Evaluating the Benefits of Gamification both in Business Environment and for Business Purposes

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KONSTA SINISALO: Evaluating the Benefits of Gamification both in Business
Environment and for Business Purposes

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Gamification is a current hot topic of industry and business. It is seen as a way to
improve menial tasks, customer interaction, employee engagement, and many other
subjects. Even though gamification is marketed as an effective solution to multiple
problems, gamification solutions in the business environment are rarely properly
evaluated. The evaluation of the effects of gamification in business solutions requires an
effective method to help make business decisions considering gamification.

This thesis proposes to find an effective solution for evaluating gamification in a
business environment. Theory considering gamification and gamification study is
presented based on which two case-control studies of two gamified solutions are
designed.

During the study many factors affecting both organizing the testing in a business
environment and effectively gathering meaningful data during the tests are recognized.
Addressed issues include:

- Difficulty in gathering enough voluntary participants
- Measures to creating a sufficiently functional test case
- Efficiently gathering data so that meaningful results can be derived from it

This thesis shows that a case-control study is an effective method for evaluating the
benefits of gamification in a business environment and describes guidelines for
effectively conducting similar gamification testing in a business environment in the
future.

Keywords: gamification, evaluation, business, case-control

TURUN YLIOPISTO
Tulevaisuuden teknologioiden laitos

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Pelillistäminen on aiheena noussut pinnalle liikemaailmassa. Se nähdään tapana
parantaa yksinkertaisia tehtäviä, nostaa asiakasvuorovaikutuksen tasoa, kohentaa
työntekijöiden keskittymistä ja ratkaista monia muitakin ongelmia. Vaikka
pelillistämistä markkinoidaan tehokkaana ratkaisuna useisiin ongelmiin,
yritysympäristöön tarkoitettuja pelillistämisratkaisuja arvioidaan vain harvoin kunnolla.
On olemassa tarve pelillistämisen vaikutusten tehokkaalle ja toimivalle arvioinnille
yritysympäristössä pelillistämiseen liittyvien liiketoimintaratkaisujen tueksi.

Tämän diplomityön tarkoituksena on määrittää toimiva ratkaisu pelillistämisen
arviointiin liiketoimintaympäristössä. Työssä esitetään pelillistämiseen ja sen
tutkimukseen liittyvää teoriaa. Näiden perusteella luodaan kaksi erillistä tapaus-
verrokki-tutkimustapausta kahteen erilliseen pelillistettyyn ratkaisuun liittyen.

Työn aikana tunnistettiin useita osatekijöitä, jotka vaikuttavat sekä testauksen
järjestämiseen liiketoimintaympäristössä, että tehokkaaseen ja merkitykselliseen tiedon
keräykseen testeistä. Käsiteltyihin aiheisiin lukeutuvat:

- Ongelmat riittävän vapaaehtoisen osallistujamäärän keräämisessä
- Toimet riittävän toimivan testaustapauksen luomiseen
- Tehokkaan tiedonkeräämismallin luominen, jotta merkityksellisiä tuloksia
  voidaan johtaa

Työssä näytetään, että tapaus-verrokki-tutkimus on toimiva tapa arvioida pelillistämisen
hyötyjä liiketoimintaympäristössä ja määrittää ohjenuorat, joiden mukaan samanlaisia
tutkimuksia voi tehokkaasti järjestää vastaisuudessa.

Avainsanat: pelillistäminen, arviointi, liiketoiminta, yritys, tapaus-verrokki-tutkimus

Foreword

I started 1st grade in the fall of 1999. After 20 years, I finally feel ready to finish school with my master's degree.

Like Bilbo Baggins, I feel like my time as a university student has been a great adventure. Like Bilbo, I am glad have been able to experience it so vividly.

Like Bilbo, I am also glad to return home from my adventure.

At the end of my student career I would like to thank the following people for playing a part in me finishing this thesis:

- Jouni Smed, for mentoring me through the process of writing this thesis. It took long, but now it is done.
- NordicEdu for facilitating my thesis.
- Tomi Kokkonen for easing my nerves by saying "Just do it about LOGE" and Linda Kokkonen for actually coordinating my thesis with me after this.
- Kim Lehtola and Juuso Manninen for ensuring that I was able to do more than the bare minimum for my thesis.
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- Ida Laitoniemi, for giving me space at our home to work on my thesis. At times even by moving to another country.
- For the close friends I made in my class. You are all a superb bunch of stellar individuals.*

*The statement presented here is merely the opinion of the individual presenting it. Terms and conditions may apply.

Contents

1. Introduction

In modern industry and especially software industry optimization, influence and effective and intelligent design have become imperative for economic competition and progress. In these fields, there is always a demand for ways to enhance productivity and current processes. In recent years, gamification has become a way to achieve this through UI and UX design.

Gamification is a term originally coined by Nick Pelling in 2002 [1]. The term refers to the application of game design elements in non-game environments and contexts [1][2] [11]. It is often used with the intention to engage users, solve problems, and to purposefully change how people behave [1][2].

Gamification as a concept has risen to public popularity in less than a decade (see Figure 1) and its concept has in that short time become a point of interest for both academy [3] and industry alike. For academy, there is interest to understand its effect and study its application; for industry, to optimize performance and influence with its application. Both to the psychological and the behavioural effects of gamification have been examined in a multitude of studies in the past decade [3][5]. These studies vary greatly in their experiments' timeframe length, methods, and the aspect of gamification they focus on [3][5].

When considering gamification to optimize their business, companies are mainly interested in its ability to produce value to the company. This can happen either by gamification having a direct calculatable effect on the company's efficiency or by it
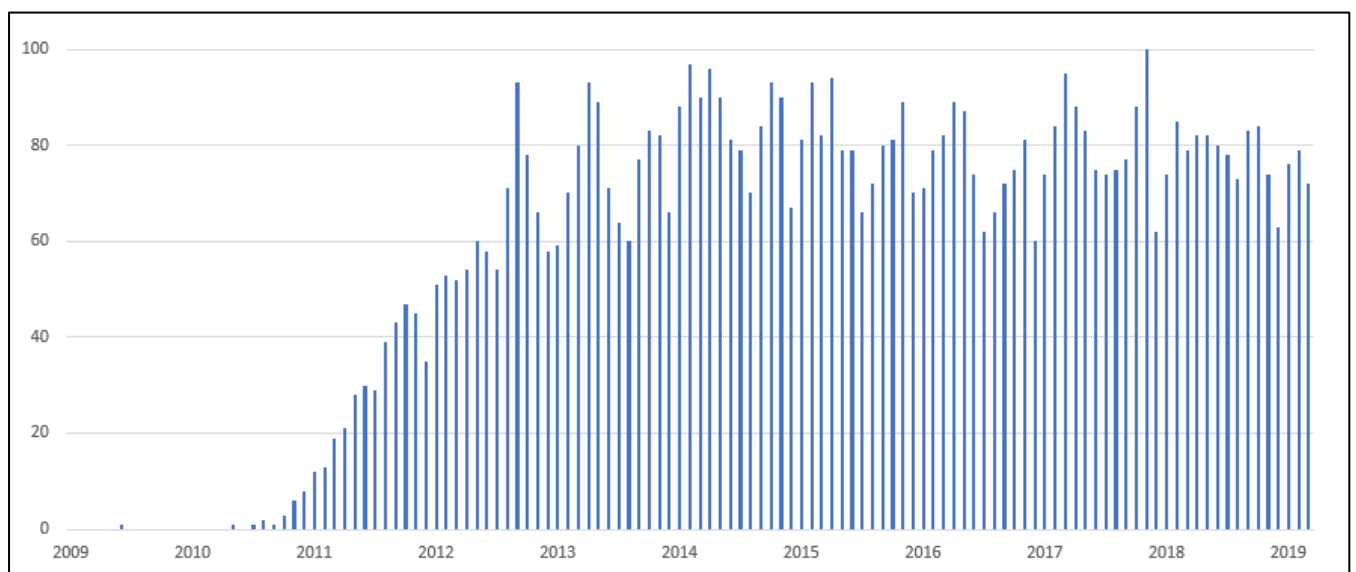
Figure 1 Trend data for "gamification" between 2009 and early 2019. Time represented by the x-axis, relative value by the y-axis. In the relative value 100 is the greatest number of searches and all the other values are in relation to that. [4]

affecting the mood of the workers positively. Evaluation and quantification of these benefits has a clear value for companies that implement gamification.

In this thesis, we will investigate the current methods of measuring gamification benefits. We will take a look at how effective they are as tools in an industrial setting, and how they could be further improved. Chapter 2 discusses the theory of gamification and its benefits and how it has so far been evaluated in academic study. Chapter 3 presents the outlines of the research and how the evaluation of gamification benefits was implemented in the study. Chapter 4 presents the results received from the research and how useful and creditable they were in showing the gamification benefits of the research object. Chapter 5 analyses the effectiveness of the used methods and the applied theories and looks for ways to improve them. Chapter 6 presents the conclusion of the thesis along with discussion on possibilities for future gamification research methods.

1.1. Background for the research

Gamification in the current industry media is presented as a silver bullet that can be used for almost anything in any field.

"*Inspire a more focused, proficient, efficient and engaged workforce with real impact on your business*"
 -    Front web page of the gamification company Gameffective [6]

"*Gamification has the ability to drive new and returning customers to your store*"
 -    Blog text of the e-commerce company Shopify [7]

These quotes reflect the way gamification is commonly presented to the industry by gamification companies and consults. There appear in fact to be multiple different benefits in gamification depending on what one wants to focus on. The benefits can be examined focusing on the experience of an individual user that the gamification targets, the effect of gamification on the task that gamification is applied to, or the cumulative effects that gamification has on a company level.

Gamifying a task (or a process) also has a direct impact on its individual executor. Thus, it seems reasonable to assume that these two aspects are most heavily influenced by the gamification. The commonly supposed benefits of gamification usually involve the task becoming optimized and easier to execute; the implication is that bringing game elements to a task makes the flow of the task more intuitive and

engaging, keeps the users more focused, cuts the execution time, and might produce other unforeseeable benefits. For example, a simple task of filling in a form might become easier for the customer, if the form or the filling activity were to be gamified. Thus, gamification would by extension make the task faster to execute while also removing a lot of the company's need for customer support

For the purposes of this thesis, an individual's perspective in gamification means the perspective of an end user of the gamified task (if something else is meant it will be made clear in the context). When considering an individual in gamification, the perceived benefits are twofold: the gamified task becomes less tedious to mentally engage in, and gamification makes the task more intuitive and aids its efficient completion. This has also been acknowledged in academic research, which categorizes gamification outcomes into psychological and behavioural [3]. A common public conception of gamification is not quite clear: on the one hand, gamification is a way to make mundane and repetitive tasks more engaging and tolerable. On the other hand, especially if done poorly, gamification is forced, uninteresting, and a waste of money. Another concern, albeit not as big one, is that if gamification is mixed with some sort of real-world reward system it will encourage people to cheat in order to win, to abuse system, or to instil other kinds of animosity among users.

Lastly, gamification can have great significance for the company. As stated above, it has been described almost like a silver bullet that can engage any workforce and make any task more effective. This has obvious and great benefits for a company that seeks to optimize their tasks in order to maximise profit or simply to minimize the employee turnover.

With these interests in mind, commercial gamification would greatly benefit from an efficient way to measure the actual benefits of gamification to a task and companies that sell gamification could better present their effectiveness. Companies buying gamification could have a better understanding of what gamification can achieve. Both sides would also be able to better negotiate the criteria that the gamified solution should fulfil.

1.2. Environment for the research

NordicEdu is a Finnish company founded in 2011 that specialises in gamification and educational games. [8] As of March 2019. NordicEdu has grown to employ over a

dozen people and has developed tens of software products, out of which 30 have been gamified software. [9]

In practice all NordicEdu's profits come from ordered and tailormade software projects. [9] This thesis tests and measures two gamified products developed by NordicEdu: a gamification project ordered from them by one of their customers and a product that NordicEdu is actively developing. NordicEdu has approved this testing of the products they developed. The company that ordered the first gamification project has also approved and accommodated this testing on their part but wishes to remain anonymous in this thesis. It will be referred to as *the customer* or *the customer company*.

The customer company that ordered the first gamification project is a large enterprise (over 250 employees) and their objective lies in retail. They have multiple outlets all around Finland and a steady economical standing. As a retail-oriented enterprise, the customer wanted to further develop their customer service by gamifying their introductory training of new retail workers. The customer was also in the process of renewing their e-commerce system. As a result, they ordered another gamification project with a goal to introduce their retail workers to the system and teach them its proper presentation and utilization in a retail environment. This latter e-commerce system training for their retail workers is the first study case for this thesis.

The second gamification project is a product developed by NordicEdu called LOGE. LOGE is based on a board game called Good Decision Game. The board game was developed by Talent Vectia and it aimed to gamify the interaction between people in corporate setting. To make Good Decision Game available to use even when working remotely Talent Vectia and NordicEdu began work on a digital version of the game in 2016. The end result, now called LOGE, is a browser-based tool developed using MEAN stack technologies (**M**ongoDB, **E**xpress.js, **A**ngular, and **N**ode.js). It is still being actively developed by Talent Vectia and NordicEdu, former of which offers it to its customers as a SaaS. [34][35]

This thesis focuses on properly evaluating how successful (effective) gamification has been for both the project of the customer and LOGE. We will go through the gamified solutions, the empirical tests that were used to evaluate the success of the gamification and how well they functioned to measure gamification in a commercial setting. The research questions are as follows:

1. What current gamification theory and metrics are most suitable to evaluate commercial gamification?

2. How can the evaluation of gamification benefits best be implemented in a commercial environment?

2. Previous research and theory

Gamification is a concept that emerged after the growing popularity of gaming. Especially video games have in a few decades grown into a massive economic influence that is consumed more every day. For a long time, it has been a common part of people's lives and lifestyles. Games are typically extremely good at getting the end user (i.e. the player) interested in playing them and in wanting to keep playing them. In some cases, the time is not in any way pre-determined. This is a highly sought out goal in practically any professional work environment.

Gamification has received a lot of academic interest after its emergence to public knowledge in the past decade and, especially, gamification of education has been the subject of many studies [3] [10]. Research on the subject varies widely from the psychological reasoning for gamification's effectiveness [13] to optimal designs for singular game elements for gamification purposes [14]. To understand gamification and to evaluate its implementation, one must first understand how gamification works and what can be achieved with it. [15]

2.1. Reasons for gamification

"...it is expected that gamification can foster the initiation or continuation of goal-directed behaviour, i.e. motivation."
- Michael Sailer et al. [15]

Gamification is, in essence, a way to make tasks more appealing to the end user and to encourage active engagement in them. By extension, intelligent gamification can also be used to solve different UX (user experience) problems and to guide the user through the task without a need for tutorials that can most often be described as unappealing. One of the most used examples of this is the social networking platform LinkedIn [16] in which a new user is prompted to fill in potential missing information as they are simultaneously shown an abstract title of how well maintained their personal profile is. This is highly engaging and gets the users quickly invested in the platform without holding their hand through a painstaking tutorial.

User motivation is often overlooked but has a far graver effect on an enterprise as it becomes a constant and steady factor in corporate world. Unmotivated and

disengaged workers have been evaluated to cost 300 billion dollars overall per year in the US alone [27]. Research also indicates that employee engagement can reduce staff turnover by up to 87% and boost employee performance up until 44% [27]. Although motivation and engagement are hard to measure, it can be argued that these kinds of numbers are signs of positive subsequent secondary results.

Although gamification is used to motivate users and to make a task feel less tedious, it has also been used to achieve other benefits as a result of these. For example, it has been used to engage customers [17], to help students achieve better grades [18] and to promote health activities [19]. In all of the previously mentioned cases, gamification has been evaluated to have a positive influence on the subject research subjects.

However, quantitative studies on gamification that have reported more than descriptive statistics have also discovered evidence to indicate results that are not entirely positive; some studies have showed that the results of gamification may not be long term and that, once implemented, removing gamification might in fact have "detrimental effects" [3] [10]. When discussing qualitative results, gamification studies tend to be more mixed and often the gamified aspects that appeal to one individual are explicitly disliked by another [3].

In the end, these studies seem to indicate that gamification can be used to achieve other results beyond simply user motivation. There have yet been fairly few limitations as to what could be achieved through it; there is a plethora of game elements to utilize and even more scenarios to use them in. The implementation of gamification is often done on an intuitive understanding user of motivation, even though theories of its reasoning have emerged. These theories are based on behavioural psychology and have received some recognition.

2.1.1. Motivation psychology relevant for gamification

Guiding end users effectively to do what is intended of them is not a straightforward task. Telling someone to do something is not often enough to get them actually do it. And even though they might do what they are told, there is no incentive for them to prolong their engagement or exert any extra effort into it. Motivation through gamification is one way to achieve better user interaction. In order to understand the effects of gamification it is important to understand the psychology of human

REGULATORY STYLES	Amotivation	Extrinsic motivation				Intrinsic motivation
		External regulation	Introjection	Identification	Integration	
ASSOCIATED PROCESSES	Perceived non-contingency Low perceived competence Nonrelevance Nonintentionality	Salience of extrinsic rewards or punishment Compliance/ Reactance	Ego involvement Focus on approval from others	Conscious valuing of activity Self-endorsement of goals	Hierarchical synthesis of goals Congruence	Interest/ Enjoyment Inherent satisfaction
PERCEIVED LOCUS OF CAUSALITY	Impersonal	External	Somewhat external	Somewhat internal	Internal	Internal

Figure 2: A taxonomy of human motivation. (Ryan and Deci) [21]

motivation. Concepts that often come up are intrinsic and extrinsic motivation [21], self-determination theory [22] and flow theory [20].

