indicated the survey portions of the game were not as interactive as the rest of the game, and so a new revision of the question rooms became the primary focus of this iteration.

5.1 Build - Reevaluating the Surveys

For this iteration of the IT artefact, the primary focus was set on interaction with the survey and its questions, as it was noted that the current version had the potential to break the flow with the rest of the game, and in general felt like a very separate part of the game. As such, the design of the survey-component was revised, in order to create a design that would provide a more balanced experience as a whole.

To summarise, the overall problems expressed, concerning the interactions with questions were:

- Question room feel separate from the rest of gamified survey.
- The given question occupy too much screen space.
- The player avatar continuously shoots in the room, which distracts from the question.
- The manner of asking the questions disrupts the flow of the game.
- The design opens up the possibility of speeding.

Implementation

To integrate the question room more into the gamified survey, a new design was created to blend more dynamically with the rest of the game. This was to conform with the newly introduced design principle, 'Attain Flow'. The design of the question room is based loosely around Cannell's Process theory and its various stages [10]. How the stages are implemented will be highlighted as they are detailed. This design consisted of small obstructions that force the player to interact in a unique way to submit their answer. The new design can be seen on figure 5.1. New elements are highlighted in red.

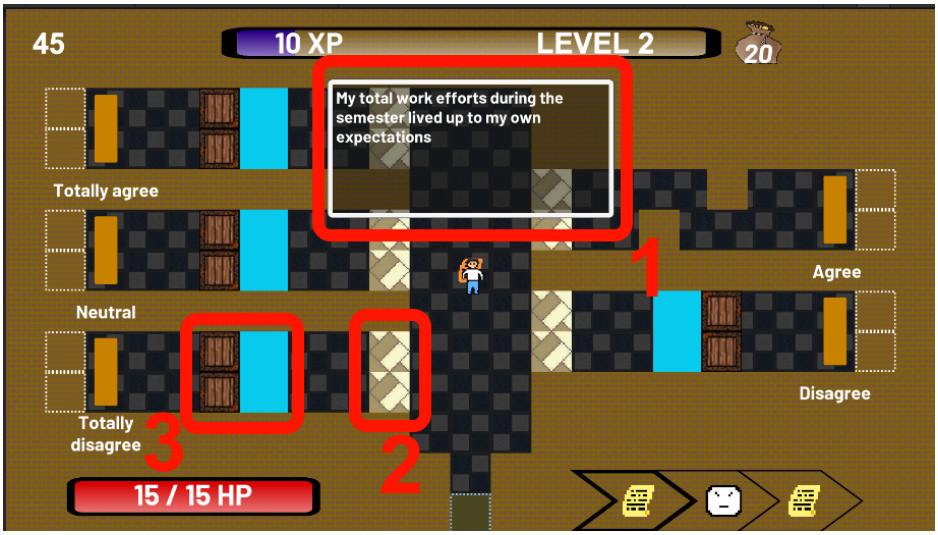

Figure 5.1: Redesigned Survey Room

From figure 5.1:

1. The question has been placed within its own graphical element. This element appears when the player comes into contact with a 'scroll' present in the survey rooms. The question in the element is displayed with a typewriter effect, gradually writing the question. When the player moves away from the scroll, the question persists for a moment before it closes. This forms the **Comprehension** part of the survey response.
2. A set of barriers occupy each space that leads to a survey answer, such that the player is encouraged to read the question. Shortly after activating the scroll that displays the question, the barriers will disappear. This is to allow for the **Retrieval** part of the survey response.
3. A 'trap' occupies each space that leads to a survey answer. These traps have to be circumvented in order to reach their desired answer and proceed. Each trap is designed to be a slight, harmless hindrance that may push or impede the player in unique ways, with their own method of proceeding. This makes up the **Judgement** part of the survey response, as the player has to consider how they answer the question. It is then followed up with the **Response**, as the user actually carries out answering the question.

   The highlighted trap is a platform that carries the player across a body of water. If the player touches the water, they are pushed backwards towards the entrance.

These elements aim to increase the interactive experience of answering survey questions without being too demanding of player abilities. Each of the trap elements, placed in front of each answer, is designed to only be a small deterrence that won't perpetually halt the player. As a further improvement, the player will no longer shoot while in question rooms.

Other design principles are also adapted. 'Ease of Access' is incorporated by making the process as intuitive and easily understandable as possible, without compromising the gameplay too much. 'Intentional Feedback' may be compromised by the idea of 'preventing' the player from answering, but these obstructions are designed to be as minimal as possible, while providing more gameplay interaction to the survey segments of the game.

5.2 Second Intervention

The focus of this intervention is the player interaction with the survey question rooms and examining if they find it an enjoyable experience. The same overall method from the previous intervention is repeated, detailed in section 4.2, where a test participant is invited and interacts with the gamified survey for a period of time, followed by a semi-structured interview. This method was repeated as the redesign of the question room warranted qualitative feedback on how users interact with it. The questions arranged for the test participants are detailed in appendix A.3.

5.3 Evaluation of Revised Question Rooms

In total, 5 participants were examined for the intervention, 1 female and 4 males, their semesters ranging from the 6. semester to 10. semester. Two of the participants from the first intervention were reexamined, with the purpose of obtaining new perspectives using their existing insight and experience from the previous iteration. 4 out of 5 participants reported they regularly answer the semester evaluation surveys.

5.3.1 Evaluation of Interaction with the Questions

Overall this version seemed to cause more enjoyment and engagement with the game. During the discussion, on the topic of gamified surveys, the participants started to replay the gamified survey and answered more questions, both in the game and in the verbal discussion. All participants made comments on the process of being asked a question, noting it was an interesting approach, or fit well with the game concept. The process of a question being written on screen with a typewriter effect, as well as the delay before the door opens, resulted in a natural wait period. This waiting period was found as a good interaction by the test participants, as it gave them time to read the question and consider their answer before answering it. The waiting period was always 2 seconds, yet some participants thought it was set from the length of the question which felt natural to them. They stated that this resulted in a more natural relation between reading the question and interacting with question room.

All of the participants preferred this type of interaction with a survey as feel more natural compared to a normal survey but they had questions related to the survey, how their

interaction would be saved and two of them would like to know about time estimates for answering the survey, as this would allow them to make a plan to answer it.

5.3.2 Evaluation of Interaction with the Answering

Some participants had a desire for the traps to have more severe consequences for failing them, in addition to them being more difficult and varied. This progressed into a thorough discussion of potential ideas. Ideas such as the traps being able to defeat the player were found to be counter-productive, but other concepts like traps being able to tamper with the player in some way, like temporarily stealing their gold, may have been interesting.

Overall, traps in a question room resulted in the participants finding it to be a more integrated part of the game experience. Only one of the participants referred to separated parts when discussing the experience.

5.3.3 Evaluation of overall gamified survey

The majority of the feedback received regarded the content of the game itself, particularly focused on the level of current content. The feedback can be separated into **Game-Session** content and **Meta-game** content.
The **Game-Session** content refers to the level of content within the game itself. Elements such as variation in enemies, room layouts, player weaponry, etc. Some of this feedback also consisted of an increased relation between the game and the student's institution of Aalborg University. This was highlighted through examples such as the visuals matching the university, or their semester coordinator being an entity in the game that would ask the survey questions. Other feedback included increased information to the player, such as seeing their survey progress during the game and information about their progress after a game over.

Meta-game content refers to content that is outside of the game, which mostly related to features that could exist between play sessions. Participants stated that they would likely find the survey trivial and less interesting, if it was repeated identically each time the surveys are distributed. Ideas brought up were persistent progress, customisation of their avatar and limited time 'events' or themes at different time intervals.

Overall, all participants found the gamified survey interesting and liked it. Some of the participants would even replay the gamified survey during the questioning, resulting in them answering more of the questions. Two participants, whom answered 4 and 8 questions respectively, cited the genre of game as the reason for stopping early and stated that they would likely completed more of the survey if it was another game genre.

5.4 Reflection & Learning of Cycle 2

This section covers the Reflection & Learning stage of cycle 2, including a revision of the design principles.

5.4.1 Informative Progress Principle

Similar to BIE 1, during this cycle some participants gave feedback concerning wanting to get information about the purpose of the survey in advance, as well as information about their progress. However, the feedback was still not unanimous. Some participants did not care at all about their survey progress, and cared much more about their high score or game progression. This leads to the conclusion that Informative Progress is not a design principle which provides value for every single participant. However, no one seems to believe it to be a negative, whereas to some it seems to be very important. As such, it is kept as a design principle.

5.4.2 Revision of Design Principles

The intervention and evaluation of this cycle has lead to a second revision of the design principles, which are shown in table 5.1.
Green indicates a new design principle, while yellow indicates an existing principle that has been revised or modified.

Design Principle	Description
Informative Progress	The player should be informed of their current progress in their game session, as well as their total progress for the game and survey.
Intentional Feedback	It should be clear to the player when they are about to submit feedback, and no game elements should conflict with the submission process, making them able to give exactly the feedback they intend to.
Ease of Access	The game's objectives and controls should be immediately understandable and obvious, without requiring extensive learning or practice.
Capture Player Attention	The game should attempt to maintain player attention and focus by using Flow Theory and demanding constant player interaction.
Diverse Motivational Factors	The game should provide motivation factors for people motivated by playing games and people motivated by providing feedback
Integrate the Survey & Game	The game and survey should aim to be unified as a single element, such that players will find it enjoyable to both play and answer surveys. Answering the survey should be a part of the gameplay, such that the survey part is a continuation of the rules and mechanics of the game part

Table 5.1: Revised design principles

New - Integrate the Survey & Game

From our intervention and evaluation, there was a desire for the survey and game to complement each other more. The prior iteration had surveys that were stated as being too

disconnected from the regular gameplay, which lead to people 'losing' their flow.

The results of this intervention demonstrated that some level of gameplay integration with the survey segments does not deter players from fulfilling the questions. In fact, some participants even wanted further gameplay integration through potential consequences or threats. Other elements can also aid in this principle, such as visual or auditory additions, which were demonstrated with the scroll item, and typewriter dialogue interface, all of which assisted in bringing the interaction of the survey closer to the gameplay segments.

Update - Capture Player Attention

Previously called **Attain Flow**, this design principle now covers a more general perspective to obtaining the attention and focus of player participants. While Flow remains an integral part of the principle, it is not an exclusive part of it.

Capturing the player or participants' attention is vital to ensuring they remain interested and focused during play, which carries over to the survey element of the game. If the game is fun and interactive, then participants will naturally want to continue playing, and subsequently answer the content of the survey.

Update - Diverse Motivational Factors

Revised from **Clear Goals**, the design principle was deemed unclear in what the artefact should contain in order to facilitate it. The principle focused on elements of a gamified survey that would warrant multiple play sessions, but this neglects the goals of the game and the survey itself, which heavily limits the design space of the IT artefact.

The new design principle concerns design choices of the artefact that motivates the individual participants, which are primarily categorised as either those who enjoy playing games or those who want to submit their feedback, and how the artefact can be designed to cater to both of these types of participants.

6. Build-Intervene-Evaluate Cycle 3

The third cycle of the iterative process for this project focuses on gathering feedback on the IT artefact, applied in the desired context. The overall goals of the prior cycles have been refining the user experience and increasing the overall enjoyment of interacting with the IT artefact. In order to then evaluate its functionality and effectiveness in a larger context, this cycle involved distributing the IT artefact to a larger audience of students in a more practical setting, and only included a few minor adjustments to the game and survey experience.

6.1 Build - Online Infrastructure

In order to perform a larger-scale test, the relevant infrastructure was arranged. Since the IT artefact would be distributed to many participants, whom, in a practical setting, would not be interviewed or questioned, data about their experience must be obtained through their actions and results.

Implementation

The IT artefact was fitted to store data in an external database. This was accomplished by running a server hosting an API handling communication between the artefact and the database. This would allow for saving of the answers each player made to the survey's questions, as well as saving and displaying their high score.

