Master Thesis
Computer Science

Radboud University Nijmegen

Gaming the system

Making personalised learning fun

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Abstract

Online learning environments have the advantage over traditional education that they can be enriched in multiple ways to enhance learning motivation and speed up learning. One of the methods to do this is by including typical game elements in the environment. This is what is referred to as gamification. This thesis takes an e-learning environment that is focussed on personalised learning, and structurally analyses it to identify its weak and strong spots. This allowed us to determine how we can gamify it, and figure which elements seem the most promising. We found cooperation elements to be a suitable candidate, and implemented them in the application as a collaboration feature. Afterwards, we conducted a case study, encompassing an observation and interview, to evaluate the elements' effectiveness from a Computer Supported Collaborative Learning (CSCL) point of view. The results showed that the students collaborated as expected and successfully used the feature. We did not find prove of our feature's contribution to their motivation and learning. The students already collaborated often and indicated it is collaboration in itself that really motivates them and supports their learning, rather than a collaboration feature. We conclude our research with suggestions for future research.

Acknowledgements

While written by me, it was certainly not me who made this thesis possible in the first place. There are many people who have helped me in various ways writing this thesis, and it are they who opened the door to completion. Without them, I highly doubt I would have been able to complete this work, and even if I did the quality would not in any way be near its current level. Therefore I would like to thank everyone who supported me.

First of all, I thank Lopexs for allowing me to use their product for my research, and all of its employees for supporting me during the process. In particular, my thanks go out to the following people, without whom I would not have been able to complete my thesis:

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Also, I would like to express my gratitude to Holly Struikman-Fogarty of the Hondsrug College, Emmen. She made this thesis' case study possible by allowing me to observe and interview some of her students. Of course, these students have my thanks as well.

Furthermore, I feel very much obliged to my supervisor, Erik Barendsen. He provided me with very helpful feedback over and over again, and was a source of many useful ideas. Also, when I needed help, he was quick to give it, and when things started to go awry, he came up with solutions. My thanks to Sjaak Smetsers as well, who took the time to read and assess this thesis.

Last, but certainly not least, I am very grateful to my family, friends, and colleagues, who gave me feedback when I asked for it, and supported and advised me when (they thought) I needed it. Especially Mathijs Vos has my heartfelt thanks for being very supportive, complementing me when things went right, and dragging me through when things did not. This has helped me enormously.

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Contents

Preface

Writing this thesis has been a very educational experience. Not only did it involve a lot of research in areas I was not (very) experienced in, also was the type of research I performed entirely new to me. Never before had I prepared and conducted a case study, let alone one that was part of a research as large as this. Of course, when looking at the actual numbers it isn't that big a research, but considering my largest one up to this point was my Bachelor's thesis, it is. However, exactly this is what I think made writing this thesis so instructive. Save for all knowledge I gained, it taught me to gather large amounts of information from an even larger number of sources, and process this to a form and structure fitting my specific needs. I learned how to distil questions from a problem statement, or even from a vague idea, and how to answer them. Also, I now know much better what a case study encompasses. How to devise one, how to carry out one, and how to evaluate one, all in a reproducible and scientifically accurate and responsible way. This all made for a very valuable experience.

However, it was not all fun and games. As the acknowledgements already may have made clear, I really needed feedback and support at the times I got stuck. Sometimes I even needed others to drag me through, to tell me I could do it, or put me back on track. Yet, no matter how hard this was sometimes, I had a larger setback. In order to complete this thesis, I cooperated with Lopexs, a company that provided me with the expertise, experience, and contacts I have not. At least as important was their product, a personalised online learning environment on which they allowed me to work. To implement gamification in and ultimately use it to conduct my planned pilot. Unfortunately, my plans were not to be. As they say, to all good things come an end, but I had neither hoped for, nor counted on one that came as soon as Lopexs'.

This of course forced me to significantly change my plans. I had already written the larger part of my thesis and was working on – nearly finishing even – my pilot plans and preparations, when it became clear a pilot would no longer be possible at all. Suddenly, I had to rethink the evaluation stage of my research in such a way that it would still match my research objectives, preferably without having to discard much of my work. As you may have guessed by now, I managed, although this would not have been possible without both Erik Barendsen and Jurriaan Souer, for which I would like to thank them yet again. Ultimately everything turned out alright, and now I look back on it as yet another valuable, albeit somewhat bitter, experience.

In the end, regardless of the setbacks, I believe this thesis is a work to be proud of. And I am.

1 Introduction

E-learning can enrich traditional education methods by providing an online learning environment, and for the last decade it has become increasingly popular (R. C. Clark & Mayer, 2011). Take the so-called iPad schools that have been founded, schools that are actually focussed on e-learning (Henderson & Yeow, 2012). And also in China, where the occasionally large distance to schools is an issue, the interest in this area is growing (Ding, Niu & Han, 2010).

One of the major advantages of e-learning is that everything is done digitally. This offers the possibility of *personalisation*. Not everyone has the same optimal learning path, a student learns best if the study material meets their needs and matches their preferred mode of learning (Conlan & Wade, 2004). Personalised learning systems can provide this optimal path by tailoring a student's curriculum to their individual need (Conlan, O'Keeffe, Brady & Wade, 2007). This may significantly boost the student's learning experience, and improve their results (Conlan & Wade, 2004).

An other advantage of e-learning is that it provides the opportunity to make school more fun. Currently, the average student does probably not see school learning activities as enjoyable (Lee & Hammer, 2011). However, learning is inherently fun, it is even one of the most important elements in games (Koster, 2013). During the first years of this century, this inspired game designer Nick Pelling to extract fun elements from games and implement them in other applications, transforming *"electronic devices into entertainment platforms"* (Smith, 2012; Pelling, 2002; Marczewski, 2013). This is what he calls *gamification*.