Intrinsic motivation is motivation that derives from within, while extrinsic motivation derives from outer factors. In other words, intrinsic motivation is the desire to do something for the fun or challenge of it, whereas extrinsic motivation means that something is done as out of necessity or as a means to an end. For example, a child may play football because it brings them joy and because their parents tell them to strive to become a professional football player when they grow older. The joy of football in this case is an intrinsic motivator, while the pressure from the parents is extrinsic. As is apparent from this example, intrinsic and extrinsic motivation can both affect the end user while committing to a task. [21]

What is interesting when considering the differences between intrinsic and extrinsic motivation, is that intrinsic is typically more effective than extrinsic. People with authentic or self-imposed motivation tend to be more interested and excited about their tasks. This manifests as enhanced performance, persistence and creativity. [22]

Ryan and Deci [21][22] have done extensive work in the field of motivation psychology and especially self-determination theory (SDT) [22]. SDT is the theory that human nature repeatedly and consistently shows effort, commitment and agency when certain needs are met. These are, in essence, the manifestations of motivation and a high manifestation of these is a sign if exceptional intrinsic motivation. Ryan and Deci also

recognize the three major psychological needs that, when fulfilled or neglected, contribute essentially to the manifestation of these characteristics. These are competence, autonomy, and relatedness. Competence in this context means a person's feeling of competence and relatedness the level of social relations a person can share regarding the subject of the motivation. What is even more important is that two of these appear to be closely linked in terms of how they affect a person; a feeling of competence will not enhance intrinsic motivation without a sense of autonomy ("*an internal perceived focus of causality*"). [22]

Often the amount of intrinsic motivation is practically non-existent and external motivation needs to be applied for the end user to go through with the tasks. Purely extrinsic motivation like this is much less effective in comparison to intrinsic; although it may be enough for the task to be completed, it will most likely also manifest as disinterest, low effort, and other side-effects such as blaming others for negative outcomes. Ryan and Deci recognize that motivation often is not purely extrinsic or intrinsic. Extrinsic motivations can be integrated by a person, in which case they manifest more like intrinsic motivation (see Figure 2). This integration has four defined levels ranging from very external (external regulation in Figure 2) to very internal (integration). This is a sub-theory of SDT called organismic integration theory (OIT) and it provides a great base for gamification evaluation. [21]

In gamification both intrinsic and extrinsic motivation play a crucial role. Gamification is most often applied to tasks that are uninteresting, unengaging or monotonous; often even all these qualities. In such tasks, extrinsic motivation is the only reason for the end user to complete the task. It would be highly beneficial to integrate at least some of the external motivation into internal motivation. Very often gamification offers a valid solution to this.

"*A person in flow does not operate with a dualistic perspective: one is very aware of one's actions, but not of the awareness itself.*"
- Mihaly Csikszentmihalyi on merging action and awareness during flow [24]

Flow theory is a concept in positive psychology ("*a science of positive subjective experience, positive institutions and positive institutions*" [23]) that is also often brought up when gamification is discussed. The term, flow, was originally coined by Mihaly Csikszentmihalyi in 1975 who used it to refer to the mental state of a person fully immersed in an activity as flow state. [20]

Csikszentmihalyi identifies multiple elements of flow, the most notable of which is merging action and awareness. By this he means that a person in the flow is not actively reflecting on their actions even though they are aware of their actions. As an example of such a state, Csikszentmihalyi uses a tennis player who pays undivided attention to the ball and the opponent but pays no attention to the activity itself. The moment that awareness is split to reflect also on the activity "from outside" the flow is interrupted. As a direct result of this, the flow is difficult to maintain for any length of time. [24]

Centring of attention to a limited stimulus field is also recognized by Csikszentmihalyi as one of the five other elements of flow. He describes that during the flow the stimuli that would "intrude" on the task need to be kept out of attention. This also makes the merging of action and awareness possible during the flow state. Loss of ego (or loss of self-consciousness) is another element of the flow. This should not be interpreted as letting go of self-control. Quite the opposite, it means that the task involves the person with its demands for action to such an extent that "'selfish' consideration becomes irrelevant". [24]

A person in the flow is also in control of their action and of the environment. Csikszentmihalyi describes this control more as the condition of "not being worried by the possibility of lack of control" and remarks that the loss of ego intricately affects the state. Another element is that the task usually contains coherent and noncontradictory demands for action and a clear unambiguous feedback to a person's actions. Feedback is especially important and during the flow there is no doubt whether the action is "good" or "bad". Lastly, the nature of a task is autotelic if it induces the flow state. This means that the task appears to need no goals or rewards in itself; in other words, it is intrinsically motivated. [24]

Flow as a phenomenon is not too common an occurrence. Csikszentmihalyi recognized common restrictions to multiple situations where flow should be attainable and concluded that flow only occurs when persons face tasks that are within their ability to perform. He refines this into a flow state model (see Figure 3) and states that in order for flow to be achievable both the challenge level of the task and the skill level of the person should be on equal level. If a task is not challenging enough for the person, the person gets bored. If the person is not skilled enough for the task, the person gets anxious about the task. [20][24]

As a person is in the flow, in essence, completely engaged in whatever they in that moment are doing, the flow state can be viewed as the ultimate goal for
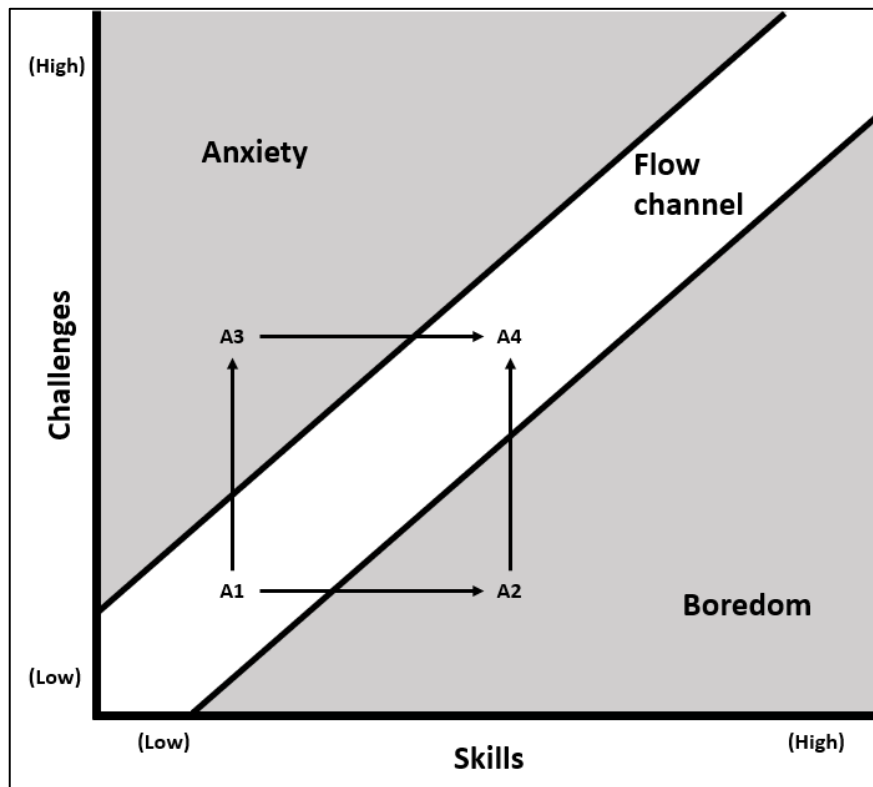
Figure 3: Diagram showing the stacking complexity of flow as the result of personal development. A1 is a low skilled person doing a low challenge task, A2 is a highly skilled person doing a low challenge task, A3 is a low skilled person doing a highly challenging task, and A4 is a highly skilled person doing a highly challenging task.[20]

gamification. Csikszentmihalyi gives an in-depth description of how flow functions and much of it should be considered in proper gamification design. Both SDT and flow handle subjects that are essential to gamification and its design and it would be highly beneficial to apply both theories while gamification is planned.

2.1.2. Other perceivable benefits of gamification

Meaningful gamification is a term developed to describe gamification that has achieved internalization, if the activity (as per SDT) does not depend upon external rewards [25]. Ruhi, however, refers to corporate scenarios where gamification is applied to integrate with existing business processes or information systems and used to help drive positive employee and organizational outcomes as meaningful gamification in an enterprise context [26]. This latter definition is more advantageous for the purposes of this study and so for the rest of this thesis "meaningful gamification" means meaningful gamification in an enterprise concept, as per Ruhi's definition.

As stated earlier, gamification is often applied not because of the end user motivation and engagement, but because of other benefits that come with the heightened user interaction. Enterprise gamification can easily be divided into two different

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segments based on the target of gamification: internal and external. Naturally, internal gamification in an enterprise context refers to gamification targeting to the companies' own employees, whereas external refers to gamification that targets to existing or potential customers. Both of these groups can be referred to as the end users or targets of gamification. So far, we have been using end user as the designated term and will continue to do so in this thesis. [27]

Even though the projects examined in this thesis focus on internal meaningful gamification, it is useful to take a brief overview on the external or customer-oriented aspect as well. Customer engagement is characterized by the repeated interactions of a customer with an organization through which emotional and psychological bonds with the organization are strengthened [17] [28]. This has been shown to boost customer loyalty [28]. Gamification has been shown to correlate between a positive effect on customer loyalty and even on positive buying behaviour which are indicative of better user engagement and can also be reasonably assumed to be caused by it [28]. External meaningful gamification is easily justified as an investment and can be, at least to some extent, measured by its effect on a company's profits.

Meaningful internal gamification in enterprise level seeks to improve employee engagement in the organization. Through this improvement of the organizations performance and better business outcomes can be achieved [29]. Employee engagement is emotional commitment to the organization and its goals [27]. This as a motivational construct is comparable to SDT and internalized motivation, where a person integrates extrinsic motivations as a part of their own behaviour.

Employee engagement has in itself an indirect impact on a variety of things. Especially strong effects on employee engagement have been found in relation to employee turnover, customer satisfaction-loyalty, and safety. Smaller but still notable correlation has also been observed between employee engagement and productivity, as well as profitability. The smaller correlation between the latter two to engagement, as opposed to the former three, could be the result of the latter being "more remote downstream variables" that are influenced by other variables besides employee engagement. All of the correlations were positive in their nature. Also, the correlations between these have been noticed to generalize across organizations, meaning that no matter the organization, similar correlation can be found between employee engagement and the above-mentioned aspects of an organization's business performance. [29]

When considering gamification from a business standpoint, it is interesting what results it can achieve on a single process. Gamification has been shown to improve the

amount of information a person can internalize [18], which would make it highly suitable for introductory and general training for enterprises.

Gamification's effect on the process speed has been studied only a little even though it would be extremely interesting from a business standpoint. Some research has been done on how "speed-gamification" affects other aspects of the performance by Jin et al. [30], but this hardly covers the subject in the way that would be beneficial in a corporate interest. This may be because when it comes to gamification, the aim is hardly ever to make the users to go through a process faster than before gamification was applied. Often the goal is to get better results from the process. This goal does not lend itself well to optimizing the process speed. Kaila et al. [18] note that they have utilized other automation in addition to gamification, automated code assessing for student exercises to be exact, that can significantly reduce the time spent on evaluation of student work, but this is not, strictly speaking, related to gamification. This should, however, be considered since direct and instantaneous feedback is an important aspect of gamification and in that sense automated evaluation is essential for the purposes of their gamified education project. Also, the end-user engagement not only can increase the effectiveness of the work done but has a chance of increasing the amount of time used working on the gamified task. As such gamification's effect on the process speed can be affected both negatively and positively by gamification which makes it less straightforward.

Both speed and effectiveness are variables that are relatively easy to measure in both projects this thesis focuses on. As such they will be taken into account during the conducted research.

2.1.3 Gamification design

In designing gamification for a task, there exists a common general procedure for coming up with the end gamification solution.
This path is as follows:

- o preparation – the objectives of the gamification should be made clear (what should be achieved)
- o analysis - the target task is analysed with the intention to identify necessary aspects to be taken into consideration like the knowledge of the users
- o ideation - the point for coming up with different ideas for gamification design

- o design – the implementation of the gamification design is decided on based on the ideas from the previous phase
- o implementation – the design is implemented appropriately
- o evaluation – corrections and improvements to the implementation are considered
- o monitoring – the development continues based on the effect that gamification has [31]

What this model shows is that after understanding and analysing the desired goals and task at hand, there are four steps that can be looped to make gamification development: ideation, design, implementation and evaluation. After the design implementation is evaluated it can start over from the ideation state to improve on the now existing design. With a well-implemented pilot testing of the design even some aspects of the monitoring phase (mainly the end-user feedback) can also be implemented as a part of the development loop.

2.2. Evaluation of gamification benefits

As stated in the previous chapter, gamification has, in the short time it has been in the public eye, become an interesting research subject in multiple fields. As it has only been around for less than two decades and has properly surfaced into public consciousness less than a decade ago, both the content and the quality of its studies are reflected on with interest and tenacity. [3][5][10]

The previous research in the field of gamification has had a noticeable focus on educational applications [3][5]. To be fair, the field of education is, as stated above, an excellent target for applications of gamification as one of the consistent problems in education is student engagement and motivation [32].

To develop the evaluation of gamification benefits we will survey the previous work in the field of gamification research. Through this overview we will acquire a better understanding of how gamification is commonly measured and what shortcomings others might have recognized in their own work or in the works of others. Another point of interest is the level to which the study methods are applicable to our own research scenario.

2.2.1. Quantitative versus qualitative evaluation

In gamification studies, there are many ways to categorize the study itself. Two aspects of how gamification affects a task are the psychological and the behavioural outcomes of gamification. Behavioural refers to how gamification affects the end user's task execution. This can be (and usually is) studied through measurable qualities of the gamified task, such as task execution times and the quality of the results of the task. This means that those studies are usually quantitative by nature. Behavioural studies are relatively straightforward as the measured results can be evaluated and compared using statistical analysis. [3]

The psychological aspects of gamification refer to how the end users perceive the effects of gamification and usually include questionnaires or interviews. These studies are qualitative and their interpretation, while not always straightforward, have been extremely fruitful for gamification studies. [3]

There are many notable details that need to be brought up considering both ways of conducting gamification research that have been mentioned by Hamari et al. [3]. Often quantitative papers on gamification are descriptive and do not actually offer profound insight into how big of a difference gamification actually produced [3]. Descriptive statistics is fine as indicators of general performance and often adequate to demonstrate that the task is accomplishing its intended function either well or poorly. However, we consider that in there is interest in an enterprise setting to also differentiate the effects of gamification from the general effectiveness of the task as a whole.

Qualitative studies of gamification's effects on user motivation have commonly brought to attention both positive and negative user perceptions regarding gamification [3] and that more often than not these notions contradict one another. By this we mean that the same aspects of gamification liked by many are often also disliked by other end users [3]. Although this is an interesting result and provides fundamental insight into the nature and problems of gamification, it also means that qualitative tests might not always provide an unambiguous confirmation or denial for a study hypothesis. This is not to say that they are in academical sense without worth, far from it, but in an enterprise setting this ambiguity is not desirable as it makes the decision-making regarding gamification hard and unclear.

It is common for an academic research to measure both quantitative and qualitative (in general meaning simultaneously behavioural and psychological,

respectively) aspects of gamification. These studies are usually referred to as having mixed methods [3] [10]. This seems to us a highly effective tactic as it could help to define the relationship between the psychological and behavioural effects of gamification, either demonstrating underlaying correlations between the two factors or revealing contradictory dissonance between them.

Although we did chastise the usage of qualitative evaluation only namely because of the possibility of contradictory results that might produce unwanted corporate uncertainty and frustration, it is our firm believe that leaving it out altogether would be counterproductive as to the interest of the company. After all, we do recognize that even though the qualitative tests might produce mixed results, the quantitative tests might grant us with definitive results. In this manner, they might compensate for the lack of definitive answers by the qualitative tests. On the flipped scenario, if the quantitative studies produce, in a corporate mindset, unsatisfactory results, the qualitative studies might imply a clear shift in the employee motivation which might in turn compensate for the disappointment of the quantitative results. By unsatisfactory results we mean results that are neither positive or negative, thus providing no help for corporate decision making. From an enterprise standpoint, probably the most anxious result would be that neither quantitative or qualitative tests produce satisfactory results thus giving no clear guidance as to whether gamification was worth the investment it took or not and should the applied gamification be reversed or embraced.

2.2.2. Gamification evaluation in practice

Gamification has been studied on multiple different subject matters. By taking a look into how those studies were conducted we might come up with examples on how to implement gamification evaluation. Studies focusing on education gamification make up for a major portion of gamification research [3] [5] [18]. This is understandable, as education measures student performance constantly via exams, grading and other means like the percentage of students that have passed the course. This means that quantitative studies should expose the positive or negative effect of added gamification when comparing post-gamification results to their recorded pre-gamification counterparts. These studies most often focus on the impact gamification has on the student's grades, with the second and third most researched aspects being motivation and satisfaction [5]. It is not uncommon for these kinds of studies also to look into student interaction [5].

This might provide an interesting point, as increased interaction might imply better engagement.

In many other areas where gamification is applied, the end goal is to encourage end user participation and change behaviour [10]. Especially end user participation is a point of interest for marketing, online communities and social media platforms. In these settings, end user interaction and its development are relatively easy to monitor; the end user is not commonly an employee of a company, but first and foremost a consumer. The related applications have been built for gathering user data effectively precisely for that reason. However, when the focus shifts into employee gamification, things might not be so straightforward.

All in all, literature reviews provide plenty of criticism as to the current state of gamification research. Hamari et al. [3] states that gamification research tends to suffer from small sample sizes, where the number of samples for testing is around 20, and time frames are very short. They speculate that in the latter case novelty might have skewed the data gathered from the experiment. Sometimes the performed experiments also lack proper control groups to compare the gathered gamification data to and many studies presented only descriptive statistics. Hamari et al. also observe that the reporting of results in gamification studies tend to lack clarity [3], which affects their general usefulness. These points are something that we need to address when describing our evaluation methods.

2.2.3. Evaluation methods for the research

In order to evaluate gamification benefits in a business environment it would be beneficial that the metrics being used would provide more than mere descriptive data. Although descriptive data might be interesting and even useful, it leaves the objective effects of gamification up to the interpretation of the researcher. If the interpretation cannot gain definitive results for either positive or negative effects of gamification, it can reasonably be assumed to have less informational value for any corporate decision making. Because of this, in an ideal setting we would need data to which compare our gamification results. If there exists previously collected data of the target task before the gamification process, that is also usable for comparing the gamified task and analysing the results of gamification

In this thesis, the research is carried out as a case-control study in which the control group will provide data that can directly be used to compare gamification

results. There were numerous other reasons for this, the first and foremost being that the gamification projects serving as the study targets were easy to convert into non-gamified versions and were thus well suited for it. For both tests a ready-defined pool of test subjects was also available: for the first test case they came from the customer and for the second they were in-house (by NordicEdu and its parent company). The customer of the first test case is a big enough organization for their employee count to facilitate the required test subjects. The decision was further affirmed by Hamari et al. [3] who criticized some experiments in their literature review as lacking control groups and relying solely on user evaluation. As stated, we consider the case-control study effective as its results can easily and immediately be interpreted based on comparisons to data from the control group.

Based on the theory, we have decided to gather mainly execution time and task result evaluations as data of user performance during testing. After testing the user also fills in a form with questions regarding their motivation toward the test, evaluation on its effectiveness and evaluation on the functionality of the task. The user evaluations of the effectiveness of the gamified solutions and the motivational stimuli they produce are the main point of interest for the qualitative part of this study. In the first test case (the one for the customer) there are also other questions that hold no meaning to the experiment itself. These are however useful to NordicEdu and the customer as they provide valuable information for the future development of the solution.

The research will thus be carried out as a mixed methods research. This seems sensible because, aside from the reasons stated above, it allows for the measurement of three different aspects of the gamification, namely its effect on the time spent by the end users on the target task, the effectiveness of the user during the target task, and the motivational factors that affect the user during the testing. These are fitting metrics for an evaluation of gamification benefits in an enterprise scenario. The two former metrics are tangible in the sense that they are telling of direct benefits to the business of a company. The measurement of motivational factors affecting the end users is also a point of interest as improved employee engagement indirectly affects employee turnover and a multitude of other things.