Alongside a server and database, the game would also need to be easily available, without needing too much time or effort to play. By using Unity's WebGL platform builder, the gamified survey was made available in web browsers. This version was uploaded to a website host, such that it could be accessed through a hyperlink.

Based on feedback from previous cycles, the game lacked information on how the game worked, such as the fact that the player can continue on the same survey, even after losing. To alleviate this, the design principle 'Informative Progress' was further implemented. Within the IT artefact itself, a UI element was added to the title screen, displaying how many questions a participant has answered in the survey. Additionally, to further conform with 'Ease of Access' a set of text boxes were added in the first room of the game, that further detail some of the mechanics of the game.

6.2 Intervene - Larger Test

The intervention of this cycle became twofold. The overall idea was to do a summative evaluation of the IT artefact, using two interventions, which emulated the way the semester evaluation is usually sent out, much more closely than the interventions of the previous BIE cycles. Having two parts to the intervention was based on emerging opportunities to test the system in an practical context closer to the ordinary surveys.

First Session

First part was a distributed test shared with students of two study programmes.

As a measure to try and increase participation in the semester evaluation survey, the second semesters of BAIT and IxD, two of the programmes under the CS department, got an arranged session where students could join and complete the evaluation survey together. The purpose of this was to actively incite and motivate students to submit their feedback to the CS department and the university. The semester coordinator would be present and display the statistics of the survey responses in real-time, to further demonstrate the value of the student participation. For one of these evaluation sessions, we were allowed to present the gamified survey to the students, once they concluded the evaluation survey.
Of the two semesters who were invited, 14 students assembled for the evaluation, out of the 50 total students, counting across both semesters. All assembled students answered the ordinary evaluation survey.

Following this, each student was invited to play the gamified survey, made available through a shared hyperlink. Participants were encouraged, but not obligated, to play through the survey content, which was a tailored survey of nine questions.

These questions mirrored some of the major survey questions in the semester evaluation survey, with the exception of two questions, which were questions relating to their experience with the survey they just played. These are referred to as '*meta questions*'. The goal of these questions is to obtain information regarding their experience with the IT artefact. These questions are spread out in-between the ordinary survey questions. This was done to retain the focus on the semester evaluation survey as much as possible, and not draw too much attention away from its questions.

The meta questions are as follows, with the number referring to the question they appear within the survey:

- 4th - How does this type of game affect the answers you provide?
  - Positively | Negatively | No Difference

- 8th - Do you prefer this game or the ordinary questionnaire?
  - Game Survey | Ordinary Survey | No Preference

The students had approximately 10 minutes to play the game, which varied based on when students submitted the semester evaluation survey. After the gameplay session was concluded, students were collectively inquired about their general experience and feedback with the gamified survey.

Second Session

In the second part of the intervention, the gamified survey was sent out to all students on the 6. semester Software programme. All students received an e-mail with a message, briefly describing the concept and purpose of the gamified survey, alongside a link to a page where they could play the game. This means the overall method of delivery for the gamified survey closely emulated that of the ordinary semester evaluation.

The survey the students answered in this evaluation consisted of 15 questions in total. 12 of these were drawn from the ordinary semester survey, with the remaining 3 being meta questions related to the gamified survey itself, and the student's enjoyment of it. The number of questions had been increased from the previous session, both to get closer to the number of questions in the semester evaluation survey, and also to see if increasing the number of questions from the previous session would have any effect. The meta questions related to this gamified survey were as follows:

- 4th - Do you prefer this game or the ordinary questionnaire?
  - Game Survey | Ordinary Survey | No Preference
- 10th - What do you think is the maximum amount of questions a game like this should have?
  - 5-10 | 10-15 | 15-20 | 20-25+ | Do not know / Do not care
- 15th - Rate this game experience?
  - Very Good | Good | Average | Poor | Very Poor

The idea behind these questions was to deduce if the game could be a suitable replacement or supplement to the ordinary survey, while also gauging whether any users who did not complete the survey, skipped it or stopped early because of a problem with the game itself, or because they did not like the concept.

6.3 Evaluation of Distributed Survey

This sections details the results of the two parts of the intervention for this cycle, a comparison with the ordinary survey, and a final evaluation of the IT artefact with the head of study.

6.3.1 First Session

Out of the 14 assembled students, 12 of them participated in the gamified survey. Figure 6.1 shows the number of questions that the participants completed individually.

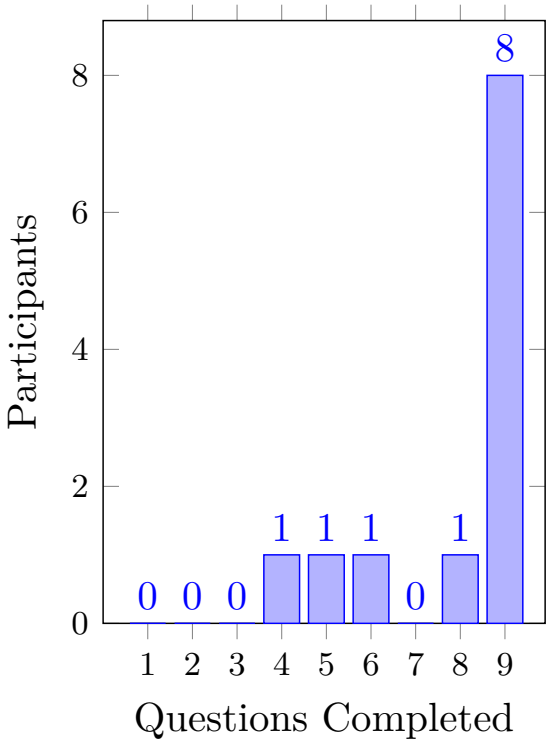

Figure 6.1: Questions completed per respondent of gamified survey, first session

The majority of the those who participated cleared all the survey questions that were present. Some participants spoke to each other during their play session, and discussed their strategies.

Table 6.1 shows the results of the meta questions that were present in the first survey.

How does this type of game affect the answers you provide? 12 Total Answers	
Positively	2
Negatively	0
No difference	10
Do you prefer this game or the ordinary questionnaire? 9 Total Answers	
Game Survey	3
Ordinary Survey	2
No Preference	4

Table 6.1: Survey answers to meta questions, first session

For the first meta question, asking if the game affected how they provided their answers, two students reported that it had a positive effect on them, while 11 students reported that it made no difference. However, none of the students reported that it had a negative effect. In retrospect, this question is vaguely defined, which may also explain the majority of participants answering 'No Difference'. In an ideal scenario, the medium the survey appears in should not affect the answers one may provide. Because of this, the value of this question is up for debate, and will be reflected upon in the Reflection and Learning stage.

There were three fewer participants who answered the second meta question. Of those who did, three answered that they preferred a Game Survey, two answered that they preferred an Ordinary Survey, and five said they had no preference.

It is clear that the time it took to answer all questions or the incentive to reach it did not engage players enough, as a large portion of the participants answered 'Ordinary Survey' or 'No Preference'. This may also indicate that the time factor to complete a gamified survey is too great. Participants also pointed out that the game could still benefit from more work. This concerns more content in the game in general, difficulty settings, usability improvements and a more coherent overall theme such as based on an AAU context. All participants completed the ordinary evaluation survey, which had 39 questions, compared to the 9 questions in the gamified survey, at roughly the same time. The expected time to complete the normal survey is 5 to 10 minutes, as stated by AAU mail.

The majority of the participants, as seen on figure 6.1, answered eight to nine questions within the given time frame. This may indicate that the time it takes to answer a gamified survey has an effect on the user's willingness to answer or complete them. Alternatively, the gamified survey may need more incentive to complete them or be in a faster format. It

can be deduced that the current engagement or motivation factor in the gamified survey can be improved, as most participants answered they preferred the ordinary or had no preference.

From the intervention, a summary of the provided feedback:

- Player wanted different challenges levers in the gamified survey.
- Thematisation of the game was highlighted, such as a boss, a stronger enemy offering a larger reward, who would resemble a professor at the university and use books to attack the player.
- Better visual feedback on the direction of the players' character to make it easier to see which direction they are facing and shooting.
- The upgrade system, and weapon system were hard to understand, due to the additive nature of the system.
- More variation in the game elements would be preferable.
- Players wanted different difficulty levels which suit their current skill.
- Some participants felt it took too long to complete the survey present in the game.

All of these topics have been found in early intervention, though not all have been focused on until this point, which means there is not much to add from discussion, except for conferring these topics of possible improvement suggestions.

6.3.2 Second Session

Out of the 101 students, results was received from 41 students. For each participant, information such as their inputted name, score, and the list of their submitted answers were stored. No identifiable information is obtained from the user nor the system they played on.

Figure 6.2 shows the number of questions that individual participants completed in total.

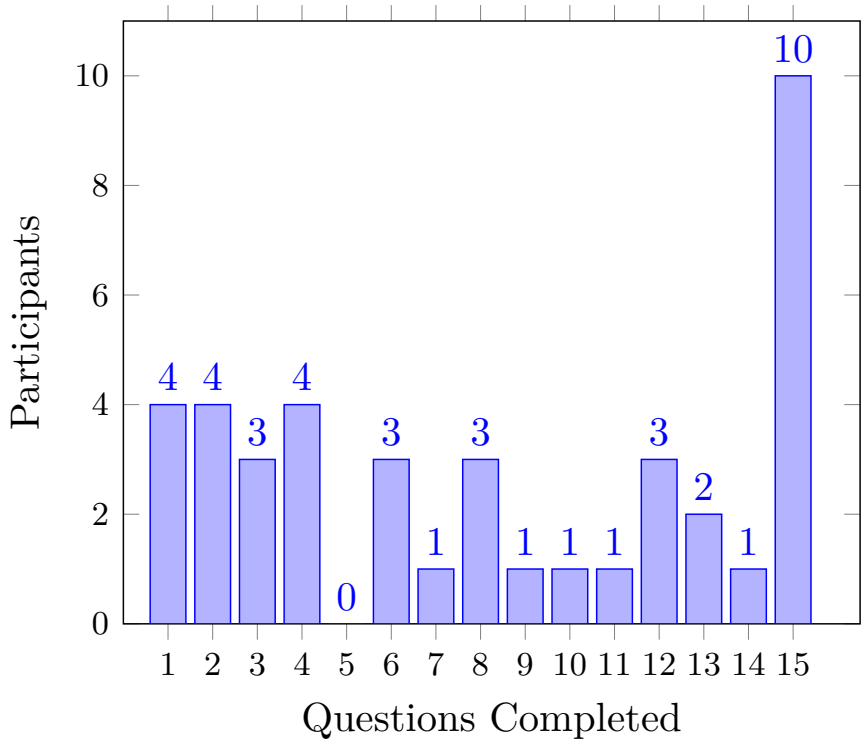

Figure 6.2: Questions completed per respondent of gamified survey

As the graph shows, the mode value is 15 questions, as that is the number of questions the most participants completed. Counting collectively, however, the majority of students only partially completed the survey. This illustrates that the focus and attention of the participating player may taper off over time, and they may end their play session early before answering all available questions. Those who completed all the questions, may either have remained captivated by the gameplay or felt compelled to see the survey to completion.

To assist in deducing participant experiences, it is prudent to examine the answers they provided to the survey meta questions. Table 6.2 details these questions along with the answers provided to them.

Do you prefer this game or the ordinary questionnaire? 30 Total Answers	
Game Survey	11
Ordinary Survey	9
No Preference	10
What do you think is the maximum amount of questions a game like this should have? 18 Total Answers	
5-10	7
10-15	4
15-20	3
20-25+	1
Do not know / Do not care	3
Rate this game experience? 10 Total Answers	
Very Good	3
Good	2
Average	3
Poor	1
Very Poor	1

Table 6.2: Survey answers to meta questions, second session

The first question, being the earliest meta question in the survey, also has the most responses. It displays an almost perfect split between the preferred type of survey, with a slight favour towards the game survey. This makes it hard to discern whether or not the game survey is more appealing and for what reasons.