In the years that follow little happened in the area. Gamification did not reach a larger audience until the fall of 2010, when it attracted the attention of both academia and industry (Groh, 2012). It has been argued that the great success of Foursquare and Nike+ exists only thanks to gamification (Deterding, Dixon, Khaled & Nacke, 2011). As another example there is DevHub. This company, launched in 2009, provides online tooling to build websites. After the launch, the number of users that completed a website was around 10%, and this didn't significantly change until DevHub decided to implement gamification. After that, almost 80% of DevHub's users completed their websites (Takahashi, 2010). There are many more companies that achieved a much higher user engagement by applying gamification, increasing the concept's popularity over time. This also made it a more interesting research topic, as is reflected by the number of papers and articles that appeared in journals and conferences. Articles on gamification in general appeared before 2010, but the number of them significantly increased as the term became more widespread, especially on the area of education and gamification. The first papers on gamification in e-learning environments were published in 2011, but one year after that the original number had already more than tripled, and this increasing trend continued in 2013 (de Sousa Borges, Durelli, Reis & Isotani, 2014).

Although there are many studies on gamification in education, very few have addressed gamification of personalised education, even though both gamification and

personalised learning are areas that are researched a lot (Chen, Lee & Chen, 2005). We would like to contribute to a solution for this 'issue' via this research. To do so, we have formulated two questions. The first question aims to select a suitable set of gamification elements for our personalised learning environment, by which we mean a set that is both fitting for such an environment, and that is likely to be effective. The second question is meant to assess these elements.

1. *Which gamification elements are most suitable in a personalised learning environment?*

2. *How do these elements influence learners' motivation and learning?*

1.1 Motivation

We believe that the answer to these questions will be a useful contribution to this field of research. Personalised learning is a very actively researched area, and many researchers focus on developing effective personalized learning mechanisms (Chen, 2008). The same holds for gamification which is a rather young and promising topic. The lack of research that combines these two subjects is confirmed via the extensive mapping study of de Sousa Borges et al. (2014); of the there mentioned gamification studies aiming to improve learning in online education, none do this in combination with personalised learning. This is curious, since gamification nicely matches personalisation; many aspects of both categories overlap with each other. Personalisation contains typical game elements (e.g. matching the challenges to the player's skill), and similarly do games contain many personalisation elements (e.g. a character that can be customized, or enemies that base their attack on the player's situation). This, one could argue, makes it obvious that gamification should include these elements as well. Furthermore, de Sousa Borges et al. concludes that particularly research that closely involves the end-users (being teachers in their case) is needed.

With a view to societal interest and the overall opinion that gamification is likely here to stay, more extensive research on gamification of personalised learning is key. Moreover, since gamification comes with risks, implementation projects have to be research-based and theory-driven (Lee & Hammer, 2011). Such a research, performed with close collaboration of teachers, may also confirm or reveal both advantages and disadvantages. This is of value as well, as Groh (2012) considers research to the pros and cons of gamification of importance. Additionally are we particularly interested in *how* game elements in education affect motivation, whereas most studies referred to in mapping studies seem to focus merely on the results of gamification.

Based on said mapping study and our own investigations, we found that almost all research on gamification of education does only apply the most concrete game elements, for example achievements and leaderboards. This is notable, as we will later see that there seems to be scientific consensus that these concrete aspects are the least fundamental elements of games. Instead more abstract elements are the ones that can really intrinsically motivate users and (thereby) are what makes a game fun (Nicholson, 2012;

Deterding, 2012; Groh, 2012). Domínguez et al. (2013) confirmed that only applying these concrete elements do not have a significant impact on students' results. Empirical research that focusses on a wider range of game elements is *"a pressing need"*, Seaborn and Fels (2015) argue. They additionally suggest to conduct research to determine the usefulness of particular game elements, in order to identify the most and least promising ones.

Finally, video games usually contain six features that are believed to facilitate good learning: *empathy* for a complex system, *simulations* of experience, player - computer *distributed intelligence*, cross-functional *teamwork*, learning within a *context*, and *freedom* for players to choose their own path (Gee, 2006). Gee thinks its worth exploring if and how one or more of these features can be used effectively for serious purposes such as education.

1.2 Research Strategy

We have conducted our research using the *Design and Creation Research* methodology (cf. System Development Research as described by Nunamaker Jr and Chen (1990)). This is the normally expected mode of research in areas such as computing science and software engineering (Oates, 2005). Additionally, since our focus is on developing *instantiations*, this type of research leaves us with a tangible product, which meets the expectations of our client. Our research is qualitatively oriented, i.e. we will perform in-depth analysis, rather than collect a lot of metrics. These type of studies allow researchers to explore young and dynamic topics. Gamification meets these requirements, as it is relatively new, especially in combination with personalised learning. Furthermore, given the fact that time is limited for a Master's thesis, qualitative studies are very suitable (Darke, Shanks & Broadbent, 1998).

At its most rudimentary level, the strategy we followed consists of two major steps: *design* and *evaluation*, one for both research questions in our case. For each step we have followed a fitting 'sub-methodology', in view of the methodologies described by Nunamaker Jr and Chen and Oates. We expand on the steps below.