In case of LOGE and its evaluation, there exists some overlap with the test participants. This is to say that a certain number of the participants take part in the test twice through different discussions. In these cases, it has been made certain the groups are switched so that most of the participants that were in the control group are switched to the test group and vice versa (further explained in Chapter 3). Although this might

sound problematic, it provides us with an interesting case, where we have a small group that is has been through a non-gamified and a gamified discussion. As the discussions are both of a separate subject this should not have a meaningful effect on our main test cases. It would be interesting to ask them to evaluate the differences, benefits, and disadvantages between the non-gamified and the gamified solution. This might provide interesting insight into the question: how well subjective comparison work does when evaluating gamification benefits. We will look at this as a separate extra test case.

2.2.4. Recognized limitations of the study

The time frame for the research has been decided to be roughly four weeks for both projects. For the scope of this thesis it is not profitable for us prolong the experiment for any lengthy amount of time. Four weeks has been deemed adequate for enough volunteers to participate and considering the gamification targets, which will be further elaborated on in Chapter 3, this should not be a problem. Although it is a valid concern that too short of a time frame for the experiment may lead to distorted or skewed results due to novelty being a major factor in user experience, this should not be a problem for either of our two test cases. This will also be further elaborated on in Chapter 3.

3. The gamified solutions and how to evaluate them

In this chapter, we present both test projects and their gamification solution. In the case of the unnamed customer project we also go through the development process of said gamification project. We describe the research plan to measure the effect of gamification for both solutions and hypothesize on the effectiveness of the evaluation. We also look at how the research went and what problems we faced during it.

"*Gamification requires holistic information system design; taking into account not only the stellar technical aspects but also the manifold and multidimensional aspects of user psychology and engagement.*"

- Morschheuser et al. [31]

3.1. Customer project

3.1.1. Requirements and constraints for the project

As stated in Chapter 1, the customer ordered two gamification projects from NordicEdu. In both projects the objective was to develop a gamified approach to the training of customer service employees of the customer. The first project and the evaluation target for this thesis had to do with the customer's renewed e-commerce system. They wanted a gamified solution for the purpose of getting their sales personnel and customer service employees acquainted with its new properties and practices that were related to working with it. The latter also included the conventions and regulations that apply to the handling of orders that come through the new system.

In this project, the customer knew exactly what the information content of the new solution should be. They also had clear guidelines on the general appearance of the solution due to their established brand. We will not elaborate further on either of these due to the anonymity of the customer. The customer had no fully set model for a gamified solution, so NordicEdu had relative freedom to design the way the solution should present the information and gamify the training.

The customer wished for the solution to function in their own learning management system (LMS), as a SCORM package [33]. SCORM comes from the words Sharable Content Object Reference Model and is a standardized way to define a packet for LMS environments like Moodle. This posed no noticeable restrictions to the

gamified solution, although the development team had to define what data needed to be stored by the package and at which points of the training they should be communicated to the LMS. The customer had no other requirements for the stored data except for the point in which the LMS should consider the training passed. This was defined during the development.

The project itself was technically straightforward. The solution was developed as a simple web page (HTML, CSS, Javascript), which was then packed into a SCORM package. For testing purposes, a simple and ready-made Moodle environment was used to check that the SCORM package functioned as it was supposed to.

The biggest single constraint for the project was time. The renewed e-commerce system was under development during the beginning of the project and the training was scheduled to be completed around the same time as the new system would be made public. This left NordicEdu with approximately two months to develop the gamified training solution.

3.1.2. The development of the project

The NordicEdu's development team for the target gamification project consisted of four people (although a few more people took part in the development during the process): two software developers, a graphics and user experience designer (UX), and a project manager, who was also in charge of the customer communication. The whole development team took part in the gamification ideation and the design of the final solution.

The solution the team decided to create is essentially a simple multiple-choice quiz about practices concerning the new e-commerce system, its uses and functionalities, as well as how it should be utilized in a customer service setting. The questions are divided into different categories based on what aspects of the system they focus on. These categories are presented so that once the training has begun, all categories are visible to the trainee but only one category is available for answering. The other categories open one after another to be answered by the trainee as the trainee goes through the categories and answers the questions in them.

After additional refinement, the solution became such that in the beginning the trainee is taken through a brief starting info that tells them how the gamified training proceeds. After that they are taken to a main view, where they can start any category of questions that they have unlocked. Unlocking the categories works as described in the
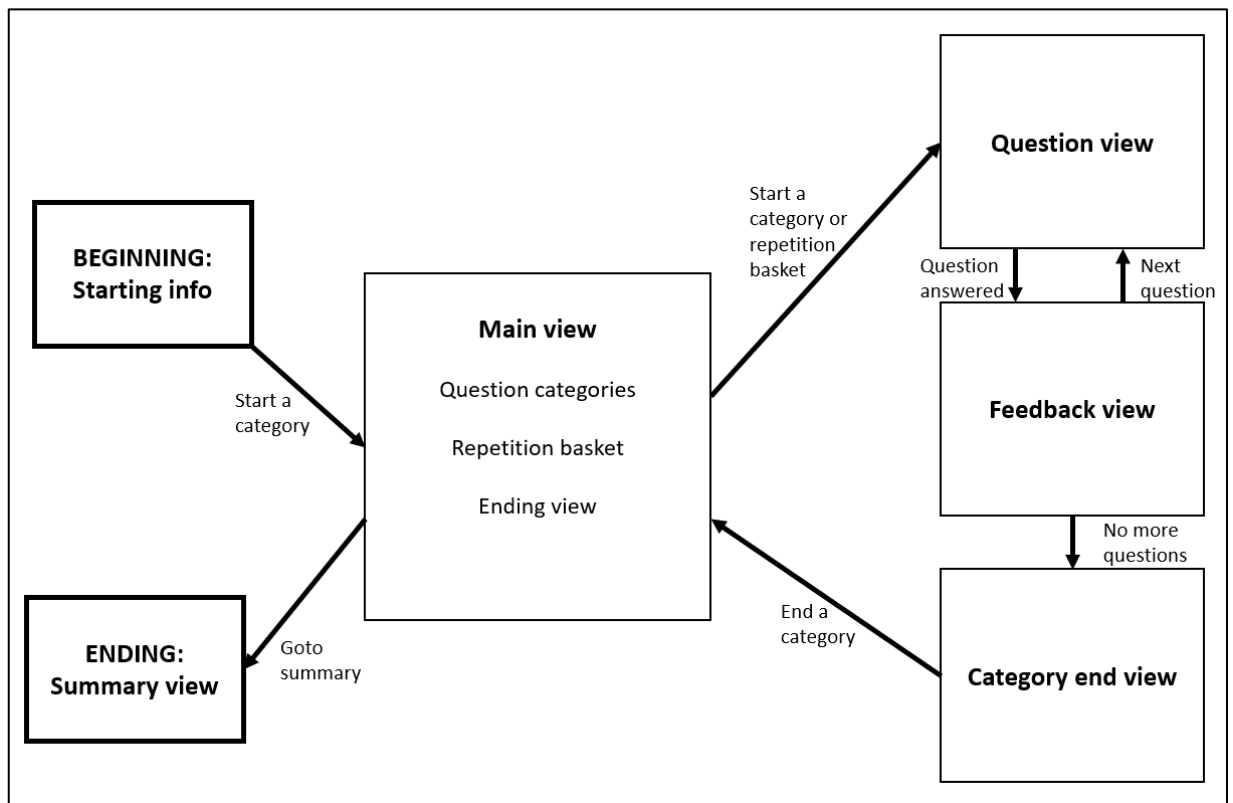
Figure 4 Flow chart of the gamified solution

previous paragraph. Once a category is entered, the trainee is shown multiple-choice questions that they then answer. In this view, they can also choose to use a hint before answering the question. This has no negative consequence on the advancement of the training. After every answer, they are shown whether the answer they gave was right or wrong in a feedback view. At the same time, they also receive additional information and, if they answered wrong, the information on what the correct answer would have been. At the end of the category, the trainee is shown how well they did in a category end view. This is shown as a score of how many questions they got right in that category out of all of the questions in the category. They are also rewarded with a humorous picture that reflects how well they did. Once all the categories have been passed, the trainee enters a summary view that shows them certain statistics of their training process and also awards them with a celebratory title and a humorous picture. This also marks the training as passed in the customer's LMS. The flow chart for the gamified training process is further visualized in Figure 4.

Once a category is completed (i.e., every question of the category is answered) the next category opens for the trainee to complete. The next category opens up no matter how many questions the trainee answered correctly in the previous category, even if they got all of the questions wrong. However, the category is not considered passed until every one of its questions has been answered correctly. The state of the

category is visualized by an intuitive colour-coded circle beside the category's name in the main view. If the circle is red, the category has had a very low percentage of correct answers while a yellow circle means that the trainee got relatively close to passing that category. Once the circle turns green, it means that all questions in that category have been answered correctly and the category is passed. This completion visualization system became referred to as the "traffic lights" by the development team.

The requirement for the category to be passed came from the customer. This was done to make sure that all of the necessary information had been internalised from the questions by the trainee. However, the development team recognized that if the end users were forced to answer all questions in a category in order to retry one that they got wrong, it would result in extreme amounts of frustration and decreased motivation. In order to avoid the negative effect this needless repeat would have on the trainees, the development team decided to use a "final gauntlet" type element, they named as "the repetition basket".

The repetition basket functions in a way that as the end user goes through the categories answering questions, the solution keeps track of all the questions that the user gets wrong. A basket button was added to the main view showing the number of questions that are being tracked. Every time a question receives a wrong answer, it will be added to the tracking list. If a trainee retries a category and gets a question right the second time, the question will be removed from the repetition basket. Once all categories have been answered, the end user may enter the repetition basket. In the repetition basket all tracked questions will be asked from the end user, and the questions that they get right will be removed from the list. Once all categories have been completed and the repetition basket is empty, the final summary view is made available. This way the training ensures that the object of getting every question right is fulfilled before the training can be completed by entering the summary view.

During the development process the development team organized a piloting period with the customer that lasted approximately ten work days. In the beginning of this session, the development team presented an alpha version of the gamified solution to a piloting group selected by the customer. They tested it and reported criticism and general development suggestions to the development team. The handling of the feedback was done through a formulated Google Forms questionnaire and an open Google Docs document. When around two thirds of the piloting had been done, the development team released a new version of the solution which contained improvements based on the feedback to the piloting group. At the same time separate

Google Forms questionnaire and Google Docs document were opened in order to gather separate data from the improved version and of the piloting process itself.

Based on the feedback the piloting process can be evaluated to having had a huge impact on the product itself. Both times the questionnaires contained the same questions regarding the solution itself and the second form had additional questions regarding the piloting process. Both forms had the same number of participants at the time of summarising of the piloting results and, upon closer inspection, the two datasets revealed great improvement on the reception of the whole gamified solution in general. Especially both the clarity and mood of the solution improved drastically during the piloting process. The three categories that showed the least amount of improvement (from none at all to very little) were the hints, the humorous pictures and the starting info. The one category that received unanimous praise during both rounds was the repetition basket. In the end, most of the participants in the piloting group felt that the piloting process had been effective at least to some degree and that it had given them a chance to contribute and impact the development of the solution in a meaningful way.

After the piloting process, the gamified solution experienced very few major changes. Most of the changes relating to it were either cosmetic, slight alterations to the questions and their content, or fixing errors in the solution's functionality. The solution itself was delivered to the customer for publication in their LMS in January 2019.

3.2. LOGE

LOGE's initial development has been ready and the first versions of it have been available for customer use for quite some time before the research for this thesis was started. During that time it has been consistently updated and developed on by NordicEdu in association with Talent Vectia. [34]

LOGE's essential functionality that it is a tool to organize, structure and steer team discussion. The aim is to make business meetings and other similar discussions more effective through gamification. There are three main features that are important for us to present before we go into our research plan:
- how a discussion session is created in the admin view, so that we are aware of our limitations while constructing a session for our research
- the discussion session and its functionality, as this is the focus of our research considering LOGE

-   the feedback functionality, as it is a valid option for collecting feedback from participant in our test

3.2.1. The admin view – creating a discussion and observing feedback in LOGE

LOGE's admin view is a comprehensive tool for controlling the organization-specific content of LOGE. Through it we can create LOGE discussions, which are the most essential functionality of the software. The relevant terms in LOGE while creating a discussion session are theme, question set, and season. In order to have a discussion in LOGE one first needs to create a question set with a theme. After this, a season with one or more scheduled discussions sessions is created. During creation, the season is also assigned a theme. The theme determines, which question set is used for the discussions. From this set a structure for the discussion will be formed.
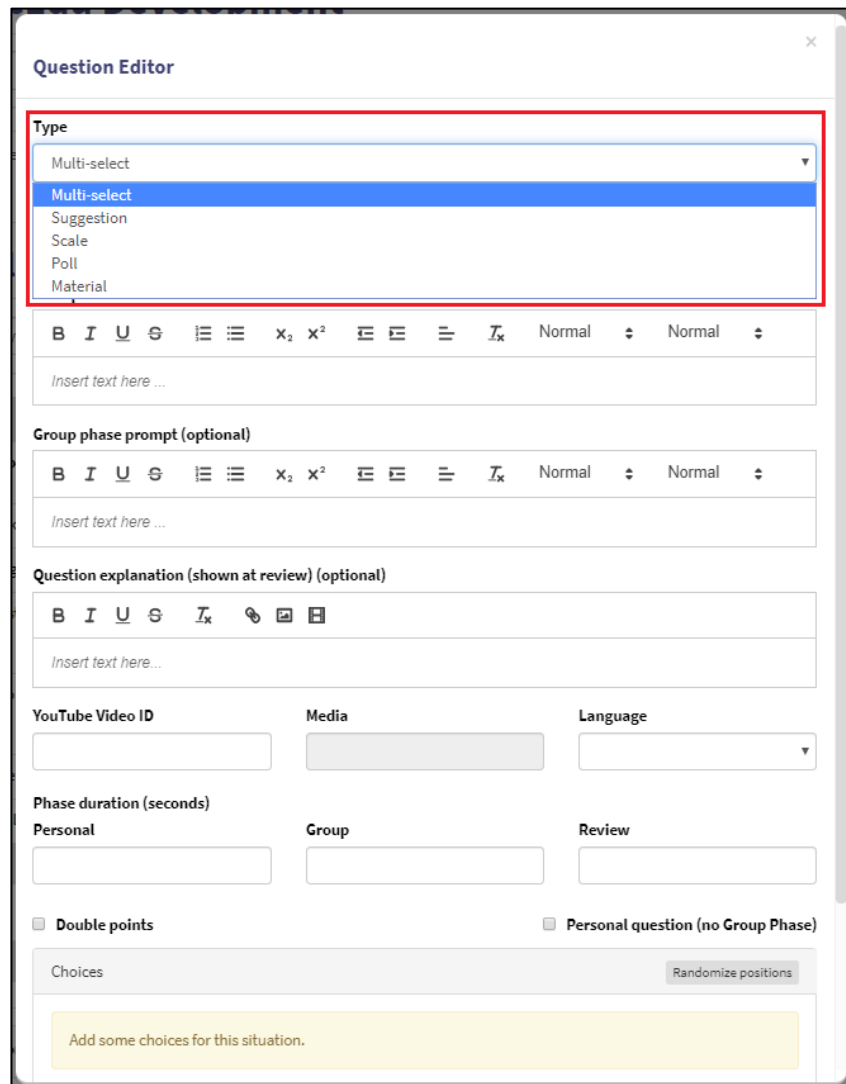
Figure 5 The question editor for Loge admin view. The different question types are in the dropdown marked with red.

The question sets for discussions in LOGE can contain multiple different question types to support different types of needs during discussions. The question types support ideation, decision making and evaluation in a varied way, depending on how they are formatted (see Figure 5) and a time limit can be set for all of them as the organizer of the discussion sees fit. A short description for each question type is as follows:

- **Multi-select**: a multiple-choice question with predefined options. Each option can have predefined feedback for the participants and a score value. During a discussion each participant is also offered a chance to write a short reasoning for their answer.
- **Scale**: either a simple slider question or a two-dimensional one (visually resembling a scatter plot). Chance for multiple options that can be predefined or polled from the participants.
- **Poll**: a multiple-choice poll with predefined options, with a fill-in "other choice" as an extra option. The way the poll results are shown can also be defined as either bar, pie, or circle.
- **Suggestion**: a suggestion with an open answer field for comments. Also usable as a question with a field for a written answer.
- **Material**: A way to show audio-visual material (e.g. a video) as a part of the discussion.

In LOGE, it is possible to also predefine other materials for the theme. More interestingly, self-evaluation questions can also be set for discussion participants to answer after they are done with the group discussion. The evaluation questions can be one of two types: rating or open field/written. The rating questions pose a question with the answer being a value between one and five.

A season in LOGE is a simple way to define a set schedule when discussions for a certain theme are held. Discussions in a season are adequately customisable. A maximum number for both questions used from the set and the maximum participants for participants of a discussion can be adjusted, times when discussions are available can be chosen, description for season can be written, and time limits for the discussion parts can be set. The season ends automatically after the last scheduled discussion has been held or time for it has passed. This is further elaborated in Figure 6.

As implicitly stated, the feedback received from not only the self-evaluation questions, but also from the discussions themselves. We can also view statistics of the

Figure 6 Loge Season creation options. In the blue are highlighted descriptive fields and theme selection, in the green time related fields, and in the red are fields affecting the discussion format

discussions and gather the discussion time and what points the participants got from the discussion. LOGE has a system that supports awarding points based on answering questions. This system mainly shows how active a long time LOGE user has been as a personal overall score. As our test aims to measure LOGE's influence on a single discussion, this aspect will be mostly ignored by our study, unless a noteworthy point to be made of this system presents itself.

3.2.2. The gamified discussions in LOGE

The discussions in LOGE are guided by the questions in their theme. The length of the discussion depends on how many questions from the theme the discussion should cover and the amount of time (divided to its phases) each question is given during creation. Each question has three phases: a personal phase, a group phase, and a review phase. During the whole discussion the participants are at the same chat room with both audio chat on and text chat open in the sidebar. The progress of the discussion is shown in a progress bar that is constantly visible. At the beginning of each discussion the group chooses its name by polling for suggestions from participants and then having them vote for the best name.