The second question has 18 responses, and shows that players generally will want fewer questions than the evaluation survey contains. This can also be seen in the number of participant that reached this question, as there were 12 who stopped prematurely.

The third and final meta question is meant to be an overall resolution of their experience. The majority overall rated they had a positive experience with the gamified survey.

Figure 6.3 shows the percent statistics of the 6. semester Software students for both the ordinary evaluation and the gamified survey, both of which were distributed at around the same timeframe. Due to rounding, the percentages do not equal 100%.

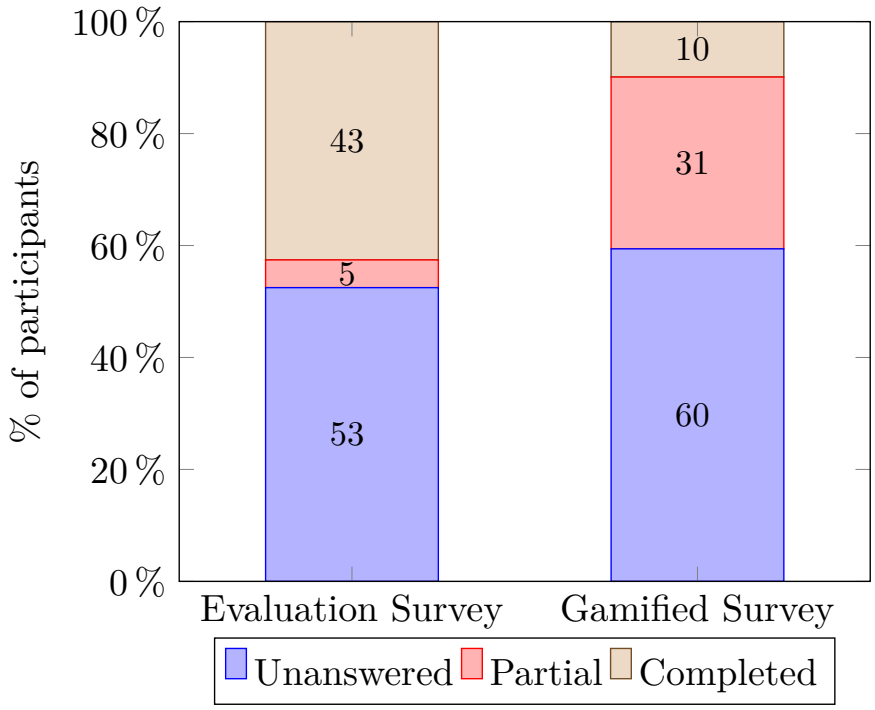

Figure 6.3: Response Rates of Evaluation Survey versus Gamified Survey

Detailing the legend, 'Unanswered' refers to those who have not submitted any survey results, 'Partial' refers to participants who have answered at least one question and 'Completed' are those who have completed and submitted all available questions in the given survey.

This graph shows that, for both types of surveys, the majority of participants do not opt to submit their feedback at all.
Following this, the gamified survey has more partial submissions than the ordinary survey. A larger portion of participants ends their session before completing all questions, which varies substantially, as can be seen on figure 6.2.
Finally, the combined 'general participation' rate, by counting both Partial- and Completed participants, is similar for both surveys, deviating by a few percentages. While it is not tracked whether the link to the game has been clicked, it can be assumed that players who do not have a high score and have answered no questions, have most likely not opened the game at all. During both earlier BIE cycles, as well as informal discussions with some 6th semester Software students, it was pointed out that many students pay little attention to mails. When considering that both survey types had similar participation rates, it seems reasonable to assume that part of the reason for low participation, is due to the students' disinterest in mails received. This indicates that it is not the type of survey, but the method of distribution, which could be a significant factor in improving answer rates.

6.3.3 Comparing between Survey Types

To further highlight the variation in the experience, the answers provided for the survey questions will be compared for disparities and similarities. The results of both types of surveys for the available questions are illustrated in appendix A.4.1. For reference, the ordinary survey had 23 and 53 responses from BaIT2 + IxD2 and SW6, respectively.

While the sample sizes represent only a fraction of those who participated in the ordinary survey, by looking at the results, it can be inferred that the overall results generally remain similar between both types of surveys. Those who answer one answer in the ordinary survey seem to give similar answers in the gamified survey. This shows that participants are potentially still answering the gamified survey's questions honestly, despite it occurring in a different medium.

When comparing participants' dispositions, some results seem to lean towards slightly more negative answers when asked in the gamified survey. For some questions, like '**How do you assess the relevance of the courses for the project?**' which is illustrated on figure 6.4, the answers fall more towards negative answers, like 'Poor' or 'Very Poor'. This could potentially mean that participants are more critical when answering within the gamified survey, or that they are more disposed to answering negatively, while playing the game.

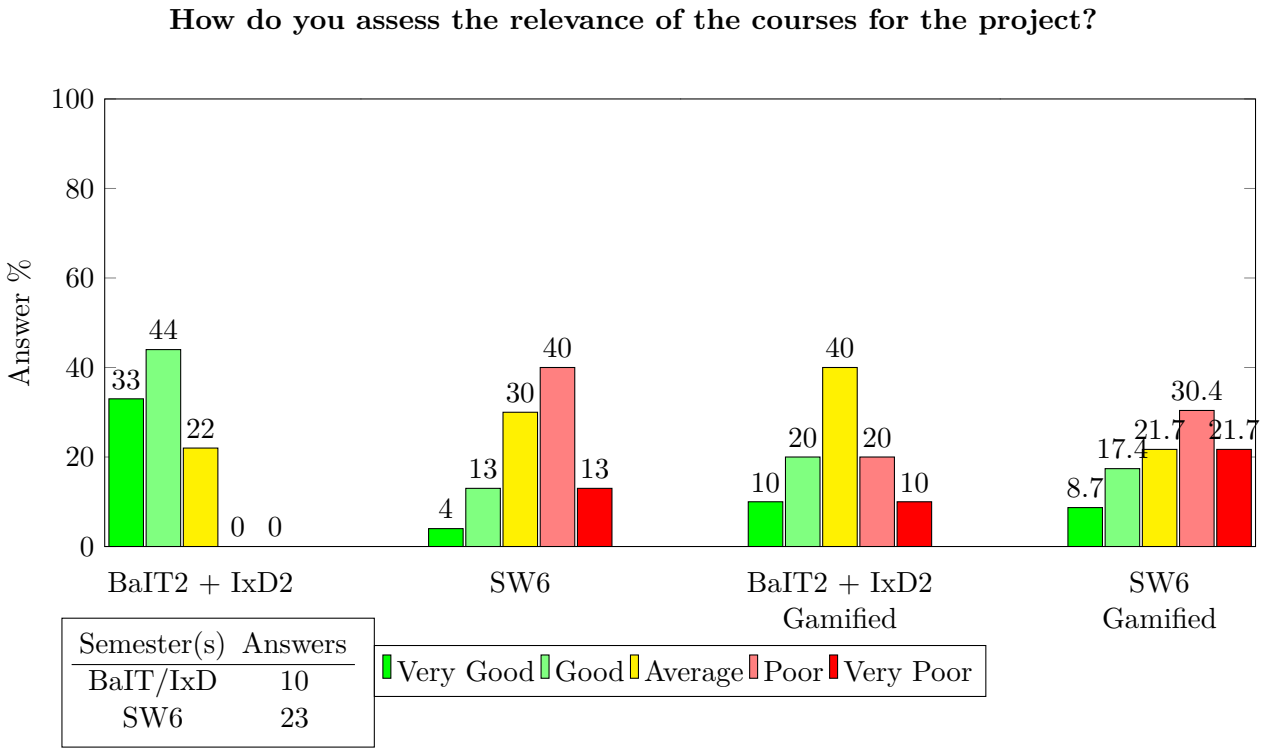

Figure 6.4: Results of questions between semesters for ordinary and gamified survey

These hypotheses should be held with some scepticism, as the smaller sample sizes may not be reflective of all the participants.

Evaluating with CS Head of Study

After concluding the intervention of this iteration, a meeting was arranged with Ulrik Nyman, the current Head of Study for the CS Department of AAU. In this meeting, Nyman was presented with the results of the project and what discoveries were made during it.

Overall, he was positive regarding the concept of an alternative survey medium, whether gamified or not. The ideal situation, as he expressed, is this alternate survey being able to easily integrate into their current survey-model, such that students could freely choose either type of survey, and the study board could aggregate the results of both surveys in the same manner. The results could then also be organised in the same way, by extracting submitted surveys into their existing system and sorting them all equally.

The considerations regarding the distribution method were relayed to Ulrik Nyman, to which he expressed frustration. He stated it was generally difficult as e-mail is considered the primary, most easily available line of communication to all students. As such, one of the recommendations given was that he could continue to reserve time during lectures, for the students to answer.

6.4 Reflection & Learning of Cycle 3

This sections details the reflections and new viewpoints obtained from this BIE cycle.

6.4.1 Evaluating the Meta Questions

The meta questions included in the surveys serve as the primary method to obtain data from participants that played the game.

The 1st question, used in the first session, *'How does this type of game affect the answers you provide?'* is arguably an unclear question, as the medium of the survey should not reasonably affect the answers a participant provides. This ambiguity is also reflected in the results themselves, as the majority selected 'No Difference'. The overall intent of the question was more oriented towards the participants overall experience, positive or negative, with the survey itself.

The spacing between survey- and meta questions was deliberate to maintain focus with the ordinary evaluation survey, such that it could simulate a real-world scenario with this game as the survey medium. Alternatively, these questions could have been presented at the

very beginning, or the very end of the game, in order to create a separation with the evaluation survey and the evaluation of the artefact. How this would have affected the results of survey and the artefact evaluation is a debatable factor for future development.
Alternatively, the meta questions could have appeared a few rooms into the game. At this point, players would have experienced all the primary content of the game, and so could provide more thorough and complete feedback of their experience, this could have ensured more answers to the meta questions, as some of the participants who did not fully complete the survey would have reached the meta questions.

Another factor is the number of meta questions entirely. The meta questions represent a fraction of the total amount of questions, in order to, as stated earlier, simulate the ordinary survey experience as closely as possible. A variation of the artefact with the majority or the entirety of questions being meta questions may have created a different experience, although this may have made the results less comparable to the ordinary survey as this context may affect the students' mentality.

6.4.2 Interpretation of data

Visible from the response rates data on figure 6.3 is that more participants of the gamified survey end their session prematurely. One possible reason for this may be due to the 'game' part of the gamified survey becoming the primary focus for some participants, and so when they feel that they have played enough of it, they stop their game session, leading to partial submissions. Contrary to this, the ordinary survey has a lower percentage of partial answers, which may be a result of the survey's more direct focus and purpose. In general, it seems the gamified survey, might need further motivational factors, for the participants to continue playing.

The validity of the survey results received from the distribution tests is up for debate, as the students who participated in the test have not been overseen or interviewed for their experiences. It is possible that the answers for the gamified survey are taken less seriously than an ordinary survey as games are often enjoyed as entertainment. The answers have not been compared to the answers of the ordinary survey, nor have the survey answers been thoroughly checked for sign of speeding or similar problems. As such there are no guarantees that students have answered the survey genuinely, or in the same way the would the ordinary survey.

6.4.3 Distribution Method of survey

We decided to use the same distribution method as the traditional semester evaluation survey, in order to simulate a normal semester evaluation. As such, the gamified surveys would be available to access for one week. As our test started the same week as the ordinary semester evaluation, we made it clear to the students that this survey was separated from

it. We used one reminder, which was sent out to the students one day before the end of the test. By using the same method of delivery, the results open themselves up to the same issues that the ordinary evaluation survey faces, which may have been more productive to try and alleviate.