Gamification Design. The aim of this step is to answer the first research question, meaning we have to decide which gamfication elements are the most suitable in the targeted personalised learning environment. To ensure we used a scientifically sound method, we followed the five-step process defined by (Huang & Soman, 2013), on which we elaborate in section 2.5. As both this framework mandates it and as it is key for our type of research, we first conducted a literature study to build a sound theoretical framework (section 2) (Nunamaker Jr & Chen, 1990; Darke et al., 1998; Vaishnavi & Kuechler, 2004). Furthermore, since we have implemented gamification in an existing application, we also needed to get a thorough understanding of this system's inner and outer workings, of both its functional and technical aspects. We do this in section 1.4. Finally, we could design and implement the gamification elements we thought most suitable in our case. We did this as part of an agile development process. This is what our client used internally and since it therefore coincided with their way of working, it allowed them to support us with the gamification implementation process. Furthermore

is the agile methodology cyclically oriented, and is gamification ideally implemented in a number of cycles. This makes for the implementation process to nicely fit in the implementation methodology.

Elements Evaluation. After having implemented the gamification elements, we continued with the evaluation step (section 4), meant to answer the other question. During this part we ran our pilot and collected the data necessary for our research. We follow multiple methods to do so, and will explain each later, but at their root lies the case study approach. We chose to perform a case study because they are ideal to answer "how" and "why" questions, and the question corresponding to this part falls into both categories (Baxter & Jack, 2008; Yin, 2013). We seek a way to improve learning and ask *how* specific elements of gamification can help us with that, and additionally *why* they do or do not help. This makes a case study a fitting approach. Finally, as we have said, we are interested in the qualitative aspects of the gamification elements, their internal working. Case studies are very suitable for this as well (Darke et al., 1998; Baxter & Jack, 2008; Yin, 2013). We evaluated the data collected during our case study mainly from an education point of view, as we will see this fits our gamification elements better.

Data collected in a case study is subject to the researcher's characteristics and background (Darke et al., 1998). Therefore, we have triangulated our data, i.e. we collected data from multiple sources. This counteracts these biases (Nunamaker Jr & Chen, 1990; Darke et al., 1998; Yin, 2013). To guarantee that our research will be traceable and reproducible, we have collected all data using predefined and sound methods, and stored and analysed it in a structured and transparent way, in accordance with Yin's (2013) advice. To prevent loss of data, we have used a version management system.

1.3 Thesis Structure

In order to answer our questions, we will start off with an overview of the context in which we will perform our study. Then, in section 2, we will provide a theoretical background. We start this section with some information on motivation and learning in e-learning systems in general, followed by a quick introduction to *personalised learning* in section 2.1. After this, we dive into *gamification* (section 2.2). For this subject we discuss motivational (and demotivational) factors, and how these translate to concrete elements. We conclude this more theoretical part by describing how suitable game design elements may be chosen, and how these can be applied and implemented in practice. Having covered this we move on to section 3, towards actually designing and implementing suitable gamification for our target platform. Afterwards we zoom in on *collaboration*, the topic of the elements we picked. We continue our research in section 4, by assessing these elements via a case study. In the section that follows we process and analyse the data we collected there. The final section (section 5) is on our conclusions and in addition discusses our research and offers some starting points for possible future work.

1.4 Context

We will perform our research at a company situated in Apeldoorn, The Netherlands: *Lopexs*. This is a company specialized in digitalized personalised learning. They provide an online platform called *PulseOn*[1]. This platform adapts to the individual student's learning style, giving each person the assignments they fit best. Their application is visually oriented, both for students and teachers. To get a better idea of how PulseOn is set up, both functional, visual, and technical wise, we will have a detailed look at each of these areas.

1.4.1 Functional Design

PulseOn is designed to be as personal as possible for each student. This means all learners can to some extent choose what they do, how many times they do it, and when they do it. More skilled students may choose to skip exercises and directly jump to the final tests, while others may require more learning material. Similarly does PulseOn offer students the possibility to follow courses above their level, if they desire so. For example, if someone is of average intelligence for most courses, but excels in English, they can follow that course on the highest level. Finally, the system accounts for a user's learning style; students preferring video tutorials over textual ones for instance will (if available) be offered more video material. This all offers students a lot of freedom, even though there is a thread linking all content.

The content in PulseOn is structured on multiple levels. At the core level we have *learning objectives* as the targets a student eventually has to achieve. Together these objectives form the curriculum. These objectives are mutually structured, each one may have one or more prerequisites (in the form of other objectives) which should be met prior to starting it. After structuring all objectives, we have what is called a *learning route*. Each curriculum contains one or more learning routes, and all individual students are assigned one of these routes. This allows for tailoring the curriculum to an individual's case. Some people may for example prefer to learn about different topics in parallel, while this may confuse others who prefer one topic at a time.

At a more abstract level we have all *courses* that are available to the student, for example English and Mathematics. Each course consists of multiple *modules*, which are coherent wholes, grouped by for example theme. Modules may contain submodules, and those modules may again contain their own subsubmodules, and so on. Each module contains one or more *learning units*. These units can simply be seen as special kind of sub-modules which together define the containing module. Each of the units resolves around some set of learning objectives and contains learning material, i.e. learning activities. Finally, the activities of each unit are split to a maximum of three parts (this is configurable, but in practice no more than three parts are used). The first one provides theoretical information on the subject, the second contains assignments to help students practice, and the last part tests the student. Both assignments and tests are referred to as *learning objects*. Assignments can be both *summative*, rated