   The handling of a single question phase by phase is a straightforward process. During the personal phase each participant is posed a question defined in the theme. The participant answers said question and has, in most cases, a chance to give a short

explanation for why they answered the way they did. After that the discussion moves on to the group phase of the question, during which all the personal answers are discussed and during which a randomly selected chairman compiles a collective answer for the question based on the personal phase answers and the groups discussion. At the end of a question comes the review phase, during which the answer of the chairman is revealed to the group, and the answer can be discussed along with any other discussion brought up during the question that needs to be addressed. Examples of these phases for an example scale question are shown in Figures 7, 8 and 9.
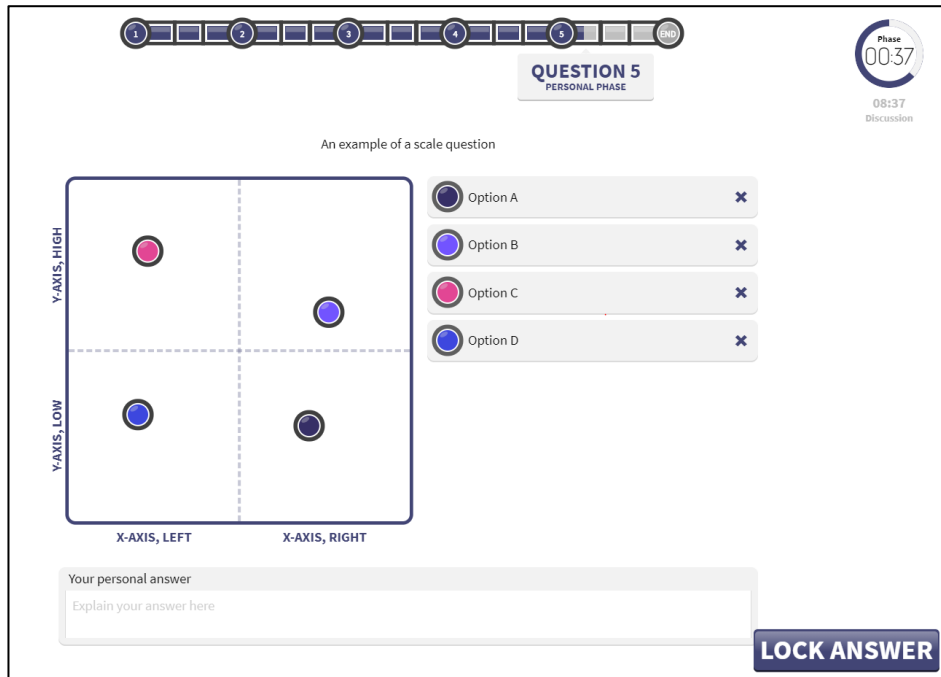
Figure 7 The personal phase of an example scale question answered. The balls representing the different options have been dragged to the matrix by the participant, who has decided to give no freeform personal answer.
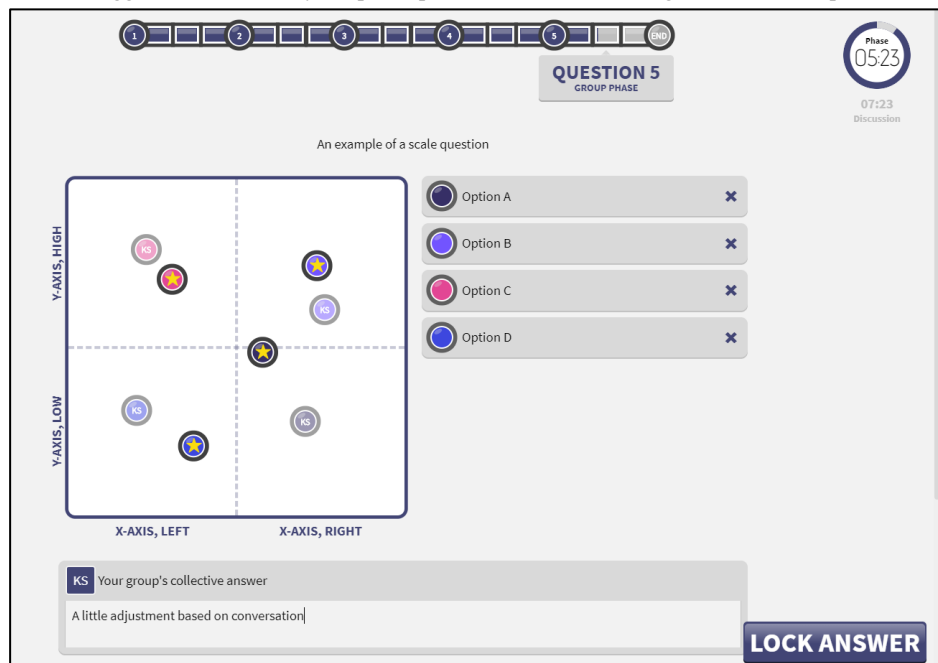
Figure 8 The group phase after the phase in Figure 7. The chairman has adjusted the positions of the groups final answers and described the answer further in the text box.
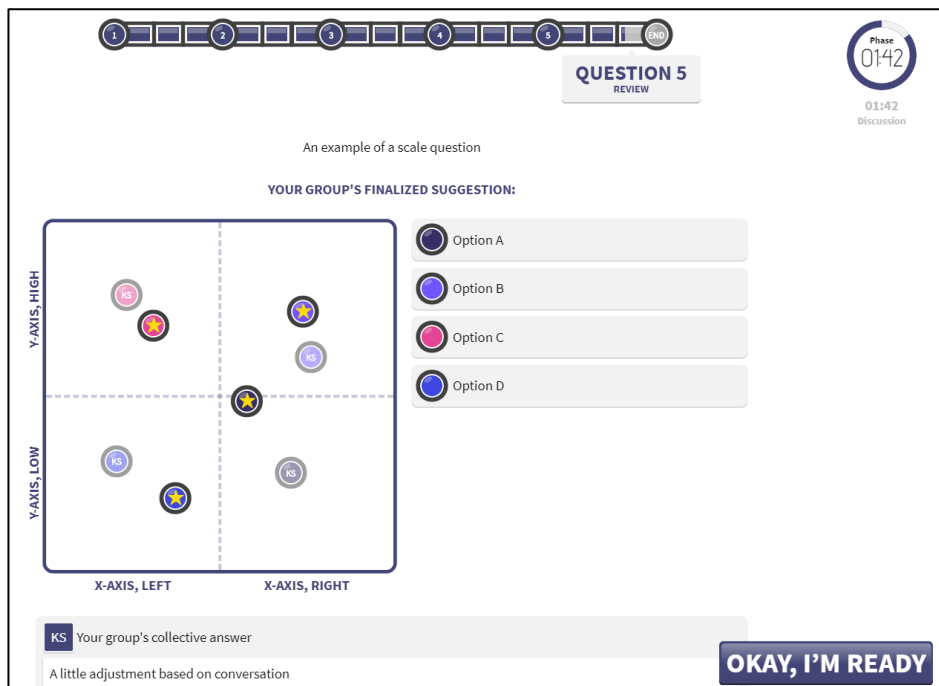
Figure 9 The review phase after Figure 8. The answer of the group is revealed, and it is discussed.

After all of the questions have been properly addressed the discussion ends and a score card for the discussion is shown to the participant. Most question types have a set amount of 25 points that the participants get by answering. In the case of multiple-choice questions, points can be addressed to individual options according to the organizer's liking. As mentioned before at the end of Section 3.2.1., these points are mainly useful for showing personal LOGE activity over longer time and will be mostly irrelevant for our study. If the question requires us to define an amount of points for different question options, we will give all of the answer options an equal value.

After the participant has had enough of the score board, they can move on to the self-evaluation portion of the discussion. If the organizer has defined questions for this part, they are shown along with two default questions that are always shown even if no other questions have been defined. These two questions are an open field question with a prompt for open feedback and a rating question which asks the participant how they would evaluate their LOGE experience. The scoreboard and self-evaluation following a discussion are illustrated in Figures 10 and 11.
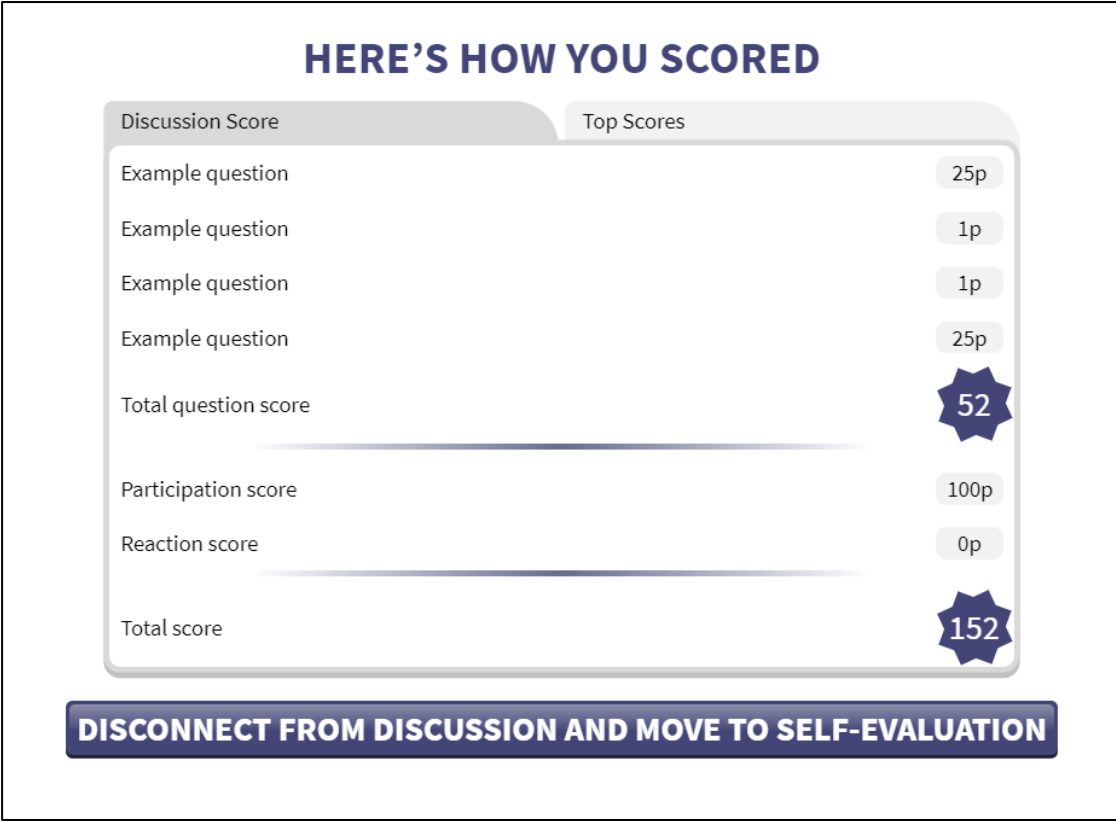
Figure 10 An example of a personal Loge score board after a discussion.
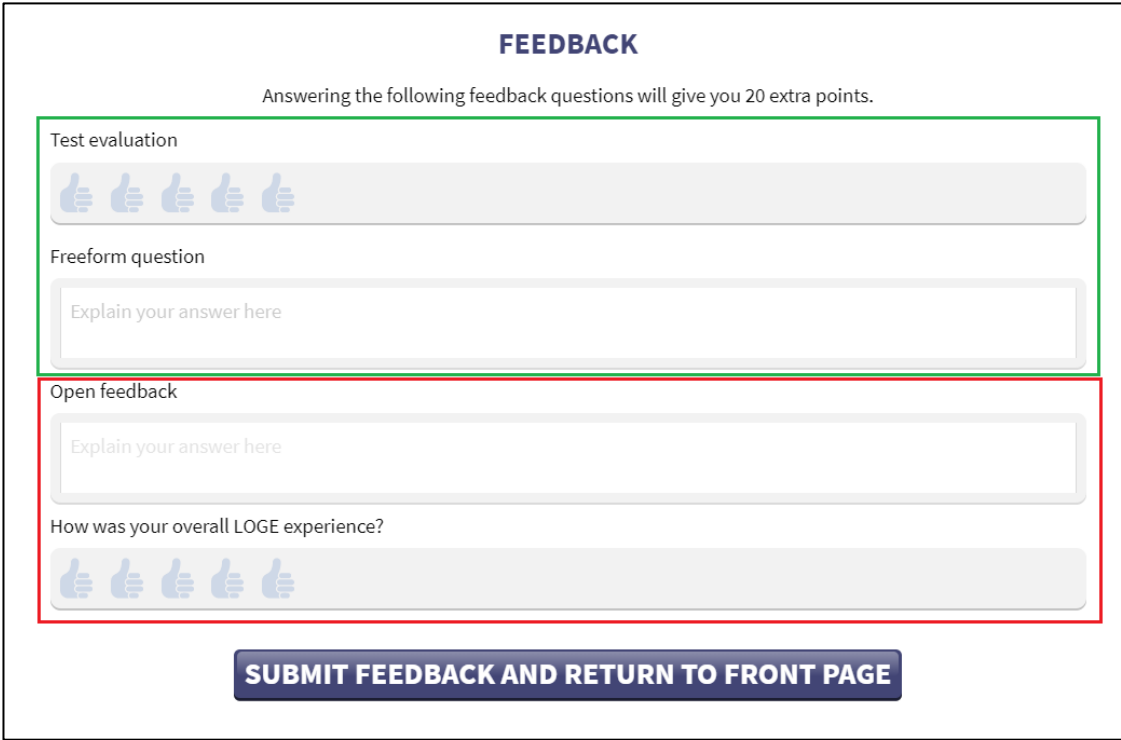
Figure 11 An example of a feedback questionnaire after a Loge discussion. The organizers questions are highlighted in green, the default questions are highlighted in red.

After a discussion in LOGE has ended, its results can be downloaded from the admin view as a CSV-file, which contains the data for all the interactions during a

session. In addition to this, the suggestion, scale and poll questions have a way to view them from the admin view, which makes the results much simpler to interpret. The feedback given for each discussion can also be examined in a separate view. However, if a participant has chosen to give no feedback, the view shows nothing to examine.

3.3. Research plan

"*As the research on gamification progresses, care should be taken to ensure that future results are more comparable.*"
-   Hamari et al. [3]

As stated in Chapter 2, the research for both cases will be carried out as case-control studies. However, because of the differing nature of the test subjects, it is easier to present the research plan for both of them separately.

3.3.1. Customer project

For a case-control study to become possible, we will need to find a way to create a version of the training that has all the same information content as the gamified
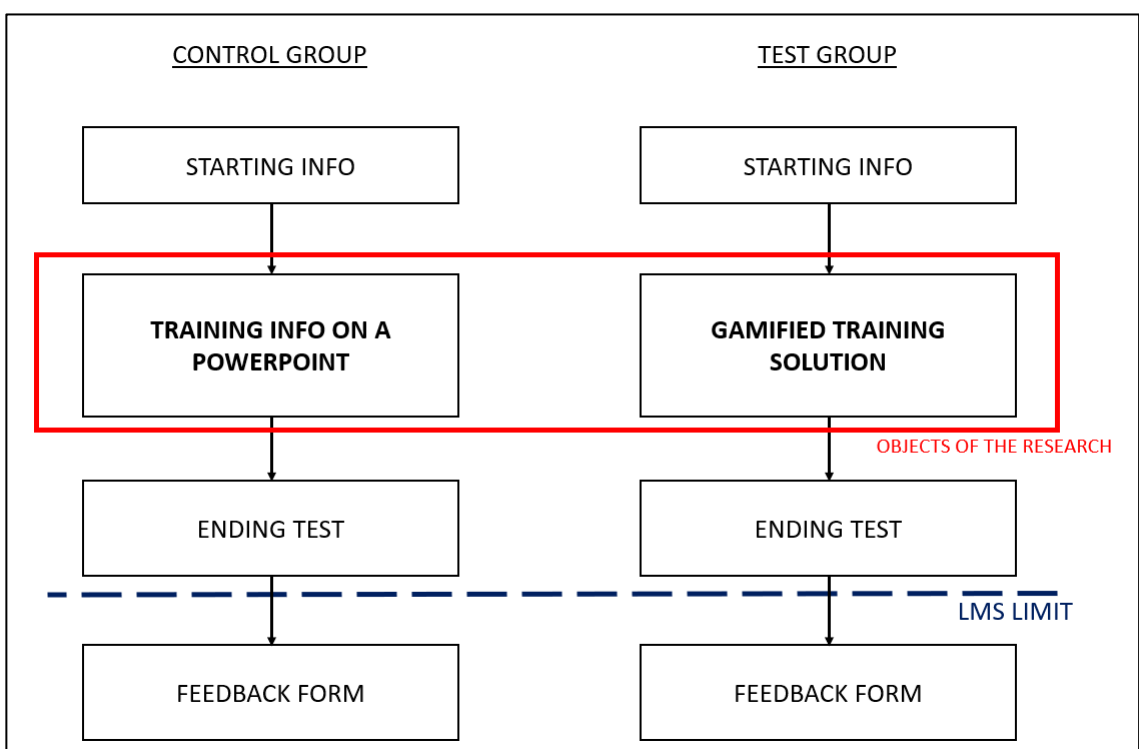
Figure 12 The flow of the study for both the test and the control group. The customer's LMS limit is marked by the dashed line and the objects of the research by the red rectangle
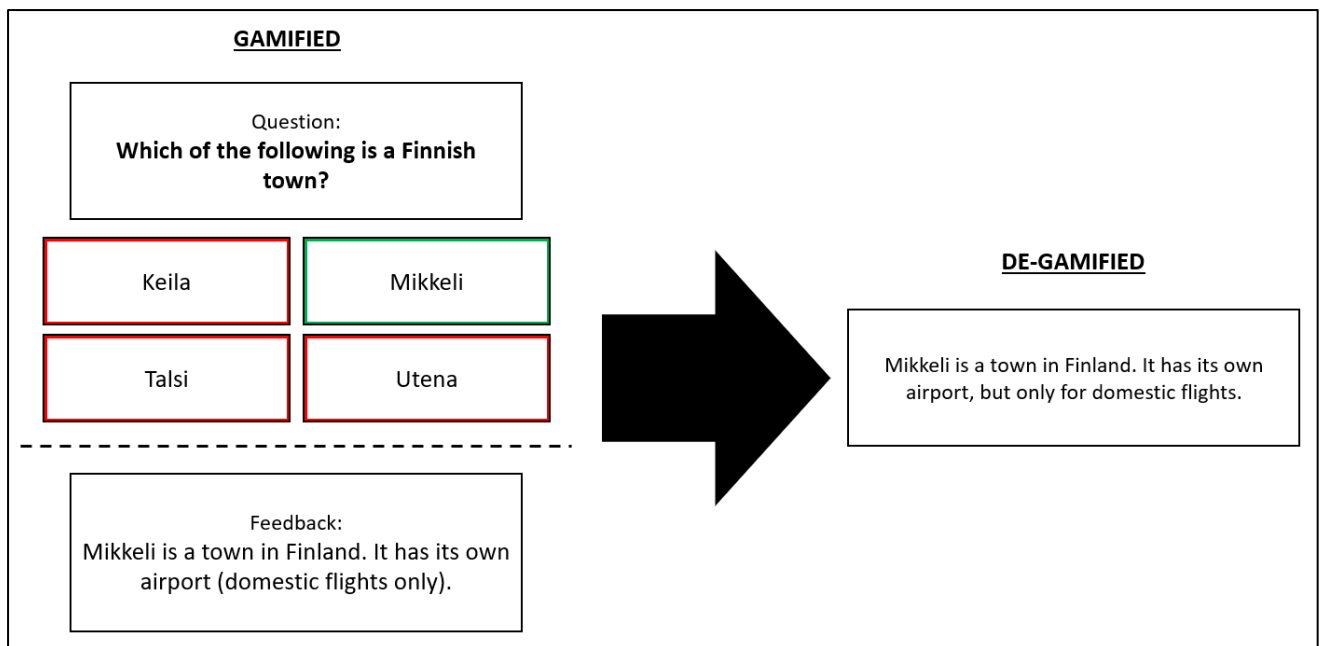
Figure 13 An example of the formatting of the training information. The correct answer highlighted in green.

solution, but none of the gamification aspects. Then we need to devise a way to test both the test subjects and the control group in a way that allows us to easily compare the results produced by both groups. Lastly, the testing environment (aside from the aspect of gamification) should change as little as possible between the two groups.