Our participation rate, counting together those who completed, and those who partially answered, is 41 out of 101 students in the second session. Compared to the normal semester send out to software 6, which had a participation rate of 48% this semester. Contrary to that, a trial was done last semester on 5. semester of the Software programme. For this trial, Ulrik Nyman the AAU head of study visited a course lecture, and asked assembled students to fulfil the evaluation survey before the lecture began. The evaluation survey for that semester had a completion rate of 71% [1].
This could be a hint toward e-mails not being the best distribution method for surveys. This is further made clear, when we compare the result for the first session to the second session. It is clear in the first session, that most of the participants answered all questions in the gamified survey, as well as the normal. Where the main difference was how gamified survey was distributed to the students and the number of students in the first session was fewer.

The issue of distributing the survey may open the possibility of an additional design principle detailing the importance of distribution-methods. If a more effective way of delivering and sharing the survey also results in better response rates, then it may prove crucial to the design of the IT artefact. To confirm this, more testing of different ways to deliver the survey will be necessary before it is proven as fact.

6.4.4 Reevaluating player engagement

The first problem, detailed in section 4.1, was centered around player engagement. Based on the presented considerations about the distribution method and students' unwillingness to open the survey at all, this might not have been the ideal starting point for research. Instead of initially focusing on how to keep players engaged, potentially developing a method to attract players more could have been more prudent.

7. Formalisation of Learning

As part of the formalisation of learning part of the ADR process, this chapter will contain a reevaluation and final explanation of the design principles of this report.

7.1 Design principle reevaluation

The reevaluation of the design principles will consist of two parts, the first will be a reusability evaluation, in the hope of maximising the potential value, for any future use. This evaluation will be based on the 'Reusability Evaluation' framework from Iivari et al. [34]. This framework was selected as it is a formal, established method to evaluate design principles in a structured manner, to ensure that they are generalised to be used in many contexts.

This framework describes five evaluation criteria:

- Accessibility: Are the design principles easy to understand for the members of the target community?
- Importance: How important is the problem the design principle is trying to address in its real world context?
- Novelty and Insightfulness: Is there a potential for practitioners to be surprised by the design principle?
- Actability and Guidance: Can the design principle realistically be carried out by practitioners, and is it within their control and, does it offer the right amount of guidance, without being too restrictive?
- Effectiveness: Does the design principle have a positive effect on the context?

As the second part of the design principle reevaluation, the design principles will be expanded with further explanation of their purpose, based on the theory of "anatomy of a design principle" which stresses the importance of the rationale behind design principles [36]. Ideally, this will also help fulfill the reusability criteria of accessibility, as well as Actability and Guidance, as this should make it clearer what the purpose of the design principle is, and what the resulting implementation should accomplish.

To conform with accessibility and especially the guidance part of actability and guidance, multiple of the design principles have been reworded. This rewording is an attempt to make it more clear what action a designer is intended to take based on the design principle and clarify what exactly the design principle means.

7.1.1 Informative Progress

Informative progress states that the player should be informed of their progress in the game, as well as on the overall survey they are doing. It can cause frustration for players, if they cannot be informed of their progress in the survey. If parts of the game do not concern answering the survey, like in Action Dungeon, players might become frustrated waiting to progress on the survey. Some players might just be playing to finish the survey, and want to know how many questions they have to go through. In Action Dungeon, when the player dies, they keep their progress on the survey. Alongside this, a counter was added to the main menu to draw attention to this fact, as not knowing this, or thinking it worked a different way, caused frustration.

In terms of reusability evaluation, informative progress arguably, does not fit fully under effectiveness for all players. During the BIE cycles, it was clear that some players did not care about the survey at all, and were simply focused on playing the game. Whereas for others players, it was very important. Since Informative Progress does have a seemingly large positive effect for some users, with no negative effect for the rest, it should still be usable as a design principle.

Design principle	Description	Purpose
Keep players informed of their progress	The player should be informed of their current progress in their game session, as well as their total progress for the game and survey.	Some players will become frustrated if they do not know when the next question will appear, as well as how much is left of the survey, to mitigate this the game should keep them informed.

Table 7.1: Revised 'Informative Progress' Design Principle

7.1.2 Intentional Feedback

The intentional feedback design principle states that players should know when they are submitting feedback, what the feedback they are giving means, and how to do it. This design principle improves the experience for both the survey participants and the surveyors. If the players are confused as to how they should give feedback, or what the feedback they are giving means, the survey results may become unreliable. At the same time, players become frustrated, if they are not able to give the feedback they want, or if they do not realise how the answering mechanics work.

This design principle can seem to contradict the later design principle 'Integrate the Survey and Game', as well as the trap-based survey design of Action Dungeon, as integrating survey and game could imply adding gameplay challenge into the answering process. When considering actability and guidance, as well as effectiveness, it may seem problematic that this conflict is present, as the design principle may be confusing to implement or seem to have a possible negative effect. However, players do not seem to mind there is a challenge involved

with answering the survey, but it is important that they do not feel confused about how to answer, pressured towards one specific answer, or that it is a direct negative thing to answer a specific question. The design should motivate them to give the answer they wish. Because of this, the design principle has been renamed so it is clearer how to avoid this conflict, by focusing on making the answering process transparent and obvious to the user.

Design principle	Description	Purpose
Make answering transparent and intentional	It should be clear to the player when they are about to submit feedback, and no game elements should conflict with the submission process, making them able to give exactly the feedback they intend to.	Players as well as survey providers are interested in feedback which is as reliable as possible, so the survey design should not interfere with this. Additionally, players can become frustrated if they feel the answering process is unclear or if it is too difficult to give the feedback they intend.

Table 7.2: Revised 'Intentional Feedback' Design Principle

7.1.3 Ease of Access

Ease of Access states that the goal and controls of the game should be easily understandable and obvious. This design principle seems obvious for most games and even pieces of software [37]. Due to the already negative feelings on surveys, however, this design principle was meant to emphasise the importance of ease of access for gamified surveys specifically. Since users already have negative associations towards surveys, if the survey is too difficult to interact with, they will quit prematurely.

In terms of the reusability criteria, this principle does not fit with novelty and insightfulness. Generally, it would be expected of any piece of software, or game specifically to be easily accessible, so as to not scare off new users. As such it has been decided to remove this design principle. While the argument of Ease of Access is quite important for gamified surveys specifically, since users are quick to dismiss them, the design principle simply does not align enough with the reusability criteria, and does not individually bring enough value outside of common design knowledge.

7.1.4 Capture Player Attention

According to this design principle, a gamified survey should capture player attention, by constantly demanding player interaction, and using the concepts like Flow Theory. Generally, it is important to keep players focused on the game part of a gamified survey, and not have them feel like they are simply taking a survey. This can be achieved by keeping them constantly entertained through the gameplay.

Design principle	Description	Purpose
Capture and Keep Player Attention	The game should attempt to maintain player attention and focus by using Flow Theory and demanding constant player interaction.	The players attention should be focused on the enjoyment of the game as much as possible. If the game allows the player to get bored, or does not take the focus away from the disliked survey part enough, players will not enjoy the gamified survey and are likely to end the game prematurely.

Table 7.3: Revised 'Capture and Keep Player Attention' Design Principle

7.1.5 Diverse Motivational Factors

During the BIE cycles, it became clear that some people were motivated by playing the game, getting a high score, earning rewards etc., while other people were more motivated by providing their feedback through the survey. This design principle tells designers to account for this duality in motivational factors.

Design principle	Description	Purpose
Motivate gameplay and answering surveys	The game should provide motivational factors for people motivated by playing games and people motivated by providing feedback	Some players will be motivated by playing the game, some will be motivated by answering the survey. Thus, if answering the survey feels deterred, some players will be discouraged, if the game feels like it only has the purpose of letting the player answer questions, other players will feel discouraged.

Table 7.4: Revised 'Diverse Motivational Factors' Design Principle

7.1.6 Integrate the Survey & Game

It is important that focus is removed from the tediousness of answering surveys, and is instead put on enjoying the experience. This design principle is meant to address this, by saying that answering the survey should be an integrated part of the gameplay, so it feels natural to answer the survey as a part of the game, and does not lead the thoughts unnecessarily towards an ordinary survey.

Design principle	Description	Purpose
Integrate the Survey & Game	The game and survey should aim to be unified as a single element, such that players will find it enjoyable to both play and answer surveys. Answering the survey should be a part of the gameplay, such that the survey part is a continuation of the rules and mechanics of the game part	To remove the player from the tediousness of surveys, the survey should be an integrated part of the game. The gamified survey can contain somewhat of a split between survey and game, but answering the survey should contain game elements, and have the player feel as if they are playing a games.

Table 7.5: Revised 'Integrate the Survey & Game' Design Principle

7.1.7 Final design principle table

This leads to this final table of design principles for the project:

	Design principle	Description	Purpose
1	Keep players informed of their progress	The player should be informed of their current progress in their game session, as well as their total progress for the game and survey.	Some players will become frustrated if they do not know when the next question will appear, as well as how much is left of the survey, to mitigate this the game should keep them informed.
2	Make answering transparent and intentional	It should be clear to the player when they are about to submit feedback, and no game elements should conflict with the submission process, making them able to give exactly the feedback they intend to.	Players as well as survey providers are interested in feedback that is as reliable as possible, so the survey design should not interfere with this. Additionally players can become frustrated if they feel the answering process is unclear or if it is too difficult to give the feedback they intend.
3	Capture and Keep Player Attention	The game should attempt to maintain player attention and focus by using Flow Theory and demanding constant player interaction.	The players attention should be focused on the enjoyment of the game as much as possible. If the game allows the player to get bored, or does not take the focus away from the disliked survey part enough, players will not enjoy the gamified survey and are likely to end the game prematurely.
4	Motivate gameplay and answering surveys	The game should provide motivational factors for people motivated by playing games and people motivated by providing feedback	Some players will be motivated by playing the game, some will be motivated by answering the survey. Thus, if answering the survey feels deterred, some players will be discouraged, if the game feels like it only has the purpose of letting the player answer questions, other players will feel discouraged.
5	Integrate the Survey & Game	The game and survey should aim to be unified as a single element, such that players will find it enjoyable to both play and answer surveys. Answering the survey should be a part of the gameplay, such that the survey part is a continuation of the rules and mechanics of the game part	To remove the player from the tediousness of surveys, the survey should be an integrated part of the game. The gamified survey can contain somewhat of a split between survey and game, but answering the survey should contain game elements, and have the player feel as if they are playing a game.

Table 7.6: Final evaluation of design principles

7.2 Research Questions

The primary research question formulated for this project, '**How can a gamified survey system be designed, which motivates students to submit feedback?**' and its underlying sub-questions, has been sought to be answered through the application of Action Design Research.

Q1, '**Which design elements create enjoyment and avoid frustration for students in a gamified survey?**'
The design elements in question are what is covered by the design principles of the report. These design elements, when correctly implemented, adds to the enjoyment of the experience, which entices and motivates participants to play the gamified survey, and for longer.

Q2, '**Does increased enjoyment lead to an increased desire to answer the gamified survey?**'
Through the results found primarily in the personal play-testing interventions, participants who found the game interesting and compelling played the game for longer, which in turn made them complete the contained survey. Generally, participants who completed the gamified surveys were those who enjoyed the survey. However, even though a gamified survey is considered more enjoyable than a conventional survey when asked, this alone does not result in increased answer rates. Other factors found to potentially affect the answer rates include the method of delivery or the type of experience offered.