[1] http://www.pulseon.nl/en/

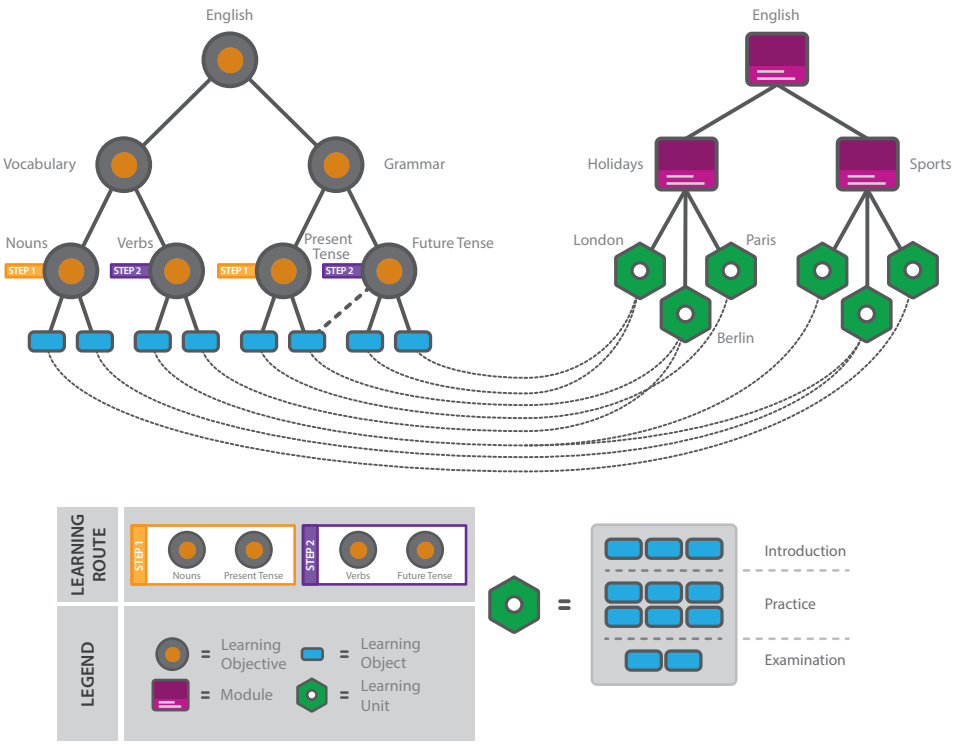

Figure 1.1: High level overview of PulseOn (image from Lopexs, author translated).

by PulseOn, and *formative*, first self-assessed by the students and afterwards by their teacher. When a student has completed enough assignments to reach the minimum total score, they will be recommended relevant final tests.

Figure 1.1 shows a high level overview of learning objectives, objects, units, and modules. We see two trees, of which the left one represents a simplified learning objective structure for English. The ultimate goal here is to master the language to some extent, and we say this is the case if the user has achieved two sub-goals, vocabulary and grammer. Each of these goals in their turn consist of two subgoals as well. In order to master English vocabulary, one has to learn nouns and verbs first. However, there is a learning route that mandates we have to know nouns and present tense (both step 1) prior to attempting verbs, and the same holds for future tense. So the learning routes create extra structure throughout the tree. In the other tree we have the module structure. At the top there is the English course (a course is a type of module), which has two submodules, each having three learning units. Each of these units is assigned a number of learning objects from the left tree, divided in three phases. Each of the objects again belongs to one or more objectives.

Assignments are assigned a maximum (content author configurable) score ranging from 1 to 100, and learners' score is calculated using their correct percentage of the assignment and the assignments maximum score. Their total score for the assignments

(called the *preliminary mastery*) is calculated by simply summing their score of all assignments in the module. Say an assignment has a maximum score of 50, and the student scores 50%, he has now a total score of 25. If he then aces a second assignment worth 30 points, he will have a total of $25 + 30 = 55$ points. The total score may exceed 100. As soon as a total score of 60 is reached, the tests are 'unlocked'. Tests have a score too, but this is always 100. Additionally, the calculation for total tests score (called *mastery*) differs as well. It is computed by averaging the score for all tests, and therefore the total score is always below 100. After reaching an average total tests score of 60 the learning unit is completed. Students that do not manage to reach the required amount of points after completing all assignments will need to retry one or more of them. It is up to their teacher to determine which assignment.

An example. Say that we have a learning unit with four assignments, weighed respectively 20, 30, 30, and 40, and two tests. Should a student score 50% on the first three assignments and not attempt the last yet, their score is $20 \cdot 0.5 + 30 \cdot 0.5 + 30 \cdot 0.5 = 40$. This is not yet above the required score of 60, so the student has to give the fourth assignment a try. Now our student scores 50% for this assignment (earning them 20 points) causing their total points to become 60. Now the tests are 'unlocked'. Were this student to achieve 50% on test 1 and 60% on test 2, their final score $= (50+60)/2 = 55$. This is below 60, so now the teacher has to review (one of) the tests and offer the student a retake. In case they allow a retry for the second test and the student now scores 80% for this test, the old score of 60% is overwritten and the new total score is $(50 + 80)/2 = 65$. Being a high enough score, the learning unit is now completed and the student is registered to have sufficiently mastered associated learning goals.

Note that we quoted 'unlocked'. All assignments and tests are accessible at any point in time. That is, students may attempt a test prior to having scored enough points on corresponding assignments. Similarly may students attempt assignments that focus on learning objectives that have prerequisites that are not yet met. This is where the PulseOn *coach* comes in. The coach is an important part of the platform that recommends students learning units based on their progress and skill level. It operates on course-level and is therefore cross-module, i.e. its recommendations are only visible on the course page and units from multiple modules may be recommended. The coach's recommendations take the learning objectives and total score of the learners into account. If a learning unit handles an objective that has an unmet prerequisite, this learning unit will never be recommended. Likewise will unit tests never be recommended if the minimal total score of 60 has not yet been reached. In addition to automatic recommendation, teachers may choose to boost a specific objective, assignment, or unit. PulseOn's coach will then prioritise units related to the boosts.