The latter of the three points proved to be the simplest of the four to answer. In order to assure minimal change in setting for both test and control group, we decided to utilize the SCORM package and the LMS of the customer. As the original gamified solution was itself a SCORM package, it lent itself well for modification. By doing the test through the LMS of the customer we not only had a ready-made and easy to use way to have volunteers participate in our study, but also a set format for how the study would be structured. A SCORM package can be divided into multiple different parts. As the development team had created the training solution as the only part of its package, new parts could easily be added without disrupting the functionality of the original solution. We added two more parts to the SCORM package to frame our study: an introductory start and a test to the end of the package. In order to gather the information we need, we decided to use Google Forms. Once the end of the SCORM package is reached, the end user is instructed to press a button that will take them to a Google Forms questionnaire. The data required for the quantitative research is filled in automatically and the participant answers the questions for the qualitative gamification evaluation. The flow design for this research and the SCORM structure is further elaborated in Figure 12.

The ending test for both the control and the test group are to differ from each other in no respect, as they are crucial to measure differences for the quantitative research. The starting information parts should similarly resemble one another as closely as possible, although some deviation might be necessary in order to avoid falsities in the instructions. In the same vein, the feedback form for the test group will contain all the same questions as the form of the control group. However, the form of the test group will also contain additional questions that are specific to the gamified solution developed by NordicEdu. The qualitative questions for both Google forms are presented in Appendix A.

In order to create a valid version of the training material that was not gamified we had to decide on what information in the gamified solution was meaningful for the purposes of the training. In the end, the meaningful data conveyed in the gamified solution came from three different elements in the solution: the questions, the answers and the feedbacks after the questions. To neutralize all gamification all of the mentioned parts were read through while at the same time copying the questions, the correct answer options and the feedback extra information to a separate file. The copied data was once again read through and formatted as a structured informative text (see Figure 13). This text is then divided into otherwise plain presentation slides with titles matching the gamified question categories. The slides were saved as a PDF file, which made the implementation very simple. PDF files as a part of a SCORM package work just like an ordinary PDF, which means that the slides did not need any special implementation in the LMS.

For the ending test we decided to use a similar question format as in the gamified solution. However, we came up with a completely new set of questions that could in theory be answered correctly by a participant whether they had gone through the gamified training quiz or the de-gamified training slides. The ending test comprises 20 questions out of which the first 5 are binary true-or-false questions and the 15 following are similar multiple-choice questions as most of the questions in the gamified training. It needs to be noted that while the questions of the ending test are similar in format, they are in fact all different from the questions in the gamified training. Also, while the gamified training contained some questions with multiple correct answers, in the ending test every question has a solitary correct answer. We defined a pass limit of 16 correct answers for the ending test. Although the test does not provide any sort of feedback after every feedback, at the end the result is shown as a number of how many questions out of 20 the participant got right. If the pass limit of 16 is surpassed a

confirmatory thumbs-up symbol is shown, whereas a thumbs-down tells the participant that they could have done better. At the same time the participant is given the options to re-do the test or continue on to the Google Forms questionnaire. The test can be taken as many times as the participant likes.

Once the participant decides to move on from the test and into the questionnaire the ending test automatically fills in the data for the quantitative parts of the form. For the quantitative research, we decided on a few key factors that interested us in our study:

- o starting time of the training
- o starting time of the ending test (the first time it is entered)
- o time of the first passed attempt of the ending test (if it is passed)
- o ending time of the training (the time Google Forms is entered)
- o number of correct answers for the first attempt of the ending test
- o number of correct answers for the first passed attempt of the test (if an attempt is passed)
- o the highest number of correct answers gotten from an ending test attempt
- o number of times the ending test was begun
- o number of times the ending test was completed
- o number of the attempt that the ending test was passed for the first time
- o number of the best attempt at the ending test

From this data we should be able to notice some correlation between the effects of gamification on the training. The factors should also be sufficient enough so that even a lack of correlation should tell us something about the effect the gamification has had on the training.

Technically, the study for the customer was not difficult to facilitate. As the ending test used many of the same assets as the gamified solution and the starting information was modelled after its starting information view as well, the bulk of the work could focus on other things. Most of the work went into refactoring the gamified training into a non-gamified slide show and devising the way that the quantitative factors were stored and delivered to us. This too borrowed many technical solutions from the gamified solution which lessened the amount of work it required. Altogether, the research materials took about a week's worth of effort from us.

3.3.2. LOGE

With LOGE we went differently about creating the test material. As LOGE is a platform where the discussions can be freely defined, the question became more about what subjects we should discuss. From NordicEdu we got two subjects, one for the technical personnel of the company and one for everyone in the company. These discussions are from here on referred to as the technical discussion and the all-encompassing discussion. From NordicEdu's parent company we also got one subject for a test case. This will be referred to as the parent company discussion.

When it came to creating test cases for all the discussions, the procedure was straightforward. First, we defined the general objectives for the discussion. After this the objectives were defined into the form of a coherent and more controlled LOGE discussion. The participants of each discussion were then divided into two groups: one that would use LOGE (i.e. the test group) and one that would have a traditional freeform discussion (i.e. the control group). For the freeform discussion, a chairman was assigned who understood the objectives and time limits of the conversation. This was done in order to ensure a formal discussion with purpose. After both discussions the participants were asked to answer a questionnaire about the discussion and how well they thought it played out. The control group filled the questionnaire via Google Forms, whereas the test group utilized the internal evaluation system in LOGE. These evaluation questions are further elaborated in Appendix B.

With LOGE the only quantitative metric we have chosen to measure is the amount of time taken by the discussions. However, in addition to the evaluation questions posed to all participants individually, we also ask the company facilitating the test (either NordicEdu or its parent company) to evaluate the usefulness of the results of the discussions and decide on which between the control group and the test group produced more useful results for the company. Though this cannot be considered quantitative, we consider this a straightforward and valuable metric when evaluating the effectiveness of gamification in a single LOGE discussion.

As stated in Chapter 2, we have some overlap in our participants for NordicEdu discussions. This should however pose no problem, as the discussions are separate and individual. We have also made sure that the groups have been assembled in a way that no participant is twice in a discussion that uses LOGE. This has been done to mitigate any effect the overlap would have on the results. It might be worth noting that one participant has been assigned to two discussion groups of which neither utilizes LOGE.

This is because of his status as LOGE's current main developer, which might affect his experience drastically. He has not been completely excluded from the discussions because the discussions hold value to NordicEdu outside of this experiment, as does his participation in them.

Because of the overlap we have a chance to examine how well subjective comparison does in evaluating gamification. As we have participants that have taken part in both a non-gamified discussion and a LOGE discussion, we will ask them to compare those discussions and evaluate how effective and helpful they consider LOGE's gamification based on their experiences. The evaluation will be done through a Google Forms questionnaire. The questions in the questionnaire are further elaborated in Appendix C.

For LOGE testing we have mapped out three subjects each with separate groups for those that use LOGE and those that do not. The descriptive numbers of each of these discussions for LOGE are presented in Table 1.

Table 1: Descriptive attributes of LOGE discussions.

DISCUSSION	Technical discussion	All-encompassing	Parent Company
NUMBER OF PARTICIPANTS	7	10	6
NUMBER OF QUESTIONS	9	16	12
OF WHICH PERSONAL OR DESCRIPTIVE	2	3	0
AVG. PERSONAL PHASE TIME LIMIT	03:27	04:28	04:55
AVG. GROUP PHASE TIME LIMIT	08:34	09:18	09:50
PREVIOUS LOGE EXPERIENCE	FEW	SOME	NONE

Table 2: Descriptive attributes of freeform discussions.

DISCUSSION	Technical discussion	All-encompassing	Parent Company
NUMBER OF PARTICIPANTS	7	10	7
LEVEL OF GUIDANCE	BROAD	BROAD	DETAILED

In Table 1 a personal phase only-question is a question that does not have a group phase. Of these 5 questions, 3 were used to set discussion context, 1 to offer a five-minute coffee break, and 1 to map out the personal interest of discussion members to further participate in development of the discussion subject. In the Loge discussions of the parent company the participants had no previous experience with LOGE, whereas in both NordicEdu's discussions at least few of the participants had tried LOGE before. In every LOGE group however, at least half of the participants have never used the system before. The group that had no previous experience with the platform were provided

guidance regarding how to use LOGE with minimal interference to the actual discussion.

Table 2 describes the precious few attributes the freeform discussions can be attributed beforehand. The level of guidance refers to the description the groups or their chairmen were given for the discussions. In both NordicEdu's discussions the chairmen were given a general description of the subject and major topics they should try to cover during their discussion (the same topics that were the basis of the LOGE questions for the test groups). However, the parent company felt it more appropriate to give the control group the same questions as the test group but without the gamified structure of LOGE. This makes that the parent company's case is a different, but all together valid test case.

3.4. Hypotheses for the research

Before our research begins, we would do well to form hypotheses of the results and the viability of the research itself based on existing theories. In this thesis, we have presented plentiful amounts of theory regarding to our study and so have good grounds to form hypotheses for it.

3.4.1. The customer project

Firstly, we should look at the resources that are at our disposal and factors which contribute to the participation for our study. The test users for the research are employees of the customer and participate voluntarily. We have laid the absolute minimum number of participants to 20, 10 for both the test and the control groups. This number is low and will affect poorly on the impact of the study should the number of participants end up remaining this low. The customer is, as mentioned, a large enterprise that has multiple outlets all over Finland and the size of the participant pool we aim for is 40 (20 participants per group). The size of the customer company keeps us hopeful that we could receive more participants than we are aiming for. They also have a functioning LMS already in place, which allows every potential participant easy access to attend our study. The participation should take between 20 to 60 minutes time from start to finish, which should not pose a problem for user participation. Our hypothesis of the amount of user participation is that we will reach between 30-40 participants (15-20 per test group).

We perceive no reason that the results of the case-control group test should contradict the previous research considering gamification. This is a very straightforward test of which there have been multiple similar ones before. Thus, our hypothesis is that gamification has a positive effect on the employee training. We can add a conditional hypothesis that should the gamification not have a positive effect on the training, it at least will not have a negative effect on it. Our thesis focuses on the development of the evaluation methods themselves and so this hypothesis is not essential to it. It is noted here purely for added interest and to demonstrate our pre-disposition in our approach to the test.

When evaluating the research of the customer project, we have recognized multiple factors that affect the credibility of the test results we might receive. These include:

- o Group/sample size – 40 participants should offer us an adequate sample amount. If the amount drops, it has a negative effect on the credibility of the results.

- o Implementation of the ending test – the ending test has been modelled after the question parts of the gamified training. It might have an unintended positive effect on the test group thus having an effect on the comparability of the groups. However, due to the questions in the ending test being worded so that they resemble the gamified solution as little as possible while carrying the same content, this effect has been evaluated to be small enough for the results of this thesis to not become skewed by it.

- o Participation situation – the employees take part on the test during their workday, which might cause them to rush through it. In ordinary circumstances they can properly take time to go through the training. This affects both the test and the control group and does not thus affect the comparability of the groups.

- o Participant pool – the participants are all current employees of the customer. This might have a positive effect on the results of the test. Again, this affects both the test and the control group and does not thus affect the comparability of the groups.

All in all, the recognized elements do not have major meaningful effect on the credibility of the test results. The biggest concern we have is about the sample size, which could in an extreme case drop low (close to 20) and so affect the study. However,

since our assumption is that we will have close to 40 participants, our hypothesis is that the test results will be credible.

When considering the relevance of the test results we are talking about their relevance for the customer. The customer is an enterprise and will be mainly interested to see either a change in the performance or in the attitude of the employees, or the effectiveness of the training. All of these aspects are directly evaluated by the test, either by its quantitative part or its qualitative part. Our hypothesis is, therefore, that the results of the evaluation are relevant to the customer. Our secondary hypothesis also is that the results of the test are academically relevant but also less impactful. This reflects what was stated previously about the straightforwardness of the test and our focus on the gamification evaluation methods used in it rather than its results.

3.4.2. LOGE

With LOGE our test case differs vastly from the customer project. To evaluate the effectiveness of gamification on the results of the discussions we have three pairs of test discussions. The metrics for this evaluation are the time taken by the discussion (quantitative) and evaluation on the usefulness of the results performed by the facilitating company (qualitative). Since we do not have a bigger sample pool for either of these metrics to form any academically conclusive judgment, we must view our results based on them as only indicative results. However, this does not mean that we could not evaluate the used study methods themselves based on these metrics.

For the evaluation of the effect of gamification on user experience our sample pool is much more sizeable, as each participant provides a sample for it. Based on our test plan our control groups will total at 24 participants and our test groups at 23. This is more than a reasonable group size for our test scale and should give our results a certain amount of credibility. However, should something unexpected happen that would make our participation count drop drastically, we maintain the same absolute minimum sample size of 10 as with the customer project. Due to the discussions being sessions that are actively organized by the collaborating companies, our hypothesis is that we will receive at least 20 participants per group.

As with the case of the customer project we have the same hypothesis that gamification will have a positive effect on the discussions, or that it at least will not have a negative effect on them. As with the customer project, this hypothesis is based on previous similar studies.

Identified factors affecting the credibility of the test results for the three LOGE cases include:

- o Group/sample size for discussions – six discussions divided between testing and control groups is too low to produce any academically definitive results, though from a business standpoint they might be enough to produce useful results.

- o Group/sample size for participants – as we are fairly confident that we will have at least 40 participants altogether, our sample size on this front is more than enough to create credibility for our results. The event in which the amount would vastly drop is extremely unlikely.

- o Participant pool – the participants for the discussions are not all random. Instead the discussions have a certain participant profile. For the technical discussions there is expected to be only one female participant. Also, in the parent company's discussion, the participants are relatively young, most of them being under 25 years of age. However, the tests are arranged in such a way that as there is no notable difference between two discussions in a test case discussion pair. Thus, the participant pools should not have a notable impact on our results.

- o Different levels of guidance – as brought up in Table 2, the freeform discussion of the parent company has a more detailed level of guidance which more closely resembles its corresponding LOGE discussion. This might have an effect on the flow of the discussion in comparison to the other two freeform discussions and also on its comparison to its LOGE counterpart. This will be taken into account during the evaluation of the results.

- o Overlap in discussion participants – in the NordicEdu discussions, the participation pool of the all-encompassing discussion contains the participation pool of the technical discussion. However, as the two discussions do not share any common subject matter, this should not be an issue. In addition, the effect of overlap is further minimized by having most of the participants in the technical discussion be on the "inverted" group in the all-encompassing discussion (i.e. those previously in LOGE will do the freeform discussion and vice versa).

The recognized elements, as with the customer project, do not have major meaningful effect on the credibility of the test results. Since we are almost certain to have a

sufficient number of participants, our most major worry is that the participant overlap has an effect on our results. As precautions have been taken to circumvent this, our hypothesis is that the test results will be credible.

With LOGE the one most interested in our test results is NordicEdu, who is also the main developer of the product. They are interested to see the effects their product had in direct comparison to a non-gamified discussion about the same exact subject. If the results were that LOGE improves on discussions, this can provide valuable marketing material. Even if the results were to be the opposite they may be used to improve on LOGE's current design. In both cases the tests (as they are planned) should produce clear indications to how well and to what extent LOGE has implemented successful gamification mechanics. Our hypothesis is that the results will be relevant to NordicEdu. As for our secondary hypothesis about the academical relevance of our test results, we believe these tests to be relevant but, as with the customer project, less impactful.

3.4.3. Hypotheses concerning the evaluation methods themselves

Arguably our most interesting hypothesis concerns the evaluation methods themselves, namely their practicality and usability for business purposes. We do recognize that the case-control study requires for us to receive double the number of participants for it to be effective, which poses a major problem when trying to implement it in a commercial setting. The study, although effective, requires for either a high participation percent (in practice that participation is mandatory for a number of people) or a huge number of potential participants. In the project of the unnamed customer we would not have considered it in any way a viable evaluation method, were it not for the large size of the customer company. This is also alleviated by the already in-place LMS of the customer that enables participation practically anywhere. In the case of LOGE, we are counting heavily on the internal drive among both NordicEdu and its parent company to produce a readied pool of participants for the test cases of LOGE. The chosen key factors for the quantitative test and the questions for the qualitative test are relatively common for such cases and were easy to implement. This can be generalized to similar situations, or to situations where the incentive for participation is high enough to allow for the required sample size.

Our main hypotheses for this thesis are as follows:

H1. The evaluation methods are effective and produce valuable results from a business standpoint.

H2. The evaluation methods are practical and easy to implement in a business setting.

3.5. Conducting the research

As is to be expected, both of our research cases faced problems on their courses. These problems were so varied in their nature, that they are easier to discuss separately.

3.5.1. The customer project

After we had begun our research on the customer project we soon discovered a bug in our test package that forced us to reject three samples. This was extremely unfortunate and discouraging, as participations for the research had proven scarce. The bug was fixed in a timely manner before it could affect any more samples and the test was continued according to plan.

After the research case had been going on for a few weeks it soon became clear that one month was not going to be long enough for us to reach even the minimum of 20 participants. This led us to prolong our research. After a total of three months we were still unable to attain the absolute minimum of 10 valid participants per test group. We even began collecting a separate supplementary sample pool from non-retail workers of the customer with the idea that the usability of these separate samples and their validity for our research would be closely examined before taking them as a part of our results. This too was to no avail as altogether, counting in the supplementary participations, after three months of collecting data, we had following sample sizes:

CONTROL GROUP: 8

TEST GROUP: 4

REJECTED: 3

After failing to reach the minimum participation level in this time frame, we terminated the test.

It should be noted, that during our research, we frequently fell out of contact with our contact person from the customer company. Despite our numerous attempts, we were unable to receive any response from them, sometimes for weeks at a time. Though the actual effect that this one-sided communication had on the research can only be speculated on, it seemed to play a part on the failure of the test.

3.5.2. LOGE

In the case of LOGE our research for most of the cases went almost completely as planned. Not all participants were able to attend every discussion fully, but we managed to gather large enough sample sizes for us to present credible results. With the parent company's LOGE discussion we also had few minor technical mishaps, which affected the length of the discussion. This will be taken into account, when the results of the tests are discussed.