Q3, '**To which extent does a gamified survey provide an alternative to a traditional survey?**'
The data collected have shown that the same or very similar questions from the ordinary evaluation survey can exist in the gamified survey. However, the desirable number of questions present, is often lower than what an ordinary survey contains, meaning some information can not feasibly be collected in a single gamified survey. Some personal questions may also not be appropriate to include in a gamified survey. It was also stressed that it is important that the gamified survey is easily implementable, and that it integrates with the traditional survey system, such that it is of minimal extra effort for the organisation using it. Results have also shown that it takes longer on average to complete a gamified survey. Designing a gamified survey in and of itself also requires time and resources, which may offset the potential benefit of using it in the long term.
Besides this, participants stated that they very much liked the idea of a gamified survey existing as an elective alternative survey, preferably if the genre of game could change from survey to survey.

8. Discussion

This chapter discusses the overall contribution this project provides for the problem field encompassing gamification and surveys, as stated within the research question for this report.

8.1 Contribution

Our main contribution is a set of design principles that serve as a basis for designing a gamified survey. In addition to that is this report itself, which documents our observations and development of the design principles through an ADR approach.

8.1.1 Principle 1 - Keep players informed of their progress

Few studies have provided detailed descriptions of the information given to participants regarding their progress in gamified surveys, and no studies have been found that details the specific effects it had on the participant. In these studies, participants preferred the gamified version with its' progress system. [24, 28]

One problem found during the evaluation is that progress can be visualised in many ways, such as through achievements, progress bars, information about the stages of the gamified survey, etc. Multiple studies have implemented some kind of progress feedback to a user in their gamified survey. These show that in some cases that participants expected some kind of a relation between game mechanics and progress. [26, 28]

Our contribution shows that there are multiple facets with regards to this aspect of gamified survey research and highlights that there are multiple ways to fulfill participants' expectations regarding progress feedback. There were no consensus among participants regarding the amount of information they desired or needed regarding their progress in their current survey. Some participants found it highly relevant, while others did not, and other participants did not even comment on the prospect. Therefore, it is crucial to provide progress feedback in a way that does not interrupt participants' overall experience.

8.1.2 Principle 2 - Make answering transparent and intentional

In multiple studies, it has been shown that the method people use to answer a gamified survey influenced their willingness to answer a survey. If the answering process is properly executed, it results in a better user experience. In a limited study, it resulted in higher response rates when compared to conventional surveys. [26, 28]

One study found that they could ask survey questions, without it being phrased directly as a question [38]. This is in clear contrast to this design principle. Many survey participants consider it important that the feedback they give is actually the feedback they intend to give, so a design which leads to questions being hidden or unclear, or where answers may be up to interpretation, can cause concern. The authors of the study concerning the phrasing of questions do highlight that this method is imperfect and has many aspects that must be considered before applying it in a practical scenario.

Our contribution presents a more detailed design approach to do it. By gamifying a survey, non-traditional answering options can be utilised, but the focus of the given question, as well as the process of answering, must remain clear and understandable.

8.1.3 Principle 3 - Capture and Keep Player Attention

This aspect is a key focus of our study and has been found to be a crucial component of gamified surveys. Many studies have attempted to make gamified surveys enjoyable, with varying degrees of success. Overall, these studies prove that a gamified survey that is deemed fun can be created, mainly when the concept of flow is employed and experienced by survey participants. [24, 29]
Our findings also confirms this case. However, it also highlights the difficulty of achieving a consistently enjoyable experience across a larger user base, as different participants are captivated by different elements. It is important to note that what may engage one type of participant, may disinterest another. Our study emphasises the importance of varying game elements to cater to the diverse preferences and interests of participants. Additionally, while flow contributes to an enjoyable experience, this design principle adds that keeping constant player interaction also comprises a significant part of the experience, by keeping players focused on the game.

8.1.4 Principle 4 - Motivate gameplay and answering surveys

This is a key aspect of gamification, where the aim is to transform something that may be considered trivial or uninteresting into a more enjoyable experience or motivate people to take certain actions. Many studies have focused on participants who are motivated by gameplay, using game elements, contextualising questions in a new way, or implementing storytelling and other game elements into the survey experience. As opposed to participants who are motivated by answering surveys, but would simply like a more interesting experience. These approaches have shown success in overall participant motivation and enjoyment of the experience [24, 26, 29, 38]. When comparing motivation based on receiving points for an image tagging task, and being told there is a meaningful purpose for the task, one study indicates that points makes users tag more images, while a purpose increases the quality of the tags. Both increase the motivation for the task. This indicates there are multiple ways a task can be motivated.

Our findings, based on interviews conducted, confirm these findings, although our contribution highlights two types of survey motivations, survey motivation and game motivation. A prime example is the scoring system present in the IT artefact. Some participants were extrinsically motivated by the idea of gaining points, but others noted they were much more motivated by the idea of being the highest on the scoreboard and enjoyed the idea of competing against fellow students. Some also indicated that the scoring system was not important to them at all, and if they were doing a gamified survey it was simply for the sake of the survey and to provide value to the surveyors. The gamified survey may still be valuable to them as the experience could still be more enjoyable than traditional surveys.
There are at least two areas of motivation, with regards to gamified surveys. Some individuals are motivated by game-related factors, while others are motivated by factors specifically related to answering surveys. It is important to consider the needs and preferences of both types of users when designing a gamified survey. Our findings also indicate that letting participants strategise and plan for optimal play, leads to enhanced motivation.

8.1.5 Principle 5 - "Integrate the Survey & Game"

Many studies have explored different levels of gamification, when applied to surveys. Some studies have implemented achievements within surveys, while others have embedded surveys within games. Overall, these studies have reported positive but limited results in terms of the interaction with gamified surveys. They have resulted in a better user experience but often come with higher costs, such as the need for custom software, the implementation of a story or theme, or specific wording and placement of questions. A common observation is that the level of integration of a game and a survey may become so complex, that it becomes difficult to measure and evaluate each component separately. [23, 24, 26, 29, 38]

In our study, we adopted the 'Hard Gamification' approach of having a game with embedded survey questions. Our design principle emphasised the need to integrate the survey seamlessly within the gamified experience. We demonstrated that a traditional survey can be effectively implemented within a gamified survey without the need to rework the experience around questions or narrative structures. Moreover, our findings suggest that an explicit story told to the player may not be necessary. However, an overall theme will still contribute a lot to the experience. There should be a natural relationship between game elements so that no element feels disconnected from the overall experience.

8.2 Practical Implications

During the development of this project, two parties who might benefit from the contributions of this project were identified. The first group are those who develops software for gamified surveys. The second group are the surveyors, like Ulrik Nyman, who makes the survey

questions and uses the survey to draw knowledge from it.

Developers

The main contribution to them is our design principles. By applying them, they can create a foundation for a gamified survey. The following observations are based on results found in the interventions of the project cycles but have not been thoroughly explored. There were found additional factors that can help developers affect the players but have not reached to be design principles these will be highlighted here:

- For gamified surveys it is very important to know your player base due to player preferences for games, such that the game genre align with them. Therefore, it is very important to have a good understanding of them.
- The way a survey will be distributed should be accommodating to players' preferences.
- The pacing of the game has an effect on how many questions a participant is willing to answer.
  - When the pacing of the game is slower, the participant may think more about the question, but this may affect the number of questions they are willing to answer.
  - In contrast to that, when the pacing is faster, participants are more willing to answer questions, but this may cause speeding or the participants to not consider the questions or read them thoroughly. It is hard to say if they are willing to answer more questions than the slowing pacing format.
  - The immediate pacing or the tempo of the game is often determined by the game's genre. Therefore, this has not been further explored as only one game genre has been used in our development, but the design principle "Integrate the Survey & Game" indicates there needs to be a clear relation between game pacing and the pacing in the survey.

This list is non-exhaustive, as it very much depends on the context and the player base for a given gamified survey. Therefore, a key piece of advice we have is to consider the player base as much as possible, and listen to any feedback on the surveys, if any is given and find the general problems or possible improvements. Keeping in mind, that players will be different and have different experiences and preferences, causing one solution to be appealing to everyone be unlikely.

Surveyor

This section is written out on our interaction with players and their statements to surveys. Therefore, our recommendation to Surveyor is formed on that. We would like to highlight:

- Consider the number and complexity of questions in a survey, as players value their time very much and many of them look for any excuse for not taking it.

- Consider the distribution method, as well as information in. Players' relation to that media has a profound effect on their willingness to interact with it.
- If it is possible make an event out of it where players can answer the survey. Where the event should be part of the player's normal day, such as making them answer a survey at the start of a lecture. This will provide players with time to do it and be aware of the reasoning for that survey. But this should not be a general part of lectures as it will make players tired of it and it removes the focus away from education.
- If the feedback is relevant for players, provide them with it and what there will be done with it. Within a reasonable amount of time. As they would like to see what their response is used for but keep it conquered and precise.

These are our most relevant recommendations for the surveyor as they have interacted during writing this report. One of the most relevant problems is motivating people to answer a survey. This is found to be a complex issue, as a strong, universally proven incentive to generate motivation has not been found at the current time, without incurring a high cost. While gamification may add enjoyment for the people who are being surveyed, it does not solve the inherent problems that already exist in ordinary surveys, such as speeding, trouble getting people to even attempt the survey in the first place, etc.

8.3 Limitations

Several limitating factors are identified for this project. These limitations are factors that impacted or influenced the research process, results or development in some way.

The first limitation factor was time constraints. Further development and experimentation, in the form of additional BIE cycles, could have been beneficial for the state of the artefact and improved the overall intervention- and evaluation results. The project however had a fixed deadline, meaning further development had to cease in order to articulate and document the findings.

The second limitation of our study is the limited scope of the project, which primarily concerns the CS department of Aalborg University. For the playtesting interventions, 8 unique participants, students of the university, were invited to test the artefact in various interventions. Among these participants, 5 had prior familiarity with the project, through personal connections with someone from the group. Additionally, 2 participants were involved in two interventions. This relatively small number of participants may not accurately represent all the users of the context, which in turn affects how the users in a larger context are represented. Moreover, there is a high probability that our participants already have a predisposed interest in computers and games, due to their academic focus on computer science.
Furthermore, our evaluation of the design principles was conducted over three cycles using

a single IT artefact, which further narrows the scope and applicability of our findings, this is a consequence of using ADR as the research method. This implies that the application or implementation of the design principles may not have the same impact on a broader user base or users from different contexts, as they are likely to have different relationships with surveys and games. To ensure that our design principles were as generalisable and widely applicable as possible, they were evaluated using the reusability evaluation framework from Iivari et al. resulting in minor changes to them at the end of the project [34].

The third limitation of our study was our data collection methodology. During BIE cycle 1 and 2, the intervention consisted of a play session and an interview. Interviewers were present and observed participants during the play session. It is unclear if this presence and observation affected the participant in some way, which may not reflect the true experience within the context.

The fourth limitation was the method of distribution used in delivering the survey, which resulted in 41 answers from the chosen semester. By using the same distribution method as AAU, we were also limited to only getting an answer from students who checks their mail in the week the gamified survey was available, this is similar to the problems normal semester evaluation surveys face.

An alternative data collection approach could have been used, such as by observing a study group from the outside, as they played the gamified survey. This could then be the basis for an interview with them individually or as a group, such that there are as few influencing factors present as possible, while they interact with the IT artefact in the intended context.

8.4 Future Work

For future work there are two interesting topics for a gamified survey, These areas are the distribution method and the game genre and how it affects people's motivation.

8.4.1 Distribution method

The results of the interventions points to the distribution method being a substantial factor on whether or not people are willing to submit surveys. Therefore, it would be prudent to examine whether a gamified survey being in another medium, such as a mobile phone, would affect people's willingness to answer a survey. Approximately 97% of all adults in Denmark use a mobile phone. In addition, there are around 2.6B people who play mobile games in the world [39]. Therefore, we believe there is a good probability that the average Danish smartphone user also plays mobile games, meaning it might provide an effective method of delivery to the users.
A practical example could be a poster with a QR code, which could say try out the new

survey game for the cafeteria. When they scan it, they would get an app with a survey game. This could provide participants with a new incentive to answer surveys, as they are in the context of that survey.