Score progress is measured on three levels: learning unit, learning object, and learning objective. Object progress is represented by a maximum of five bulbs, using the points students can achieve. The first four bulbs each account for 25 points (starting at 1), and the last is anything above one hundred points. This means that if an assignment has three bulbs, a maximum of 51-75 can be achieved. With four bulbs, the maximum ranges from 76 to 100, and five bulbs mean the maximum is greater than this range.

Initially the bulbs are empty, just telling the user how many points can be gained. The bulbs are filled in accordance to the learner's score on respective assignment or test. Learning units are measured using the same bulbs, but this time averaged over all assignments and tests of the unit. Learning objective 'progress' on the other hand is measured by averaging the score of all submitted tests that are related to the objective. If an objective is associated with three tests and a student completes one test with a score of 90, the progress for the objective is $90/1 = 90$. Were they to submit a second test with a score of 50, the progress will be calculated to be $(90 + 50)/2 = 70$. Once again, an average score of 60 or higher marks the objective as completed. The objective progress is measured using disc-like figures. The inner part of a disc contains the score and is coloured either red, yellow, or green, depending on the score. Furthermore, the size of the discs represent the spent time. We will get back to this in the following section.

Next to score progress, PulseOn also provides insight into what students are currently working on and (for modules) estimates the remaining time. For all items hold that after opening they are presented with a blue transparent overlay. Learning objects also show an icon to indicate the progress. In case the learner has not yet completed the item a big pause icon is shown. If the learner has completed the object but the results are yet to be determined by the teacher (i.e. for a test), a clock icon is shown. A perfectly completed object has as icon a green diamond. All other scores result in a coloured checkmark icon accompanied by a small progress bar that loosely indicates the score of the assignment. These icons are an addition to the bulbs which effectively display the same information. Modules and learning units display slightly different icons: a (different) diamond for a perfect score, a star for an above average score, a loudspeaker for a beneath average, and a flashing light for a score that is far beneath average. If a module is still in progress the icon 'pulses'. Finally, learning units display all targeted learning objectives accompanied by green checkmarks to indicate mastery.

1.4.2 Interface

To get a better view of PulseOn's structure, let us have a quick look at the relevant parts of the application. Upon opening, we arrive at the home page (figure 1.2). On top of this page we see our name. Clicking it takes us to our profile page where we can adjust our profile picture and some personal details. Just below there is a carousel with some suggestions to start working immediately, and again a little lower we can access our message centre by pressing the white arrow. Finally, at the bottom we see the courses we are enrolled in: in our case English and Dutch, year 1.

After selecting the English course the corresponding course page loads, see figure 1.3 (for practical reasons we have split our screen capture in the middle and placed the bottom part at the right). The page is divided in four parts: *Verder gaan* (Proceed), *Coach*, *Modules*, and *Voortgang* (Progress). The first section is similar to the carousel at the home page; it suggests a thing to do, based on the student's progress. Additionally, it shows some information on the recommended unit, the currently spend time, and estimated remaining time. Below this 'main suggestion' the coach displays a number of

other suggestions based on the learner and the boosts of the teacher. In our case we see three units of which we have not touched the first two, but did moderately successful try the third. At the very bottom we see our learning objective progress as coloured discs; we got a score of 83 on the *Speaking* objective and spent very little time on it, but did not do so well at the *Reading* related learning objects, even though we gave it a lot of time. Finally, there is an overview of all modules within current course. The two rightmost modules are greyed out, i.e. they are not yet recommended for us and neither have we given them a try yet. We already started with *The Paper Round* and made a little progress.

The paper round module, as shown in figure 1.4, contains two introductory items and two submodules that each consist of three learning units. The blue layers indicate that we have viewed layered item, while the grayed out modules are those that are not recommended. Out of the three submodules of *First Thing*, we have completed the first two (one below average and one excellent), and are still working on the third, hence the pulse (the 'extra border') around its icon. Even though we still have to complete the third module, our score is already above average, giving us a rising star.

Let us zoom in on the *Grammar* unit. Using figure 1.5, we distinguish two introductory items below *Introductie* (Introduction), four assignments under *Aan de slag* (Get to work), and finally *Laat zien wat je kunt* (Show us what you got) displays three tests. Additionally, *Wat je gaat leren* (What you're going to learn) to the left shows two learning objectives – we already mastered the bottom one. The the top right of the left page there are three filled bulbs and two empty bulbs, meaning there are over 100 points to achieve, and we have 51 - 75 of them. These bulbs also appear on each of the

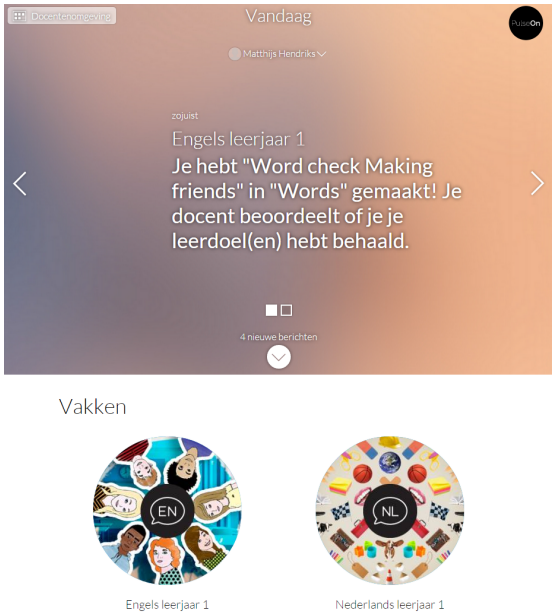

Figure 1.2: The home screen of PulseOn, showing all courses for logged in student.