The all-encompassing LOGE discussion was the only point in our test cases where we encountered a serious problem. During the discussion it became clear that the design of the discussion was extremely poor. The questions were poorly designed. They were repetitive and unclear, and there were too many of them. The discussion also had 10 participants, which was a lot compared to the other LOGE discussions. These factors together had a cumulative negative effect on the discussion itself as follows:

- The increased number of participants in addition to the unclear questions caused there to be an increased amount of discussion.
- Because of the unclear questions most of the increased discussion was essentially fruitless as it focused on the participants trying to reach a consensus on how the questions should be understood.
- The amount of confusion and fruitless discussion in addition to the repetitiveness of the questions lead to the participants becoming increasingly frustrated and this frustration affecting the discussion.
- This frustration in addition to the large number of the questions lead to the discussion eventually ending prematurely, as the participants ran out of time and saw no reason to continue the discussion.

In essence, we had to consider this discussion a failed test. The results we got from it had to be rejected as faulty.

- o The time the discussion took could not be used for accurate depiction of the discussions time requirement, as the discussion was cut short.
- o The results of the discussion could not be evaluated. Almost half of the questions did not receive an answer from the discussion, and the questions that had an actual answer were affected by the confusion of the participants.

- o The evaluation questions answered by the participants were in and of themselves fine. However, we found it problematic to bring these results into the same comparison with the other LOGE evaluation results as they were clearly affected by a subpar design by us. The premise of the study did not take this case into account but instead implicitly assumed that all LOGE discussions have no notable differences in how well they are designed. Because of this we decided to ignore these results.

In short: A bad evaluation of a design that is already known to have poor design does not prove anything other than that the design is subpar.

To simulate what we thought would be the optimal procedure if a similar case appeared in real life business environment test we followed the simple gamification design principle laid out in Section 2.1.3:

After the design implementation is evaluated it [gamification development] *can start over from the ideation state to improve on the now existing design.*

We looked at the feedback we had received from the discussion and created a new LOGE discussion with new questions. After we had gathered voluntary participants from the ten participants of the failed discussion our refined discussion had following attributes:

- o 5 participants
- o 8 questions, of which 2 were personal or descriptive
- o 05:26 average personal phase time limit
- o 11:10 average group phase time limit
- o everyone had previous LOGE experience from the failed LOGE discussion

Of the two personal or descriptive questions one was for setting the frame for the discussion. However, in this discussion the other one was an actual meaningful question that had no group phase. The main differences in the design were the reduced number of the questions by focusing on a few key points in the subject of the discussion. We also focused on making the questions clearer. Also, the time limits in the questions were increased to allow for more free discussion.

After rethinking the questions to suit better the needs of the discussion, we got actual sensible results. It is possible, however, that the personal evaluation might have

been positively affected due to the participants having a previous negative experience with LOGE. We will take this into account as we process the results.

During the handling of the data we also suddenly noticed that we had forgotten to add the question "*How long was the conversation in terms of its content?*" into the evaluation form of the freeform discussions, which means that we are unable to compare its results between the groups. This is unfortunate but does not ultimately ruin our research.

4. Results of the test cases and their relevance

As was stated in the previous chapter, the customer project yielded no results that could be presented in this chapter. Thus, this chapter focuses on LOGE evaluation results and their relevance.

4.1. Evaluation results

With LOGE each of the three test cases has the following results that can be evaluated:

- o Execution times – measured from the start of the discussions to their finish
- o Discussion results – both a numerical and a descriptive evaluation by the person or persons who proffered discussion subjects and test groups for LOGE test cases (from here on out referred to as the subject owners)
- o Personal evaluations – data gathered by question forms after test discussions from the participants

In addition, we have a cross-case evaluation, where participants who had participated in both a LOGE discussion and a freeform discussion (with different subjects) evaluate the discussions in relation to one another.

4.1.1. The discussion results and execution times

The evaluation of the discussion results with the subject owners was carried out as an interview. The course of the interview was that we read through and talked about the results for both the freeform discussion and the LOGE discussion. During this we took notes of any worthwhile notions the subject owner might have made about the nature of the results. After this, we asked the subject owners to evaluate a few different aspects of the discussions based on their results. These results are shown in Table 3.

The results show, that all of the discussions went well, and no apparent problems were deducible from their results. Also, it is easy to notice from them that in both NordicEdu test cases LOGE discussion was evaluated to be stronger in all the categories. This means LOGE results were somewhat counterintuitively chosen to be both more concrete and at the same time more up for interpretation. This can be explained by both of those LOGE discussions having results that were both relatively varied and verbose, which attributed to them having the capacity to produce both

ambiguity and definition in their results. In both of these cases it was also specified that ambiguity was considered a positive trait by the subject owner.

Table 3: Evaluation of discussion results

QUESTION	PARENT	NE: Tech	NE: ALL
How well would you say the freeform conversation went?	WELL	WELL	WELL
How well would you say the LOGE conversation went?	WELL	GREAT	WELL
Which discussion had overall more useful results?	FREEFORM SLIGHTLY	LOGE MOSTLY	LOGE SLIGHTLY
In which discussion were the results more up for interpretation?	FREEFORM MOSTLY	LOGE COMPLETELY	LOGE SLIGHTLY
Based on which discussion could one better define concrete follow-up activity?	LOGE MOSTLY	LOGE COMPLETELY	LOGE MOSTLY

Table 4: Discussion times

DISCUSSION	Freeform	LOGE
PARENT	1:00:00	1:28:00
NE: Tech	1:24:00	1:41:00
NE: ALL	1:07:00	1:58:00

When evaluating the data from the parent company's discussions the results are not as one-sided. The freeform discussion was considered to be a bit more useful as well as more ambiguous. In this case ambiguity was seen as neither a positive nor a negative quality. For the parent company's LOGE discussion most of the questions had short personal phase answers that were also quite similar to one another with very little variance between them. The counterpart freeform discussion in comparison had more varied answers. The parent company's subject owners felt that this was the main reason that, in this case, freeform better suited the discussions agenda. However, they made a note of LOGE producing more solution-oriented answers, which also shows in their evaluation.

The verbal and descriptive evaluations were more adept at pointing out concrete differences between LOGE and freeform discussions. Main differences that emerged in the interviews were participation, creativity and concreteness.

- o Participation – in all three test cases LOGE results showed clearly the individual participation and its effect on the discussion. In one of the test cases the subject owner brought up even feeling suspicious that all of the

conversation results and feedback from individual participants had not made it to the freeform results when comparing them to LOGE results.

- o Creativity – in all of the test cases the freeform discussion results had one or two unexpected and surprising takes on their subject that the LOGE discussion did not and of which the subject owner had not even thought of. To compare, only one LOGE discussion prompted the subject owner to bring up that the results had surprised them.
- o Concreteness – as presented above, in all test cases LOGE results were deemed more concrete and guiding towards follow up procedures.

There were also other notable observations that only came up in one of the three test cases. In the parent company's test case, the subject owners brought up that the undertone in the LOGE results was, that the participants themselves could enact the solutions brought up in the discussion. This undertone was seen as positive and was missing from the corresponding freeform discussion. In the all-encompassing test case, it was noted that the freeform discussion did not address any of the "more difficult" parts of the given subject which the corresponding LOGE discussion addressed. This lack in the subject matter was seen as negative.

The execution times (presented in Table 4) are straightforward to evaluate. In all of the cases the LOGE discussions took more time. Because of technical difficulties the parent company's discussion took probably around 20 minutes longer than it otherwise would have taken. Even taking this into account the LOGE discussion took slightly longer than the freeform discussion. However, with LOGE discussions the increase in the amount of material produced and the difficulty of the subjects both somewhat correlated with the extra amount of time used. As gamification is used here as a tool to guide the conversation and improve its quality this increase in time is justifiably deemed to be a sign of increased conversation activity by our research.

4.1.2. Personal evaluation results

Our participation rate for the discussions ended up being slightly less than originally predicted, but altogether we received enough participants to compare the results. The number of participants for each discussion is shown in Table 5. From the personal evaluation results, we intend to focus on the ones that present most notable differences between LOGE and freeform participants. A more complete account of the answers is given in Appendix D.

Table 5: Discussion participation

PARTICIPANTS	Freeform	LOGE
PARENT	5	6
NE: ALL	8	5
NE: Tech	5	7

When examining the personal evaluation results, we roughly divide the answer values to following categories by their question types:

- Straightforward scale – this includes the questions where the answer was requested on a scale from 1 to 5 where 1 was the most negative and 5 was the most positive. This category includes the following questions:
  - How would you say the discussion went?
  - How useful would you describe the discussion?
  - Would you describe the discussion as having value to the company?
  - How well would you say the objectives of the conversation were achieved?
  - How well was the discussion divided into different categories?
  - How well would you say the questions guided the discussion?
- Modified scale – this includes the questions, where the answer was on a scale from 1 to 5, where 3 was the optimal value and any deviation from it was considered a negative. This category includes the following questions:
  - How long was the conversation in terms of the time it was given?
  - How long was the conversation in terms of its content?
- Multiple choice - this includes the questions, where multiple options were given, out of which one was meant to be chosen. This category includes the following questions:
  - Were the instructions clear for the discussion?
  - Which of the following did the discussion most remind you of?
  - Which of the following words would you use to describe the difficulty of the subjects that were under discussion?
  - Which of the following roles best describes the part you had in the discussion?

- o Descriptive - this includes the questions, where multiple options were given, out of which the participant could choose any and all that they felt appropriate. This category includes the following questions:
  - As which of the following would you describe the time restrictions of the discussion?
  - Which of the following adjectives best describes the discussion?
- o Open-ended – the question included no suggestions as to what the answer could or should be. This category includes the following question:
  - What did not work well or was bad about the discussion?

As a conscious decision we have excluded freeform feedback from these categories as they mostly did not add anything to the results that were received from other questions. One of the feedback answers speculated that 5 could be the optimal number of participants to a LOGE discussion, which was the most notable single aspect from the freeform feedbacks.

When examining the questions that had a straightforward scale, we notice that the answers received are overwhelmingly positive. The number of positive answers (with a value 4 or 5) we received is roughly 3,5 times the number of neutral, negative and undefined answers combined. This means, that most of the questions in this category have their overall value average between 3,5 and 5. Upon further inspection we also notice that in the cases when direct comparison is possible these averages are relatively close to one another, with each of the questions having a difference of less than 0,3. The most notable difference concerns the value the discussions produced to the company, with LOGE averaging out at 4,39 when freeform discussion has the average of 4,11. In all of these results, LOGE discussions at first seem to consistently come on top with better overall averages.

However, this advantage seems to dissipate when we examine the averages of straightforward scale question results for each individual test case. There is no single question, where LOGE got a better result average in all of the test cases. What is even more troubling is that for one of the questions the LOGE discussion actually "lost" the evaluation for how well the discussion went even though the overall average seemed to indicate otherwise. In short: the straightforward scale questions seem to offer us very little to assign participant preference either for or against LOGE, their main input being that the overall experience was, in all categories, positive.

QUESTION	AVG Freeform	AVG LOGE
USEFULNESS	4,22	4,28
CATEGORY DIVISION	3,67	3,78
ACHIEVEMENT OF OBJECTIVES	3,94	4
COURSE OF DISCUSSION	4,28	4,44
VALUE TO COMPANY	4,11	4,39

Table 7: Average results for straightforward scale questions per test case

DISCUSSION	QUESTION	AVG	
		Freeform	LOGE
PARENT	USEFULNESS	4,4	4,5
	CATEGORY DIVISION	4	4,67
	ACHIEVEMENT OF OBJECTIVES	4,2	4,5
	COURSE OF DISCUSSION	5	4,83
	VALUE TO COMPANY	4,6	4,83
NE: Tech	USEFULNESS	3,8	4,14
	CATEGORY DIVISION	3,6	3
	ACHIEVEMENT OF OBJECTIVES	3,8	3,29
	COURSE OF DISCUSSION	4	3,86
	VALUE TO COMPANY	3,8	4,43
NE: ALL	USEFULNESS	4,38	4,2
	CATEGORY DIVISION	3,5	3,8
	ACHIEVEMENT OF OBJECTIVES	3,88	4,4
	COURSE OF DISCUSSION	4	4,8
	VALUE TO COMPANY	4	3,8

When comparing the modified scale questions, we get more interpretable results. Although we still have a hard time to determine which form of discussion had a better time frame overall, we examine that the LOGE discussions are consistently evaluated as having (on average) slightly too long conversations. The freeform discussions, in comparison, have less uniform results, two of them averaging out as slightly too short and one as slightly too long. This would suggest a trend where LOGE discussions tend to feel like they should have taken slightly less time, whereas freeform discussions do not show any consistent tendencies. The other modified scale question is the one we

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forgot to add to the questionnaire for freeform discussion participants and thus, its results cannot be used to compare LOGE and freeform discussions.

When examining multiple choice questions, the first thing to mention is that even though implicitly only one option was meant to be chosen, a portion of the participants offered multiple of the choices in their answers. In this research we have counted such cases as if both options had been chosen. From the multiple choice results we can make some efficient deductions. We can examine that a freeform discussion is more likely to feel less formal and more varied in its subject's difficulty (demonstrated in Figures 14 and 15). We also deduce that a freeform discussion is less likely to have unclear instructions as demonstrated in Graph 3.

The most efficient results we seemed to get from descriptive questions. In comparison LOGE discussions seem to feel clearer and more fluent whereas freeform discussions tend to feel more exciting and possibly slightly more enlightening. This complies with the evaluation of the subject owners, where LOGE discussions seemed to produce more focused and concrete results in comparison to more imaginative solutions of the freeform discussions. This notion is demonstrated in Figure 17. Worth a notion in the graph is that freeform discussions have more negative answers in comparison to LOGE. There is, however, also a larger number of positive self-added options assigned to them.

The open-ended question about the failings of the discussions was not really useful as means to effectively evaluate differences between test discussions when comparing LOGE and freeform discussion. They were, however, effective in bringing up factors that were notable in single test cases. We can note the following factors:

- o The technical freeform discussion seemed to have an issue with a lack of concentration and structure in the discussion.
- o The technical LOGE discussion has had unclear questions and suboptimal LOGE presentation. It is probable that the latter is a direct result of the former.
- o The all-encompassing freeform discussion has suffered poor participant performance.
- o The all-encompassing LOGE discussion did not think the time limits were appropriate for the discussion they had.

If the results for a single discussion had been exceptional in some way, the above factors would have been the first way to check if there was a recognizable reason for it.

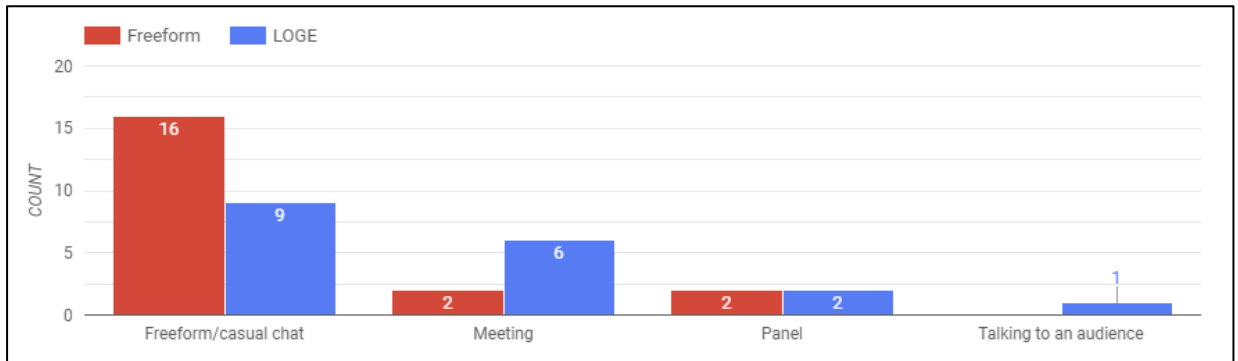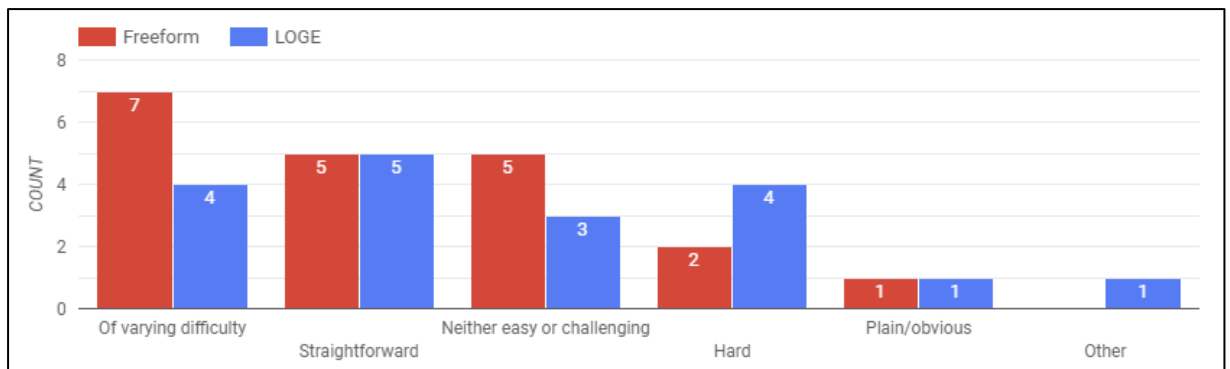**Figure 14:** Evaluation of what the discussion most resembled