Another distribution method worth looking into is making an event out of answering a survey, This has been shown to improve the answer rate in smaller cases. The question is how these events can be arranged, such that people do not find it irrelevant and they also feel rewarded for their answer, while also committing the least amount of resources on the surveyor's part. The question is how this can be made so participants find it convenient enough and feel rewarded for their answers.

8.4.2 Alternate Types of Hard Gamified Surveys

The incentive presented in this paper has mostly been in the format of a game, where answering a survey is a part of the gameplay. As some participants found entertainment value in playing it, but others did not, it highlights that participants have different preferences for games.
Overall, they have found it to be an enjoyable way to interact with a survey, compared to a normal online survey. However, it was pointed out multiple times that the genre and theme might not be interesting for everyone, and that different people will prefer different types, difficulties and features, when it comes to games. Therefore it would be sensible to investigate the effects of using other types of game genres and game elements for the gamified survey to deduce whether they have a noticeable impact on the user-perception and experience.

9. Conclusion

The results of this project show that gamified surveys are a promising approach to combat survey disinterest and lack of motivation. Combating these issues will help future surveyors to obtain more data and feedback of a higher quality. This project and its contents broadens existing research, through the proposed design principles as well as the contents of this report. The research question formulated for this project, has been sought to be answered through the application of Action Design Research:

How can a gamified survey system be designed, which motivates students to submit feedback?

The design principles proposed have been applied in a practical setting, the department of Computer Science at Aalborg University, through their implementation in a developed IT artefact. These principles and the artefact have been refined over three iterations, using feedback from the users in the context.
This feedback has been gathered from three intervention sessions, where participants would try out the IT artefact. These sessions varied in method to obtain both quantitative and qualitative results.

Examining the quantitative results, the answers provided appear similar with regards to the ordinary evaluation survey, that the department distributes each semester. The participation rates are close, and the answers reported by participants are in similar ranges. The completion rate was however found to be noticeably lower and the answers are slightly more negative than the conventional survey.
Looking at the qualitative results, however, seems to show a more positive response. The majority of participants reported they had a positive experience with the IT artefact, and were enthusiastic about the prospect of this type of survey being an alternative to the conventional evaluation survey.

For further research, the design principles should be applied and experimented in a larger context to see if their effectiveness is on par or greater, than within this isolated context. The implementations of said design principles can also be experimented with, such as through applying them to different game genres, and using alternate distribution platforms, in order to increase the entertainment values and reduce the practical and mental effort of the participants.

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A. Appendices

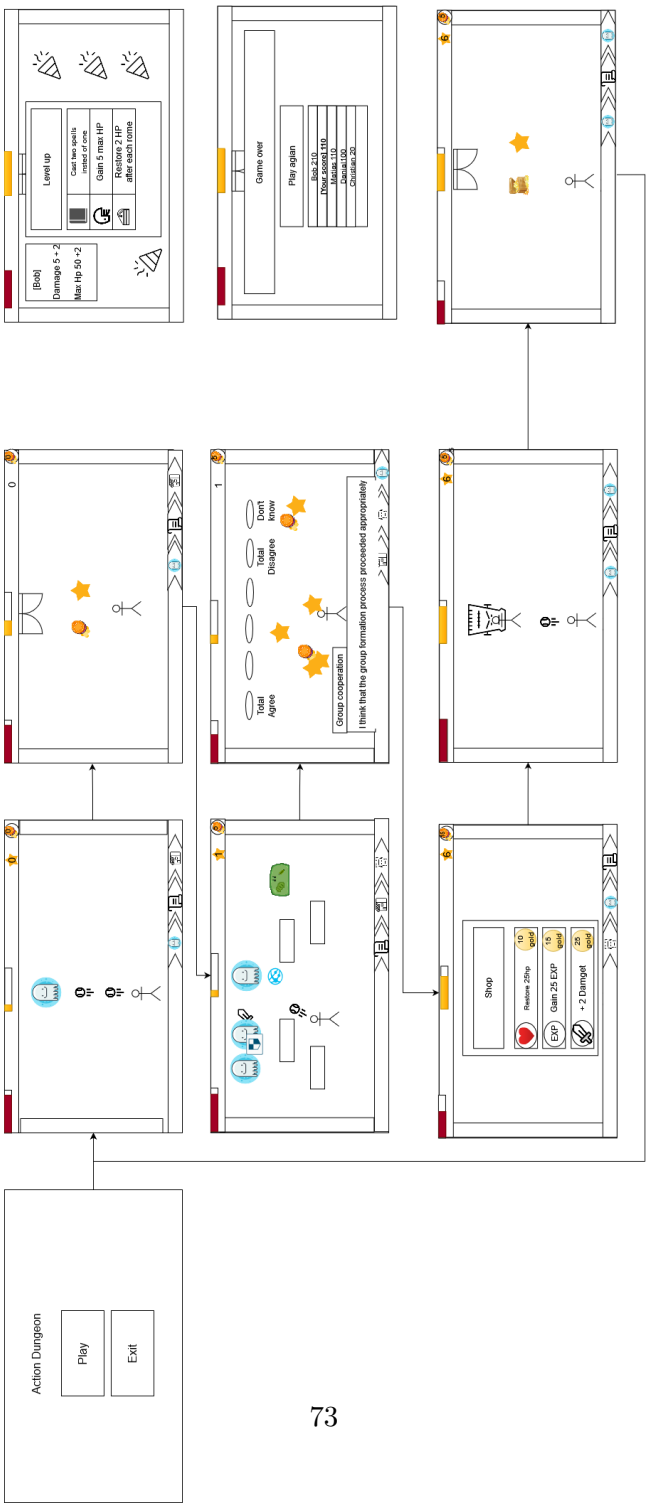


Figure A.1: 1. Prototype Wireframe

A.1 Playtesting Procedure

The members of the playtest session consists of the test participant, the test-moderator and at least one note-taker.

- **Test Participant** - Their function is to engage the survey game as an ordinary user and provide feedback related to their experiences with it. Ideally they have no prior knowledge or experience regarding the product or iterations of it.
- **Test Moderator** - Their function is to provide the necessary details and information to the test participant, as well as providing guidance if required. Following the test, they will also ask the arranged questions to the test participant.
- **Test note-taker** - Their function is to highlight and document the experiences of the test participant, as well as document the provided answers given during the questioning phase.

Test participants would be invited into a private room, where they would be presented with a laptop running the playable survey game. Before initiating the test, the test moderator asks the participant for their consent in recording the upcoming test session. Following this, a brief explanation of the product is provided.

After the participant is prepared, they are able to freely interact with the survey game, to a maximum of 15 minutes. They are free to stop their play at any point during this time. During this time, the content of the laptop will be shown to the moderator and note-takers through a secondary monitor.

Once the participant report back to the moderator or the time has elapsed, the question phase begins, where the moderator asks the arranged questions one at a time, the answers to which are documented by the note-takers. After all questions are answered, the test is concluded and the participant would be thanked for their participation.

A.2 Questions for Intervention Phase, Cycle 2

The questions presented to the play-testers are as follows:

- **Player Engagement**
  - What are your overall thoughts about the game?
  - Which elements of the game caught your attention?
  - Were there any parts of the game there led to less enjoyment or broke the flow of your play session?
- **Purpose in the game**

  - What elements of games motivate you to return to a game?
  - Did any component of the game motivate you to play further?
  - What do you think about the game's progression and score system?

- **Interaction with survey**

  - What did you think about your interaction with the survey through the game?
  - What did you think of the interval between questions?
  - Did the questions feel meaningful to the overall experience?
  - Would you like to know how many questions are left in the survey?

The above questions aims to provide insight into users' interaction with the prototype, as well as, how the design principles help in a better product.

A.3 Questions for Intervention Phase, Cycle 2

The questions and their categories presented to the participants are as follows:

- **Overall Game Experience**

  - How was the overall experience with the game / gamified survey?
  - Which elements of the game caught your attention?
  - Were there any parts of the Action Dungeon you liked? If so, please elaborate on what they were and how they can be potentially better.
  - Were there any parts of the Action Dungeon you did not like? If so, please elaborate on what they were and what could be changed.

- **Questions around Surveys**

  - Do you normally answer the semester evaluation survey?
    - 'No': Why not?
  - What are your overall feelings about this type of survey?
  - How did the obstacles in the survey room impact the experience of answering questions?
  - Would you prefer to participate in a survey through this game?

- **Debriefing & Final Thoughts**

  - What types of features would you prefer in this type of game?
  - What types of rewards will motivate you within this type of game?
  - Would you be more willing to answer such a survey a second time compared to a normal survey?
  - Any additional questions/thoughts?

- **Elements to Observe (FOR OBSERVERS)**
  - Were there any parts of the Question Room which made them stop?
  - Were there any parts of the Monster rooms which made the player stop?

These questions focus primarily on the newly iterated survey-question rooms, and the experiences regarding them.

A.4 Questions for Intervention Phase, Cycle 3

The questions present in the survey used in the first, closed session. Questions in bold are evaluation questions made for the survey itself:

- How do you assess the relevance of Datalogiens matematiske grundlag?
- How do you assess the competence of the teacher?
- How do you assess the teaching form and amount of teaching?
- **How does this type of game affect the answers you provide?**
- How do you assess the subject of the project?
- How do you assess the cooperation in your group?
- How do you assess the relevance of the courses for the project?
- **Do you prefer this game or the ordinary questionnaire?**
- How do you assess the competence and commitment of the project supervisor?

The questions present in the distributed survey used in the second session. Questions in bold are evaluation questions made for the survey itself:

- How do you assess the relevance of Algorithms and Computability?
- How do you assess the competence of the teacher?
- How do you assess the teaching form and amount of teaching?
- **Do you prefer this game or the ordinary questionnaire?**
- How do you assess the subject of the project?
- How do you assess the cooperation in your group?
- How do you assess the relevance of the courses for the project?
- How do you assess the competence and commitment of the project supervisor?
- How do you assess the amount of project supervision?
- What do you think is the maximum amount of questions a game like this should have?
- Digital study environment: The digital teaching, including online lectures, has contributed to my academic performance in the study programme?

- Digital study environment: My lecturers have been good at involving and utilizing relevant digital tools in the lectures/courses?
- Digital study environment: The available digital tools have supported project work well.
- Physical study environment :The premises are suitable for teaching (equipment, indoor climate, interior design, etc.)?
- **Rate this game experience?**

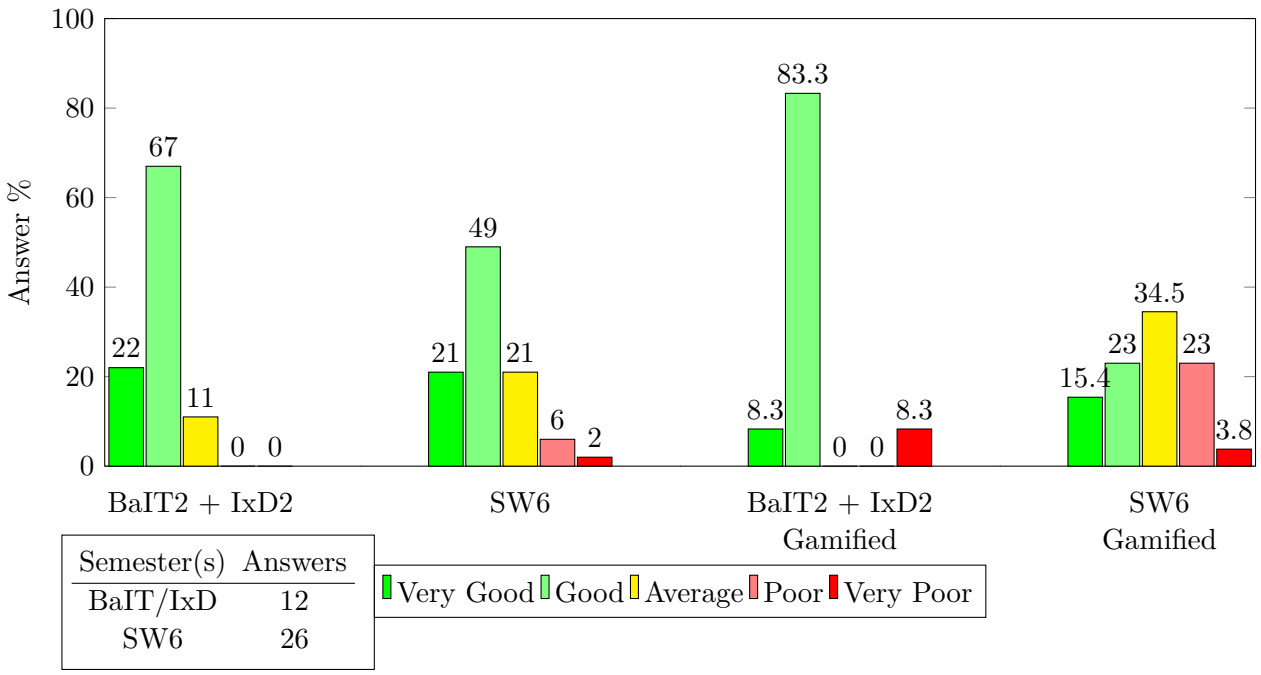
A.4.1 Comparison of Survey Answers

The number of ordinary survey submissions for the semesters:

- BaIT2 + IxD2 = 39 students, 23 participated
- Software 6 (SW6) = 110 submissions, 53 participated

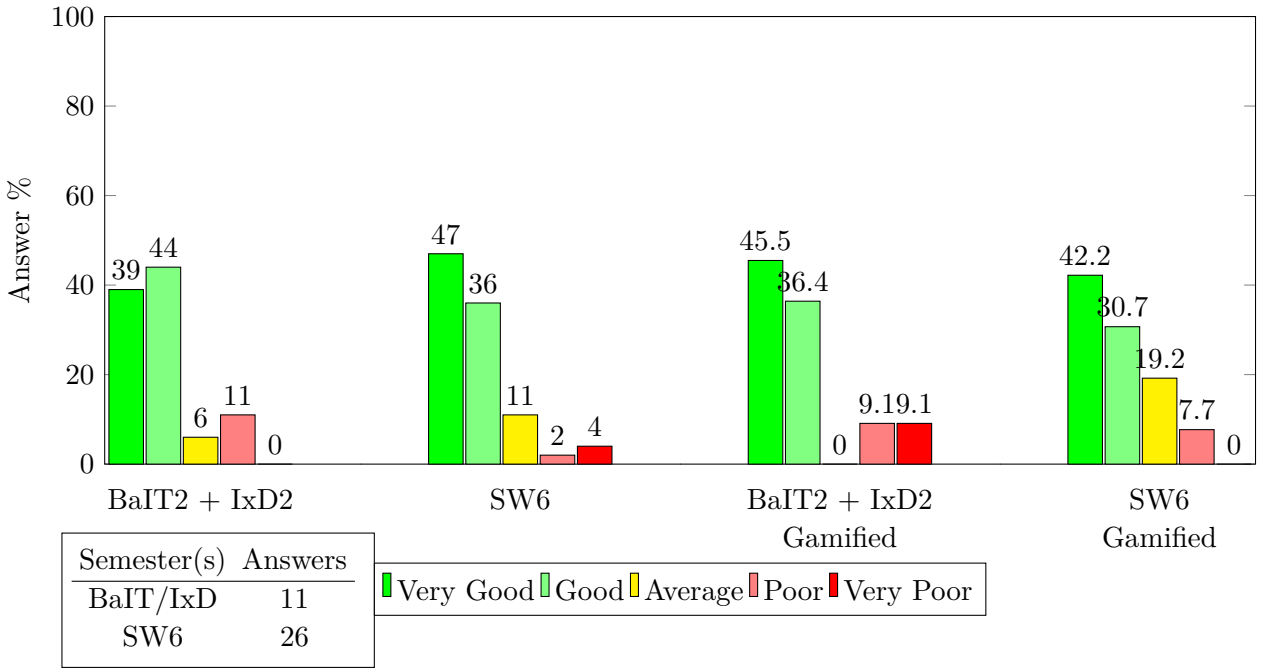
- Percentages of the gamified results (the two left groups) are based on the number of participant answers per question, which is displayed next to each graph.
- Some answer percentages are rounded, which may result in the total percentage not reaching or exceeding 100%.

How do you assess the subject of the project?



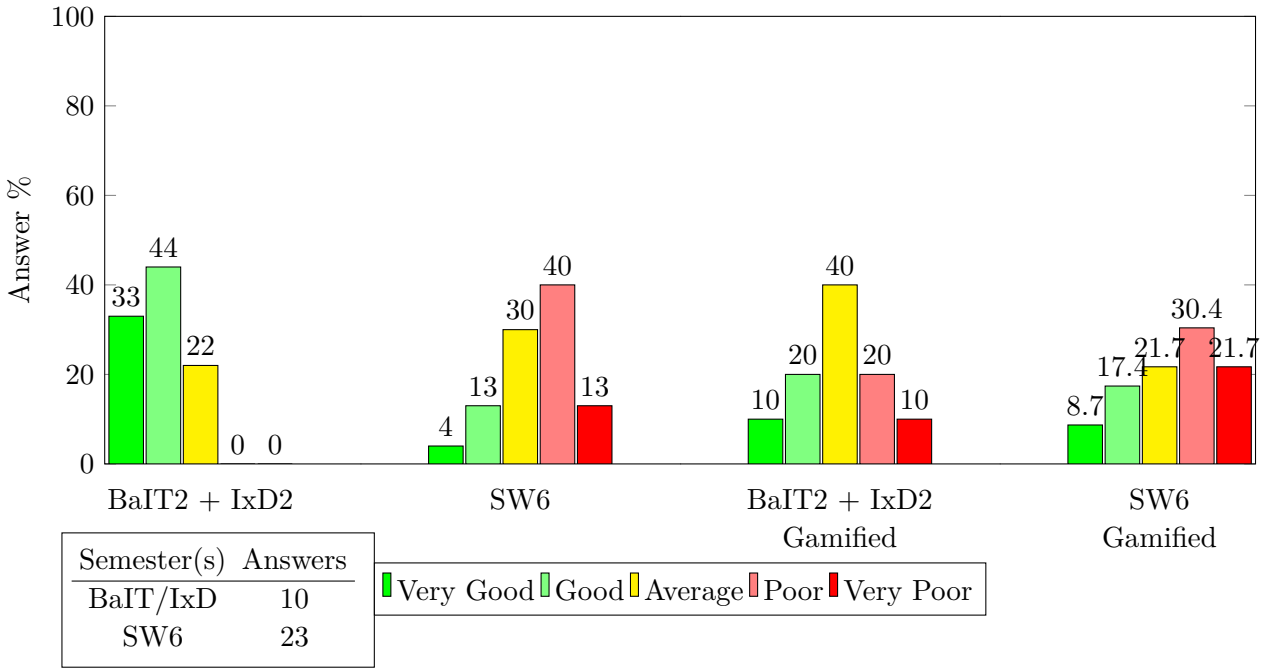
Semester(s)	Answers
BaIT/IxD	12
SW6	26

How do you assess the cooperation in your group?



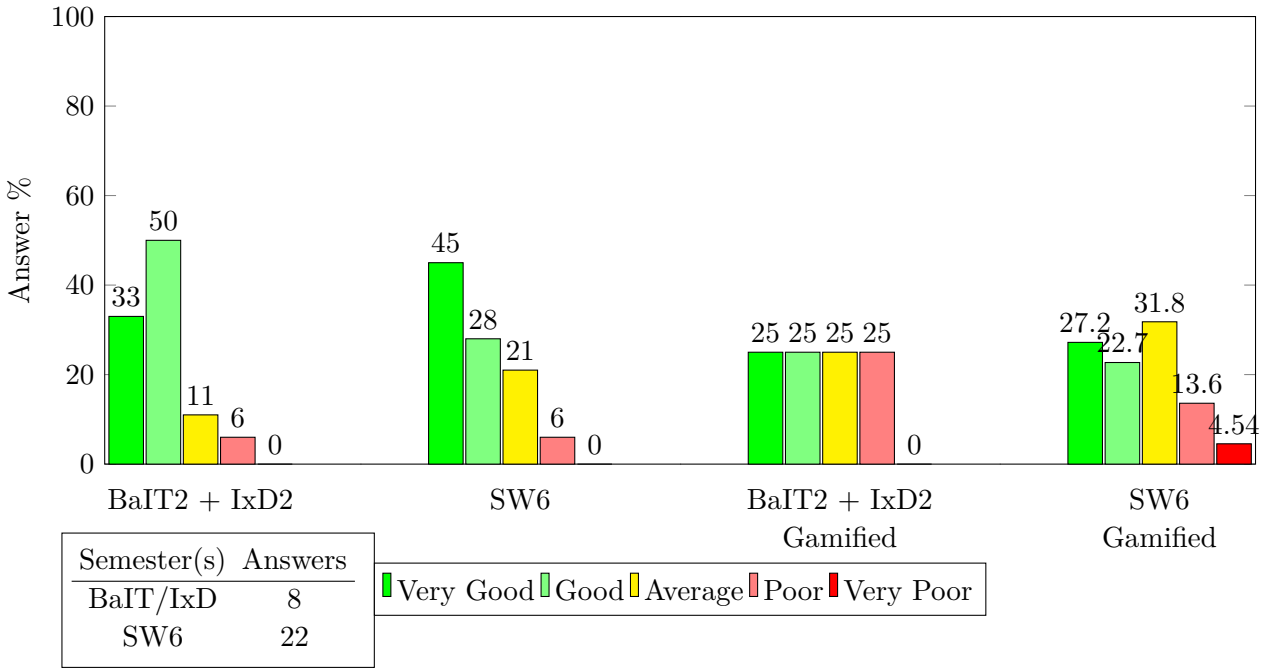
Semester(s)	Answers
BaIT/IxD	11
SW6	26

How do you assess the relevance of the courses for the project?



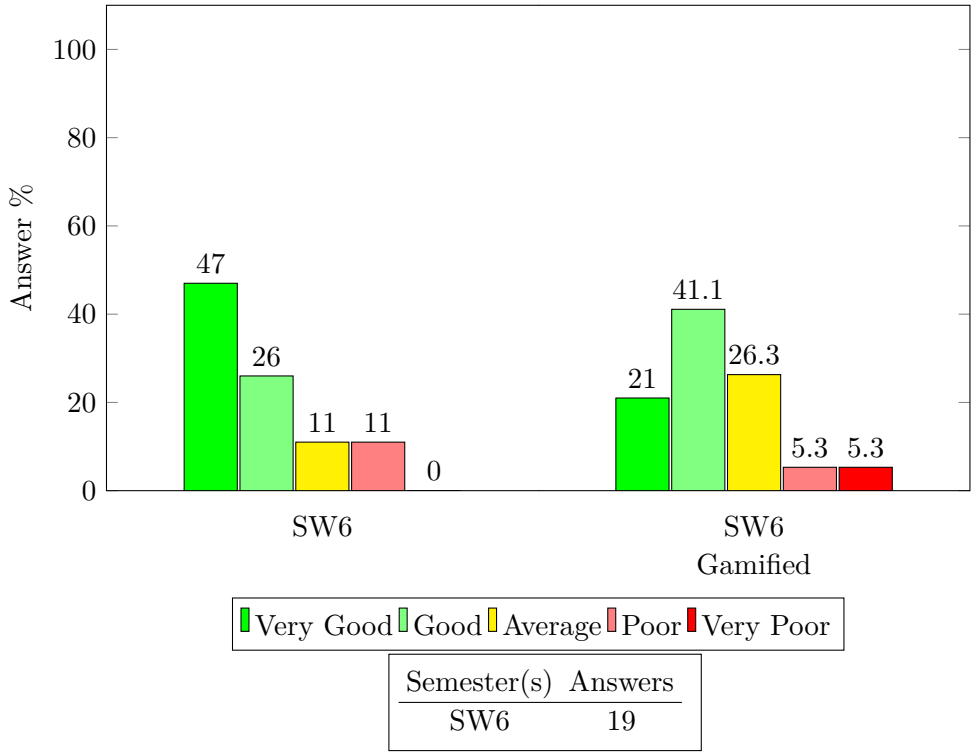
Semester(s)	Answers
BaIT/IxD	10
SW6	23

How do you assess the competence and commitment of the project supervisor?