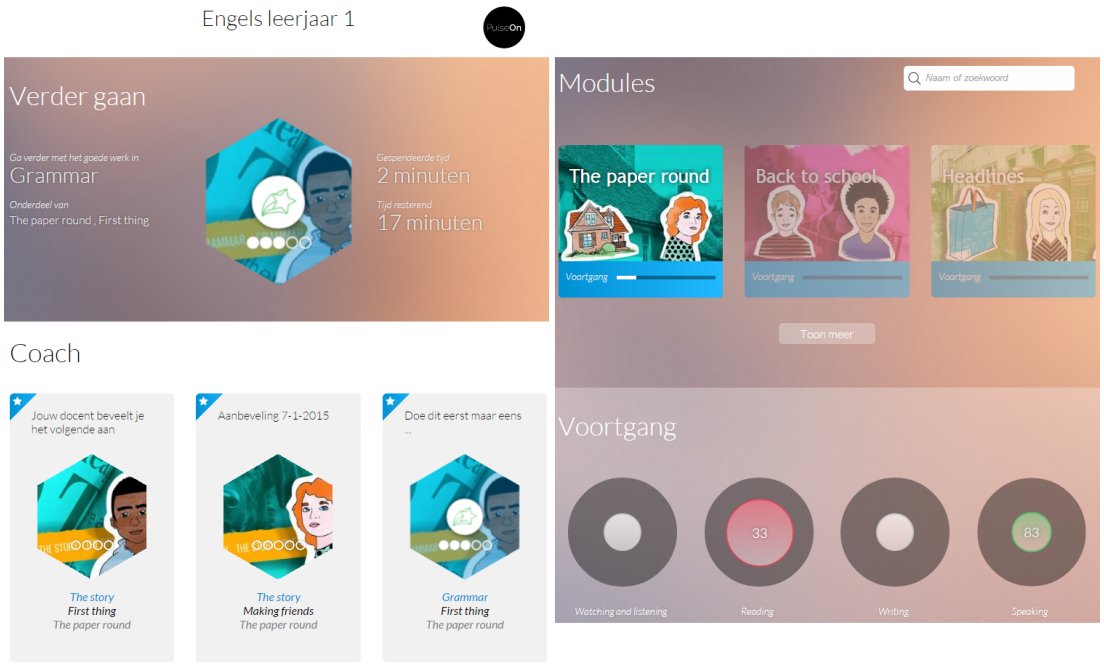

Figure 1.3: The course screen of PulseOn, showing the coach's recommendations, the modules, and the learning objective progress.

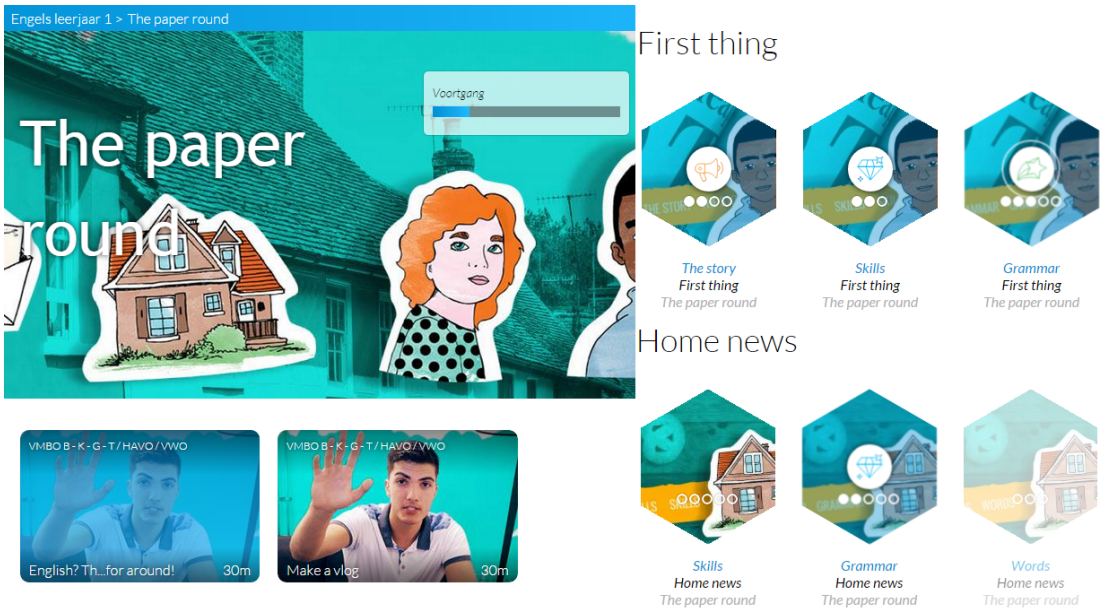

Figure 1.4: The module screen of PulseOn, showing introduction items and learning modules.