Figure 15: Evaluation of discussion difficulty
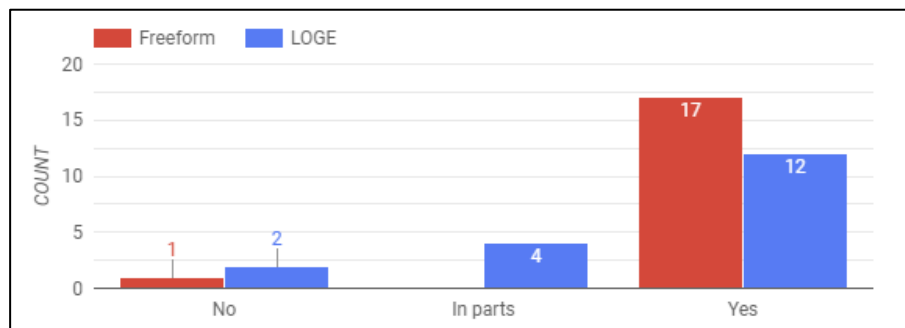
Figure 16: Evaluation of whether the discussion had clear instructions
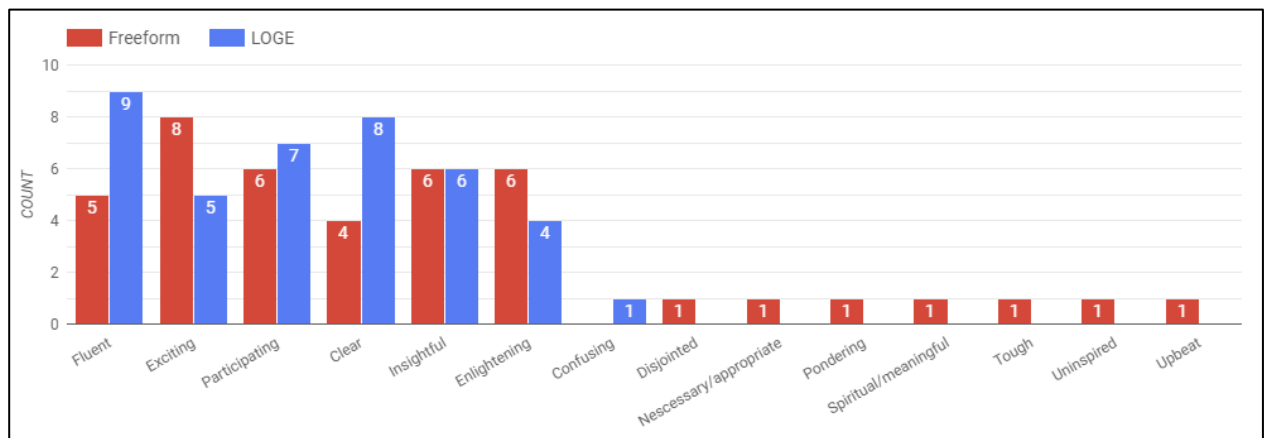
Figure 17: Adjectives that described the discussion
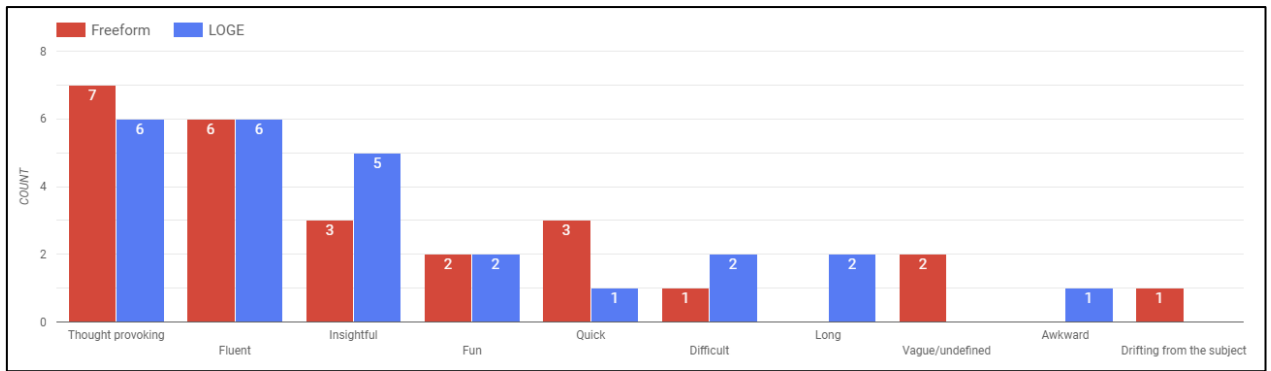
Figure 18: Descriptive adjectives from subjective comparison

The questions that were only posed to the LOGE discussion participants did not offer anything in terms of comparison between freeform and LOGE discussions. Still, there are things we can derive from them. One of them is that the LOGE discussions were evaluated to have on average slightly too much content. This correlates with the previously presented notion that LOGE discussions are on average perceived to be slightly too long. Another thing we can examine is that the time restrictions in the LOGE discussions are not very much liked by the participants.

4.1.3. Subjective comparison results

After all the test discussions were done with, we had 9 people that had participated in both a freeform and a LOGE discussion with different subjects. We asked them to compare their experiences with these discussions by answering a questionnaire (questions for this questionnaire are presented in Appendix C). In the end, 7 of them answered the questionnaire. These results are shown in Appendix E. We have not listed the open-ended feedback in the appendix. The most profound point made in the open-ended comparison was a speculation that LOGE most likely would produce more consistent and on average better discussion results than a freeform discussion.

The results of the subjective comparisons roughly aligned with the results we received from personal discussion evaluation. Freeform discussion was evaluated to be more fluent, while LOGE discussion received a slight edge when comparing the usefulness of the results and which one would prefer in the future. However, even though answerers in most cases preferred one over the other, in the end neither seemed to be altogether better.

Once again, the most interesting result came from the descriptive question (visualized in Figure 18). LOGE discussion was more easily described as insightful or long, while freeform discussion was in comparison more typically quick or vague. This

correlates highly with our previous results. However, because of such a small sample size, this result can only be taken as indicative and merits further study.

4.1.4. Summary of the evaluation

From LOGE tests we can summarize the following in as an evaluation of its gamification in comparison to non-gamified freeform discussions:

- o From the time used by the discussions:
  - LOGE discussions are at least as long and usually longer than the corresponding freeform discussions. Our research takes this as an indication that a well-formed LOGE discussion causes an increase in meaningful interaction.
- o From the subject owner interviews:
  - LOGE discussions better show the part an individual has in the discussion.
  - LOGE discussions tend to produce more focused and concrete group answers.
  - LOGE discussions do not show as much creativity in their results as a freeform discussion.
- o From the personal evaluation answers:
  - LOGE discussions tend to feel like they drag on a bit and could be slightly shorter.
  - Freeform discussions tend to feel more varied in their difficulty.
  - LOGE discussions tend to have more confusion regarding their instructions.
  - LOGE discussions tend to feel clearer and more fluent
  - Freeform discussions tend to feel more exciting and possibly slightly more enlightening.
- o From the subjective comparison answers:
  - LOGE discussion tends to be more easily described as insightful and/or long.
  - Freeform discussion tends to be more easily described as quick and/or vague.

We also made the following notions that would require further study to present as actual conclusions:

- o LOGE discussion might tend to cause the participants to feel more personally involved and guide them to seek answers that they themselves can fulfil.
- o Freeform discussions might tend to ignore more difficult and uncomfortable aspects of a discussion when not explicitly guided to talk about them. LOGE discussion addresses what its questions address.

When examining the first hypothesis we set for LOGE test results (*gamification will have a positive effect on the discussions*) we have mixed results. LOGE seemed to improve the participation of the individual and produce more refined results, but also cause the discussions to feel a little long and produce slightly less creative answers.

4.2. Relevance of results

When evaluating the relevance of the results we first examine how credible they are and after that continue to evaluate their relevance.

4.2.1. Credibility of the results

When examining the results, we quickly notice that in the academic sense they can be taken as indicative at best and not much more. Although the conclusions presented are well-formed and based on the results received, their consistency is not something that can be taken as granted. Because there are three different test cases with notable differences between each other (the key difference being their subject matter), it is problematic to look at the results received from individual participants as a uniform sample. We have taken this into account by making notion of cases where a single test case (a pair of discussions with the same subject) greatly contests the overall evaluation result, but the fact remains that the results are academically merely indicative.

However, when examining the results from a business perspective the indicative results are valid enough to warrant notion and even make decisions based on them. The key difference between academic and business viewpoints is that academic testing aims to prove a conclusion, which means there is an implicit obligation to further study indicative results until conclusive ones are received. However, indicative results are a

valid point to make business decisions, when the possible risk that the test results are skewed because of the test conditions are evaluated to be reasonably small. Because we are aware of the limitations of our study, we are able to take them into account in our evaluation and produce credible conclusions for business purposes.

4.2.2. Relevance of the results

When examining the relevance of the results of our study we must recognize the different entities to whom they might hold meaning. We have recognized 4 entities to focus on while evaluating the relevance of the results:

- o the project
- o the user
- o the customer
- o the gamifier

The relevance of the results for both the project and the user are relatively straightforward and easy to recognize. If LOGE's development had ended, the results would indicate how successful the gamification solutions chosen were. However, as LOGE is an ongoing development the results will instead indicate how the product should be improved. This is also the relevance of the results when considering the end users. When considering concrete actions, this will most likely mean that NordicEdu will work on improving LOGE so that it further encourages creative answers, does not feel like the discussion takes too long, and that the questions are clearer to the user.

In a normal case the customer is the one who orders the gamification project. In this case both NordicEdu and its parent company fit this description as in the scope of our study, they are both interested to find out whether LOGE's gamification has increased the value of the conversation. This is relevant, as it will help them deduce, if the gamification project has succeeded, should they continue using the product, and, if they were only a potential customer, whether they should purchase the product. In the case of LOGE, it proved to be a functional tool to more efficiently produce concrete results of a discussion. Two out of the three test cases recognized the LOGE discussion as producing altogether better results and the third discussion recognized that LOGE was better suited for extracting concrete solutions from a discussion. In the end, the tests indicate that LOGE's gamification functions well, but that a freeform discussion

still holds some advantages over it. For the customer this means, that LOGE can be used to a great effect, but that it still could use some improvement.

For the gamifier, similarly as for the project, the results are relevant because they show whether the gamification of the solution was successful and what should be improved in the project. However, in addition the gamifier also gains other benefits from the results. Namely that they get a better understanding how different gamification elements affect the dynamics of similar solutions and, more importantly, what are the unpredicted side effects of said elements. In the case of LOGE, for example, it is notable that while LOGE's questions and division to phases do well in forming a solid and clear answer, they also seem to "weed out" the most creative ones. This is something, that the gamifier now understands and can adapt this knowledge in similar gamification situations. Also, when talking about a gamifier as the company offering gamification services, positive test results are valuable in marketing their expertise to potential customers. In this case, NordicEdu can show that using LOGE has been shown to produce more concrete results in comparison to traditional freeform discussions.

When looking at the second hypothesis we set for LOGE test results (*the results will be relevant to NordicEdu*) we can confirm it. We can also confirm the secondary clause to our hypothesis that the tests are also somewhat relevant in the academic sense, but not as impactful.

5. Analysis of the study methods and carrying them out effectively

After going through both test cases and their results we are finally ready to analyse how functional our evaluation methods proved in a business environment. We will first analyse the methods used in this study, going through their merits and faults, and analysing how they could more effectively be adapted to a business environment. After that we will present guidelines to effective gamification evaluation in business environment and for business purposes based on this analysis.

5.1. Merits, faults, and improvements found in our study methods

There are two main categories to analyse in the methods used in the study. These are the way the tests were organized and the way we were able to gather meaningful results from them.

5.1.1. Organizing the tests

The chosen study method for the research was a case-control study. Most of the time in a business environment there is no data concerning the object of the gamification beforehand so that the effects of gamification could be evaluated by comparing the data before and after gamification. The case control method was chosen so that we would be able to effectively compare the results of a gamified solution to the results received from a non-gamified solution. This proved to be both a blessing and a curse. The evaluation of the effects of gamification was in fact made straightforward by the case-control method, as we were directly able to examine the differences between the two groups. However, for the case-control method to function properly, we had to effectively double the number of our study participants. This proved difficult, even insurmountable in one of our test cases. It is costly to assign participants to a study in a business environment.

While testing the product of the customer project we tried to gather participants from those that would participate voluntarily. We operated under the expectation that the large employee count of the customer would guarantee us the required participant number. This proved, however, to be a false expectation. We cannot for certain state the extent to which the customer promoted participation to our study among their employees. Even so, we find it telling that in a company with hundreds of employees we could not get 20 people to participate in our study purely out of their free will (i.e.

with no urgency from the customer company). This led to the termination of the test for the customer product. With the LOGE tests we looked for fitting situations to apply our study. When we thus found appropriate test cases, we had guaranteed participation to our study. As the discussions were already in the company's agenda, it cost no extra to use them as opportunities to test LOGE.

While creating the test cases for LOGE it was our responsibility to create the test discussions. We were mostly successful in constructing good test cases but had to drastically redesign one of the LOGE discussions due to poor question design on our part. This was not only frustrating and costly but could also have been avoided had we done a proper test run of the LOGE discussion beforehand.

Although we had multiple test cases for LOGE where we were able to gather enough participants for our study, we had difficulties in analysing them as a uniform sample. This was because of the discussions having a different subject matter with each other, which led to each discussion having a differing set of LOGE questions. We were able to maintain steady quality despite of this, but it would have been optimal if we had had enough participants for three freeform discussions and three LOGE discussions about a single subject. This way we would not have to worry about differences in quality between the LOGE discussions as it could be the same for all three cases.

Our hypothesis concerning the implementation of the study methods was that *the evaluation methods are practical and easy to implement in a business setting*. For this hypothesis we got mixed results. The methods were effective, as they made directly evaluating the benefits of gamification a straightforward matter. On the other hand, we faced multiple problems in implementing them in a business setting. However, we are able to address our problems and define solutions to the problems we faced. This way we can create guidelines for the evaluation methods to be easier to implement in the future.

5.1.2. Gathering meaningful data

When examining the way in which we collected data in our study we have made multiple notions on how to effectively get results that display possible differences between the gamified and non-gamified solution. The times measured from each discussion proved to be less interesting than originally thought. They were interpreted to indicate that the LOGE discussions had an increased amount of discussion, which while

notable was a conclusion made with the aid of other gathered data. In conclusion the time data in itself was relatively useless.

In comparison to the time data, the result evaluation made by the subject owners proved to be the most useful data for evaluating the benefits of LOGE's gamification. The interviews were most effective in both recognizing differences in the gamified and the non-gamified solutions and providing definitive conclusions to base business decisions on.

The personal evaluation questions provided us with varying results. We were able to recognize different types of questions and categorize them based on their effectiveness as an evaluation method. First of all, in the case with both the gamified and non-gamified solution the questions with a straightforward scale (1 to 5 where 1 is the most negative and 5 the most positive) did not offer us much when trying to distinguish differences between the two. Their informational value could have been better if we had a larger sample size, but that is purely speculative.

The questions with a modified scale (1 to 5 where 3 is optimal) or a multiple-choice answer (multiple options, one is meant to be chosen) were better at producing results that differentiated the gamified solution from the non-gamified. Although they did not definitively produce results to distinguish the better solution, they were able to show trends that only applied to one of the solutions and not the other.

The open-ended questions, although not effective in evaluating the differences between the gamified and the non-gamified solution, served another purpose entirely in our study. They brought to attention problems affecting individual discussions. These could be used to explain anomalies in our results that would have affected individual discussions. It can be speculated that if all test cases were uniform (in LOGE tests: if all the discussions had the same subject) that the open-ended questions could raise issues that affected the gamified solution in general. On the other hand, they could possibly also be used to highlight unexpected benefits.

The most useful question type in the personal evaluation was, rather unexpectedly, the descriptive question (multiple options, as many could be chosen as one wanted, one could add their own options). With these questions certain aspects of the gamified solution differentiated as more or less prominent than in the non-gamified solution.

Our hypothesis concerning the results of the study methods was that *the evaluation methods are effective and produce valuable results from a business*

standpoint. This hypothesis was confirmed by our study, although some of our methods proved to produce more valuable results than others.

5.1.3. Can subjective comparison produce reliable results for business purposes?

In our study we also got a chance to gather subjective comparison data, i.e. personal evaluation of the differences between the gamified solution and its non-gamified counterpart from study participants who tested both versions. Our main interest with this data is to find out to what extent a subjective evaluation of the differences correlates with the other results received from our study.

As we compared the received results, we were delighted to find that they seemed to approximate the results received from both subject owners' evaluations and the personal evaluations. This is highly beneficial, as it is indicative that a subjective evaluation of a selected group could be used to approximate the results of a case-control study that would require twice the number of participants for business purposes with reliable results. However, this conclusion is so far only indicative and warrants further study.

5.2. Guidelines for effective gamification evaluation methods in business environment and for business purposes

Based on our analysis we have constructed guidelines for effective gamification evaluation by case-control test case in business environment and for business purposes. These guidelines are meant to guide the gamification evaluator to create an effective test that highlights key differences between the gamified solution and its non-gamified counterpart. The guidelines are as follows:

- When arranging the test in a business environment:
  - The test needs to be either mandatory for the participants or heavily urged by the company facilitating it. If this is not followed, one will most likely not get enough participants.
  - If one test case is enough, every step possible needs to be taken that another is not required. Arranging multiple tests is not only strenuous but also costly in business environment. Often arranging another test may not even be possible.

- If possible, a pilot for the test case should be arranged. This is less strenuous than arranging a completely new test case due to the first one being poorly designed. A poorly designed test produces skewed results that are unusable.
  - When designing how to gather information from the test case:
    - Execution times are useless for evaluating gamification and require other data to help interpret them. However, if the aim of gamification was to reduce the time spent on a task the metric would naturally be essential.
    - Execution results are the most useful way to gather meaningful data. If they cannot be directly numerically compared, they should be evaluated in a comparison between the results of the gamified and the results of the non-gamified solution.
    - When gathering personal experience data from participants:
      - Instead of straightforward scale questions modified scale questions should be used to produce more informative results.
      - Descriptive questions where multiple choices can be given are an effective way to find descriptive differences between the solutions.
      - One or two open-ended questions should be used as indicators of possible unpredicted problematic issues or even exceptional positive qualities.

In a case where a case-control study cannot be organized, a subjective test group that tests both the non-gamified and the gamified solution can be considered as a secondary option. Because this method requires less participants it might prove a more manageable testing method. The initial results presented in this study indicate that, if organized carefully, it has potential to produce qualitative results comparable to a case-control study.

6. Summary

In this study we set out to define and test methods to effectively measure the effects of gamification in a business environment. Gamification has been studied mostly in the field of education where comparisons to non-gamified results (e.g. results from previous courses or classes) are easy to make. In a business environment gamification is a sought-out method to solve several varying problems. However, the methods to measure its success and benefits are often suboptimal. They often lack concrete comparison to data from a non-gamified solution and are mainly based on subjective opinion. Based on these grounds, we set our research questions as follows:

1. What current gamification theory and metrics are most suitable to evaluate commercial gamification?
2. How can the evaluation of gamification benefits best be implemented in a commercial environment?

To answer the first question, we examined many aspects of gamification and theory associated with motivational psychology, gamification benefits and the study of said benefits. We determined that in order to effectively evaluate gamification benefits we needed to organize a case-control study. This would allow us to directly compare the effect of gamification to a similar non-gamified solution and thus define the effect it may have. We decided to gather the execution times and results of the use cases, and personal evaluations of the participants' for our study's comparisons. With these we knew we would be able to point out the benefits of gamification (or the lack of them) for the purposes of business decision making.

When carrying out our test we encountered unpredicted problems, even having to completely interrupt one of our test cases and redo an individual group test case. However, we were able to gain enough data to evaluate the effect the gamification had on a solution. The evaluation was credible enough for business purposes and produced results that were notable enough to affect decision making. These results were presented in Chapter 4.