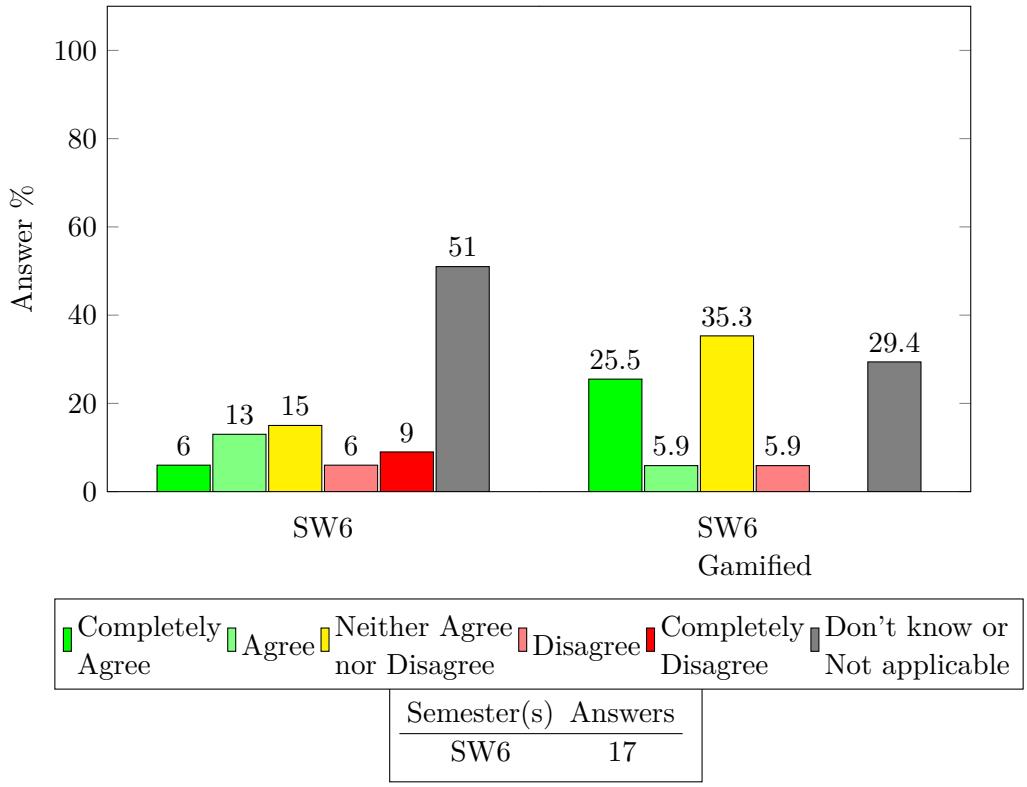
Semester(s)	Answers
BaIT/IxD	8
SW6	22

How do you assess the amount of project supervision?



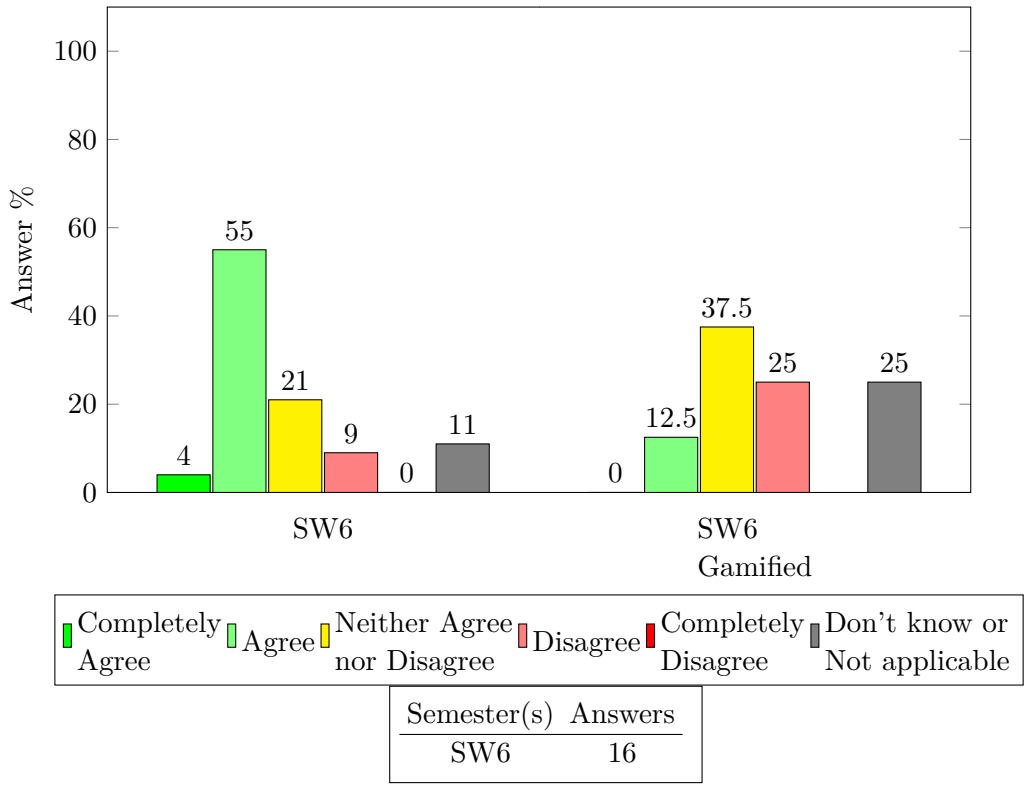
Semester(s)	Answers
SW6	19

The digital teaching, including online lectures, has contributed to my academic performance in the study programme?



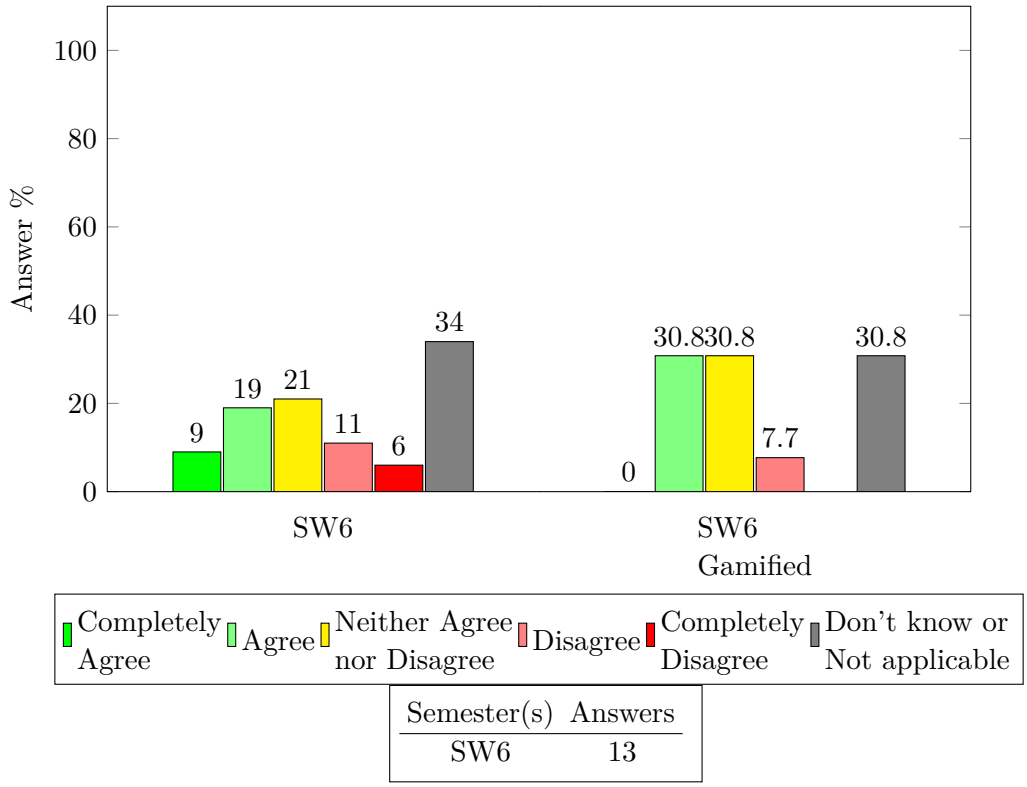
Semester(s)	Answers
SW6	17

My lecturers have been good at involving and utilizing relevant digital tools in the lectures/courses?



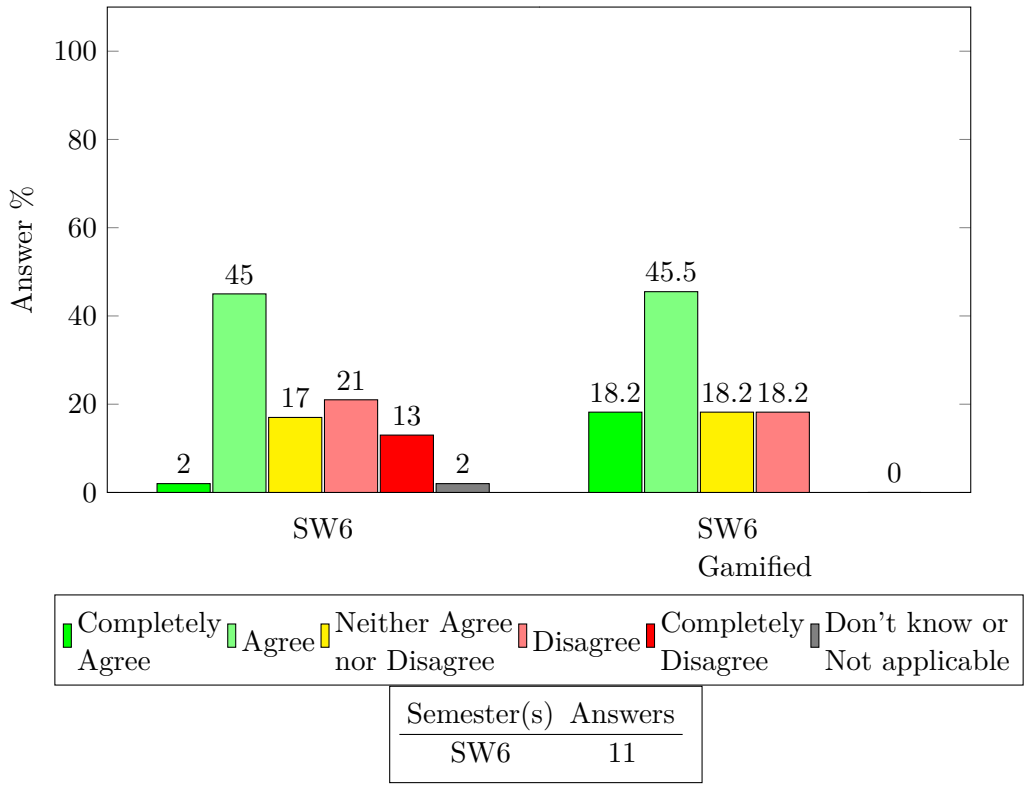
Semester(s)	Answers
SW6	16

The available digital tools have supported project work well.



Semester(s)	Answers
SW6	13

The premises are suitable for teaching (equipment, indoor climate, interior design, etc.)?



Semester(s)	Answers
SW6	11