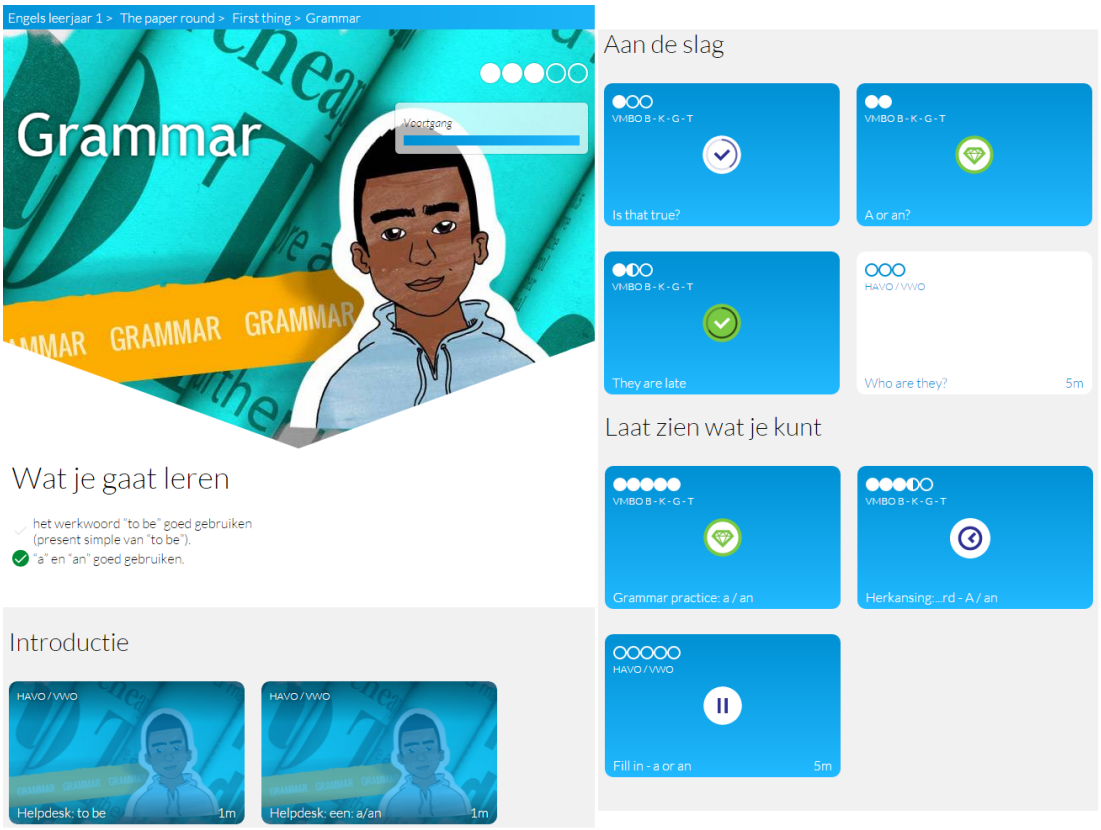

Figure 1.5: The submodule screen of PulseOn, showing learning matieral and (if applicable) introduction items.

learning objects on the right page. As indicated earlier, the icons and coloured layers represent different scores and progressions. For each non-completed unit an indication is given as to the required time to completion.

Clicking one of the units gives us the assignment or assessment page of the clicked unit, but as this is rather self explanatory we did not incorporate a screenshot of this.

1.4.3 Technical Architecture

Behind all this lies a complex technical architecture. At the highest level PulseOn consists of three separate components.

1. The *school installation*. This includes the student and teacher interface, and various server-side services.

2. The *DAMS* (Digital Asset Management System). Using this part content authors can create and manage all content and its structure in PulseOn. This is also where all content metadata is stored. The content itself is hosted externally.

3. *QTI* (Question and Test Interopability). Assignments and tests are presented, made, and reviewed using this component. It enables PulseOn to analyse a student's skills and calculate progress towards the learning goals.

Since our research will primarily impact the so-called school installation, we will take a closer look at this area and leave the other two components as they are. An installation is divided in two parts, the client-side and the server-side. The client-side is written in Javascript, Typescript and HTML5, the server-side is built using the Java programming language, and the application relies on a Mongo database. Communication between client and server is RESTful, although websockets (using the STOMP protocol) are utilised as well. Figure 1.6 displays a high level overview of the architecture of the main component.

The client-side of PulseOn consists of the teacher interface and the student interface, only the latter is relevant to us. The code has an object oriented set-up, with each 'page' being an (Angular) structure consisting of three parts, in accordance with the MVC pattern. There is a *model* that describes the contents of the page, a *controller* that can operate on and interact with the model, and a *view* that renders the model. For some pages there is an additional service which is responsible for the communication with the server, e.g. to send events or receive notifications. Furthermore, all pages may contain *directives* (basically a sub-page), which is a reusable page part. An example of such a part is the block describing the learning objects.

The server accommodates five major services. These are the profile, profiling, progress, recommendation, and notification service. The profile service provides access to the student's profiles, groups of users, and related information. The profiling service is responsible for storing an retrieving events for users. Events are published for many of the operations learners can perform within the application. For example, opening of learning object publishes an event. The progress service can then subscribe to events of this type and use their data to calculate progress on learning objectives and content modules for users and groups. The users and groups are retrieved from the profile service. The results of this service are the core of all analytics. The recommendation service for example relies on this information to determine how relevant content is for the individual student. It bases this calculation on their learning objectives and current level on these objectives. This service, informally referred to as the recommender, is what feeds the client-side coach. Finally, any part of the backend may create notifications for the user. The notification service is responsible for these notifications to arrive at the client-side.

2 Theoretical Background

Now that our context is known, we will introduce all relevant theory. We start with some more general information on e-learning and motivation in general. After this we have a look at personalised (e-)learning, and will also relate this theory to our context. Finally we dive into gamification to explain what it is and how it influences motivation, and how the context in which it is employed affects its effectiveness.