Based on our study we were able to answer the second research question we set for our study. A case-control study was deemed indeed effective as a gamification evaluation method but required extra guidelines to be effectively implemented in a business environment. When organizing the testing we were surprised by how difficult

it was to gather a suitable number of participants in a business environment. By only gathering voluntary participants we were unable to gather a sufficient sample for our study. The first conclusion we drew from this was that the tests should be either mandatory or the participation should be heavily encouraged or enforced by the company facilitating the test. The second thing was that if one test would be enough to effectively evaluate gamification benefits, measures should be taken that a second test is not necessary. This includes piloting the test procedure to make sure that it functions as intended.

Another point to answer our second research question had to do with the way we gathered information to evaluate gamification benefits. We found out that while the execution results were the most useful to our evaluation, the execution times were only useful when they complemented other data we had gathered. When gathering personal evaluations from the participants we got much better results from questions with a modified scale (1 to 5, 3 is optimal, variance from it represents the amount and direction of the negative) than from the questions with a straightforward scale (1 to 5, 1 is the most negative while 5 is the most positive). The best results to highlight differences we got from questions that gathered descriptive data by offering multiple descriptive options out of which as many could be chosen as one wanted. One could also add their own descriptions in these questions. After answering the second research question in this manner we were able to gather guidelines for creating an effective case-control test to measure gamification benefits in a business environment.

In our study, we also had a chance to gather data from people who took part in testing both a gamified and a non-gamified solution. We asked them for their subjective evaluation on the differences of the two solutions. Our interest was to examine whether the subjective results gathered this way would correlate with the results we had gathered in our case-control study. We were delighted to find that the subjective evaluations roughly correlated with the personal evaluations we had gathered. This implicates that a smaller test sample could be used to produce similar qualitative test results as a case-control study of twice as many participants. However, we do recognise that this result is merely indicative at best and requires further study.

Our study was able to sufficiently answer both of the research questions we set for it and can as such be viewed as successful. Based on this we can concur that a case-control study is an effective method to evaluating gamification benefits in a business environment. We were also able to define guidelines to efficiently carrying out similar

studies in similar environments. Possibilities for further study could in our opinion include following topics:

- o Minimum sample size for effectively evaluating gamification for business purposes as opposed to academic purposes.
- o Subjective gamification evaluation in contrast to a case-control study.
- o The effect of individual game elements in business gamification solutions.
- o How much does gamification that aims for effectiveness affect the creativity?

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Appendix A: The qualitative questions in the customer test

Below are the questions from the qualitative part of the testing form. The ones marked with * are mandatory questions. In the end there are questions that are specific to the test group and only visible to them.

- How would you evaluate your starting knowledge before you took the training?*

    o I knew the subject of the training well.
    o I knew some things of the subject matter and the practices concerning it.
    o I knew practically nothing of the subject matter and the practices concerning it.

- Did you think that you could benefit from this training before taking it?*

    o Yes
    o No.

- What was your opinion on the training?*

    o Good and educational
    o It was OK
    o Bad
    o Other: _____

- Did you find the training useful?*

    o Yes
    o Only parts of it
    o No

- How well do you think that you learned the contents of the training?*

    o I fully learned and internalized the content and the operating models from the training.
    o I learned and internalized the content and the operating models from the training really well.
    o I learned and internalized a lot of the content and the operating models from the training, but a lot of it I also did not learn.
    o I did not learn much from the training.
    o I learned nothing from the training.

- How well did you understand the reasoning behind the subject matter of the training?*

    o I understood all or almost all of the reasoning behind the subjects of the training.
    o I understood most of the reasoning behind the subjects of the training.
    o I understood a lot of the reasoning, but often I also did not understand it.
    o I understood very little of the reasons behind the subjects.
    o I understood none of the reasoning behind the subjects of the training.

- How well do you think you will remember the subjects of the training in the future?*

    o I think I will remember all about the subjects of the training in the future.
    o I think I will remember most about the subjects of the training in the future.
    o I think I will remember a lot about the subjects in the future, but also forget a lot about them.
    o I think I will not remember much about the subjects of the training in the future.
    o I think I will not remember anything about the subjects of the training in the future.

- Which adjectives would you use to best describe the training? (choose all that you would use)

    o Clear
    o Educational
    o Motivational
    o Challenging
    o Fun/nice
    o Compact/tight
    o Pleasant to look at
    o Other: _____

- What did not work in the training in your opinion? (freeform text answer)

- Did you face any bugs or errors during the training?*

    o Yes
    o No

- What bugs/errors did you face? (Answer only, if you answered yes to the previous question) (freeform text answer)

- How easy did you find the internalization of knowledge from the training?*

    o The internalization was very easy.
    o The internalization was relatively easy.
    o The internalization was not easy, but not hard either.
    o The internalization was relatively hard or required some effort.
    o The internalization was very hard or required a lot of effort.

- How well was the training material divided into categories?*

    o The division was good, clear and logical.
    o The division was somewhat clear and logical.
    o The division was not clear, but neither was it unclear.
    o The division was somewhat unclear and illogical.
    o The division was bad, unclear and illogical.
    o I did not pay any attention to the categories.

- How hard were the subjects of the training material in your opinion?*

    o Too hard or they focused on irrelevant details.
    o The focus was in the right things, but some of the subjects were too hard or focused on the wrong details.
    o The subjects of the training were well balanced and not too hard or easy.
    o The focus was in the right things, but some of the subjects were too easy or self-explanatory/obvious.
    o Too easy or self-explanatory/obvious.

- How did you feel about the length of the training material?*

    o The training material was too long.
    o The training material was just the right length.
    o The training material was too short.

- How much time did you use with the training material?*

    o Too long, the content could have been shorter or some of it could have been left out.
    o Too long, I could have been quicker.
    o Just the right amount, considering the length of the training material.
    o Too little, I rushed through it.
    o Too little, the material was insufficient or unclear.

- Were the instructions for the training clear?*

    o Yes
    o No

- How did going through the training material feel? (choose all that you would use)

    o Interesting
    o Fun
    o Boring
    o Appropriate
    o Inappropriate
    o Quick
    o Slow
    o Rewarding
    o Frustrating
    o I did not feel any noticeable emotions

- Did you use the customer's website as a tool during your training?*

    o Yes
    o No

- Feedback for the training material. What was good? What was bad? What would you want more of? What would you want less of? (freeform text answer)

The ending test

- How challenging did you find the ending test?*

    o Too hard
    o Appropriately challenging
    o Too easy

- Did the ending test test relevant subjects in the training material?*

    o The ending test focused into irrelevant details.
    o The ending test focused on relevant subjects in the training.
    o The ending test focused on too self-explanatory/obvious subjects.

- Where the questions in the ending test specific enough?*

    o The questions focused on too minute details in the material.
    o The questions focused on the material with appropriate specificity.
    o The questions focused on too vague notions in the material.

- How did you find the length of the ending test?*

    o Too long
    o Appropriate
    o Too short

- How did you find the ending test as a part of the training? (choose all that you would use)

    o Rewarding
    o Educational
    o Revising
    o Anxious
    o Frustrating
    o Repetitive
    o Discouraging
    o Useless

- Did you use the customer's website as during the ending test?*

    o Yes
    o No

- Feedback for the ending test. What was good? What was bad? What would you want more of? What would you want less of? (freeform text answer)

Questions about the gamified training (only for the test group)

- What did the training most resemble?*

    o A quiz
    o A training material
    o An official form
    o An exam
    o Other: _____

- What did you like about the training?* (choose all that you would use)

    o Clarity
    o Ease-of-use
    o Presentation
    o Flow
    o The humorous images
    o The celebratory titles
    o The questions
    o The repetition basket
    o UI
    o None of the above

- What did you not like about the gamification? (freeform text answer)

- What did you think of the repetition basket?*

  o Using the repetition basket was difficult
  o It was useful
  o It made it too easy to complete the training
  o I did not use the repetition basket

- What did you think about the humorous pictures?*

  o They were good and funny
  o They were OK
  o They were boring and bad
  o They were inappropriate or offensive

- What did you think of the celebratory titles?*

  o They are a good and fun addition
  o They were OK
  o They were boring or unnecessary

- What did you like about the UI of the training? (choose all that you would use)

  o Clarity
  o Colour choices
  o Background images
  o The customer's brand
  o The humorous pictures
  o The icons [of the UI]
  o The fonts
  o The responsiveness
  o Other: _____

- What did you not like about the UI of the training? (freeform text answer)

- How were the font sizes in your opinion?*

  o They were good
  o They were too small
  o They were too big
  o They were at times too small and at times too big

- What did you think of the clarity of the questions?*

  o The questions were clear and the answers could be found sensibly
  o The questions were clear, but the answers could not be found in a logical way
  o The questions were unclear, but the answers could be found in a logical way
  o The questions were unclear and the answers could not be found in a logical way

- What did you think of the hints?*

    o They were useful and clear
    o They were too easy
    o They did not help enough
    o I did not notice that the training had hints

- Do you think that gamification brought added value to the training?*

    o Yes, a lot
    o Yes, some
    o Yes, but only a little
    o No
    o I cannot say

- Did you enjoy more the training because of gamification?*

    o Yes
    o No
    o I enjoyed the training less because of the gamification
    o I cannot say

- Did the gamification help you internalize the subjects of the training?*

    o Yes, a lot
    o Yes, to some degree
    o Yes, but only a little
    o No
    o I cannot say

- Feedback for the gamification. What was good? What was bad? What would you want more of? What would you want less of? (freeform text answer)

Appendix B: The qualitative questions in the LOGE test

Below are the evaluation questions for LOGE test cases. The ones marked with * are only posed to the participants that use LOGE.

- What was the discussion about?

- How would you say the discussion went? (1= very poorly, 5= extremely well)

- How useful would you describe the discussion? (1= completely useless, 5= very useful)

- Would you describe the discussion as having value to the company? (1= the discussion was worthless to the company, 5= the discussion was very valuable to the company)

- How well would you say the objectives of the conversation were achieved? (1= not at all or just scratched the surface, 5= they were completely achieved)

- Which of the following adjectives best describes the discussion (feel free to use multiple): fluent, participating, clear, insightful, enlightening, dull, inappropriate, slow, exciting. You may also use your own adjectives.

- What did not work well or was bad about the discussion?

- Which of the following did the discussion most remind you of: an exam, a panel, freeform/casual chat, talking to an audience, a meeting, a jury, none of these. Feel free to provide an explanation to your answer, if it feels appropriate.

- How well would you say the questions guided the discussion? (1= extremely poorly, 5= really well)*

- How well was the discussion divided into different categories? (1= the division was illogical and had a negative effect on the discussion, 5= the division was logical and made the discussion more fluent)

- Which of the following words would you use to describe the difficulty of the subjects that were under discussion: plain/obvious, straightforward, neither easy or challenging, hard, insurmountable, of varying difficulty.

- How long was the conversation in terms of its content? (1= much too short, 3= of an appropriate amount, 5= much too long)

- How long was the conversation in terms of the time it was given? (1= much too short, 3= of an appropriate amount, 5= much too long)

- As which of the following would you describe the time restrictions of the discussion (feel free to use multiple): oppressive, hurrying, slow, exciting, challenging, none of these.*

- Were the instructions clear for the discussion? (Yes, No)

- Which of the following roles best describes the part you had in the discussion: leader/instigator, participant, ideator, commentator, moderator, listener, bystander.

- Freeform feedback for the discussion.

Appendix C: The questions for subjective gamification evaluation

Below are the questions for people who participated in both a freeform and a LOGE discussion.

- Which of the discussions would you describe as more fluent?
    - o The freeform discussion was clearly more fluent
    - o The freeform discussion was slightly more fluent
    - o Both discussions were equally fluent
    - o The LOGE discussion was slightly more fluent
    - o The LOGE discussion was clearly more fluent

- Which of the discussions would you say yielded better/more useful results?
    - o The freeform discussion yielded clearly better results
    - o The freeform discussion yielded slightly better results
    - o Results of the discussions were equal in quality
    - o The LOGE discussion yielded slightly better results
    - o The LOGE discussion yielded clearly better results

- Which kind of discussion would you rather attend again?
    - o I'd strongly prefer the freeform discussion
    - o I'd slightly prefer the freeform discussion
    - o I have no preference between the two
    - o I'd slightly prefer the LOGE discussion
    - o I'd strongly prefer the LOGE discussion

- Which of the discussions was altogether better?
    - o The freeform discussion was altogether clearly better
    - o The freeform discussion was altogether slightly better
    - o The discussions were equally good
    - o The LOGE discussion was altogether slightly better
    - o The LOGE discussion was altogether clearly better

- Choose all of the following adjectives that you would use to describe the freeform discussion?
    - o Fluent
    - o Insightful
    - o Quick
    - o Vague/undefined
    - o Useless
    - o Awkward
    - o Fun
    - o Thought provoking
    - o Difficult
    - o Boring
    - o Long
    - o Other

- Choose all of the following adjectives that you would use to describe the LOGE discussion?
    - o Fluent
    - o Insightful
    - o Quick
    - o Vague/undefined
    - o Useless
    - o Awkward
    - o Fun
    - o Thought provoking
    - o Difficult
    - o Boring
    - o Long
    - o Other

- Open feedback of the differences between the discussions

- Other feedback

Appendix D: Personal evaluation results for LOGE cases

Below are presented the results of personal evaluation divided by question types.

Table D1: The number of answers by answer option and discussion for quantitative questions

QUESTION	ANSWER	PARENT Freeform	PARENT LOGE	NE: Tech Freeform	NE: Tech LOGE	NE: ALL Freeform	NE: ALL LOGE
How would you say the discussion went?	3	-	-	-	2	2	-
	4	-	1	5	4	4	1
	5	5	5	-	1	2	4
How useful would you describe the discussion?	3	1	-	2	1	-	1
	4	1	3	2	4	5	2
	5	3	3	1	2	3	2
Would you describe the discussion as having value to the company?	3	-	-	3	1	2	2
	4	2	1	-	2	4	2
	5	3	5	2	4	2	1
How well would you say the objectives of the conversation were achieved?	2	-	-	-	1	-	-
	3	-	1	1	3	1	-
	4	4	1	4	3	7	3
	5	1	4	-	-	-	2
How well was the discussion divided into different categories?	2	-	-	-	1	1	-
	3	1	-	2	5	3	2
	4	3	2	3	1	3	2
	5	1	4	-	-	1	1
How long was the conversation in terms of the time it was given?	2	-	-	1	2	1	-
	3	3	5	4	2	7	4
	4	2	1	-	3	-	1
Were the instructions clear for the discussion?	No	1	-	-	1	-	1
	In parts	-	-	-	3	-	1
	Yes	4	6	5	3	8	3

Table D2: The number of answers by answer option and discussion for quantitative questions that were posed only to the LOGE discussion participants

QUESTION	ANSWER	PARENT	NE: Tech	NE: ALL
How well would you say the questions guided the discussion?	-	-	1	-
	2	-	1	-
	3	-	2	-
	4	-	3	3
	5	6	-	2
How long was the conversation in terms of its content?	3	6	6	3
	4	-	1	2

QUESTION	VALUED AS	ANSWER	PARENT		NE: Tech		NE: ALL	
			Freeform	LOGE	Freeform	LOGE	Freeform	LOGE
Which of the following adjectives best describes the discussion?	NEGATIVE	Confusing	-	-	-	1	-	-
		Disjointed	-	-	1	-	-	-
		Tough	-	-	1	-	-	-
		Uninspired	-	-	1	-	-	-
	POSITIVE	Fluent	2	2	2	4	1	3
		Exciting	2	2	1	1	5	2
		Participating	-	5	5	-	1	2
		Insightful	2	2	1	1	3	3
		Clear	1	3	-	3	3	2
		Enlightening	3	2	1	-	2	2
		Pondering	-	-	-	-	1	-
		Spiritual/ Meaningful	1	-	-	-	-	-
		Upbeat	1	-	-	-	-	-
		Necessary/ Appropriate	1	-	-	-	-	-
What did not work well or was bad about the discussion?	NEGATIVE	Lack of concentration or structure in the discussion	-	-	5	-	-	-
		Poor time limits	1	-	-	-	-	3
		Unclear or improvable questions	1	-	-	3	-	-
		Poor performance of the participants	-	-	-	-	4	-
		Presentation or functionality of LOGE	-	-	-	3	-	-
		Distraction	-	-	-	1	-	-
		Technical faults	-	1	-	-	-	-
		Poor subject definition for the discussion	-	-	-	-	1	-
		Other	-	-	-	-	1	-
Which of the following did the discussion most remind you of?	NEUTRAL	Freeform/casual chat	5	3	3	4	8	2
		Meeting	-	2	1	2	1	2
		Panel	-	1	2	-	-	1
		Talking to an audience	-	-	-	1	-	-

QUESTION	VALUED AS	ANSWER	PARENT		NE: Tech		NE: ALL	
			Freeform	LOGE	Freeform	LOGE	Freeform	LOGE
Which of the following words would you use to describe the difficulty of the subjects that were under discussion?	NEUTRAL	Plain/ Obvious	-	-	-	-	1	1
		Straightforward	1	5	2	-	2	-
		Neither easy or challenging	2	1	1	2	2	-
		Hard	-	-	1	2	1	2
		Of varying difficulty	2	-	2	3	3	1
		Other	-	-	-	-	-	1
Which of the following roles best describes the part you had in the discussion?	NEUTRAL	Participant	3	3	2	2	3	2
		Ideator	3	1	2	2	-	2
		Commentator	-	1	1	2	4	1
		Leader/ Instigator	-	1	1	1	1	-
		Listener	-	-	-	2	1	-
		All of them	-	-	-	-	-	1
		Moderator	-	-	1	-	-	-

Table D4: The number of answers by answer option and discussion for descriptive question that was posed only to the LOGE discussion participants

QUESTION	VALUED AS	ANSWER	PARENT	NE: Tech	NE: ALL
As which of the following would you describe the time restrictions of the discussion?	NEGATIVE	Oppressive	-	2	2
		Slow	1	2	-
		Hurrying	-	1	1
	NEUTRAL	Challenging	-	-	3
		None of these	1	1	-
		Varying	-	1	-
	POSITIVE	Exciting	2	1	1
		Appropriate	2	-	-

Appendix E: Results of subjective comparative evaluation

Below are presented the results of subjective comparative evaluation.

Table E1: The number of answers per answer option

QUESTION	ANSWER	COUNT
Which of the discussions would you describe as more fluent?	Freeform clearly	1
	Freeform slightly	3
	Equal	1
	LOGE slightly	1
	LOGE clearly	1
Which of the discussions would you say yielded better/more useful results?	Freeform slightly	2
	Equal	3
	LOGE slightly	1
	LOGE clearly	1
Which kind of discussion would you rather attend again?	Freeform slightly	2
	No preference	2
	LOGE slightly	3
Which of the discussions was altogether better?	Freeform slightly	3
	Equal	1
	LOGE slightly	3

Table E2: The division of descriptive adjectives per discussion type

ADJECTIVE	Freeform	LOGE
Drifting from the subject	1	-
Awkward	-	1
Vague/Undefined	2	-
Long	-	2
Difficult	1	2
Fun	2	2
Quick	3	1
Insightful	3	5
Fluent	6	6
Thought provoking	7	6