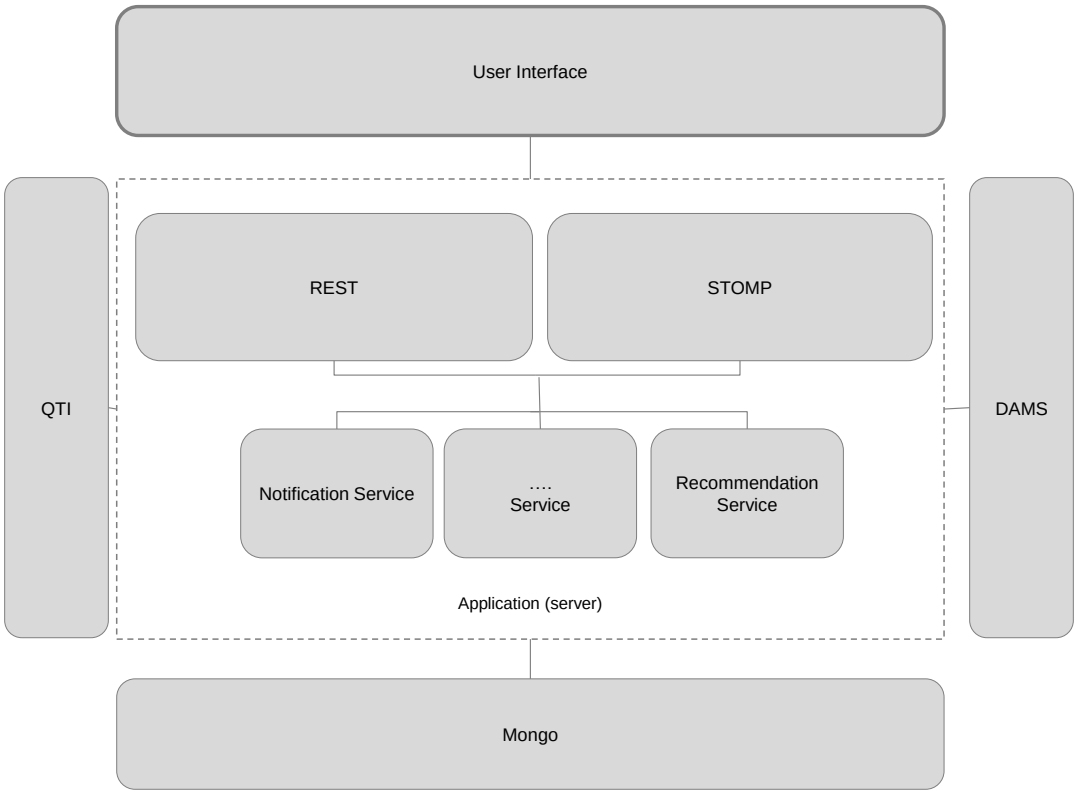

Figure 1.6: A high level technical overview of PulseOn's backend.

Online learning differs from traditional 'offline' learning in several ways. Perhaps the most important difference is that, from a pedagogical point of view, electronic devices cannot transmit emotion or engage students as well as a teacher can. An e-learning system should compensate for this and engage the learners with other means (Muntean, 2011). For example by formulating messages in a playful or even joking way and rewarding users with positive feedback, e.g. by displaying *"Good work!"* when a learner completes an assignment, rather than *"Assignment completed"* (Fogg, 2002). These positive wordings help people get a positive feeling, which in addition to in part complementing a teacher also improves their learning capability (DiSessa, 2001).

Positive emotions can grant an application the power to persuade users into showing a certain behaviour, like learning (Fogg, 2002). An other effective way to promote positive feelings is by providing a pleasant and transparent user interface. A clear interface makes sure users do not have to search for functionality. This increases the likeliness that users will be successful in the online environment. An unusable user interface can make a user feel more frustrated (Tallent-Runnels et al., 2006; Raymer, 2011). Too much frustration causes the user to be emotionally overloaded, which activates their 'affection filter'. This significantly reduces the ability to learn (Krashen, 1982). There-

fore holds that quality of the digital learning environment is vital. Badly designed digital environments significantly decrease learning effectiveness and efficiency, compared to well-designed environments and traditional 'offline' learning (Tallent-Runnels et al., 2006).

> *"As a designer, your job is to make your users feel smart or clever. Especially if what you're designing is a learning exercise. If a learner feels lost or confused, you're essentially telling them that they're stupid, and you're not doing your job as a designer."*
> (Raymer, 2011)

Positive wordings and a pleasant interface contribute to a positive experience. Not implementing these interface design elements, especially the latter, may yield frustrated users, which in its turn means an ineffective education platform (Tallent-Runnels et al., 2006). It is therefore wise that all e-learning environments provide learners with a positive experience. On top of this, a well-designed learning environment offers users a certain freedom within the application, for instance by letting them pick their own background (Shneiderman, 2004).

Freedom, or *autonomy* is one of the three factors described in what is known as the self-determination theory (Deci & Ryan, 1985). The other factors are *relatedness* and *competence*, and together they define the three innate needs that intrinsically motivate humans. These factors are thereby also argued to be the basic needs in education. If met, they result in high-quality learning and enhanced personal growth and adjustment (Guay, Ratelle & Chanal, 2008). Supportive significant adults – amongst others teachers and parents in the case of students – play an important role in helping to fulfil these needs, but learning platforms also have their part to play. For example by applying personalised learning.

2.1 Personalised Learning

Personalised learning environments tailor all learning activities to the individual's need (Conlan et al., 2007). So, skilled students are presented with more difficult assignments, and vice versa. Additionally, personalised environments allow their users to advance through all assignments at their own pace. Hereby personalisation takes a student's optimal learning path into account, catering the need for a *competence* and *autonomy*. Optimal learning paths are important, as the optimal one differs per student and suboptimal paths may prevent students from reaching their objectives (Chen, 2008). Some may learn best by reading books, whilst others prefer following tutorials or solving puzzles. Each student has their own learning style (Conlan & Wade, 2004; Peter, Bacon & Dastbaz, 2010). Similarly, some learners complete assignments and adopt knowledge faster than others, because they're more interested in the study subject or simply more intelligent. Not fully taking these factors into account may result in students becoming bored, either because their assignments are too simple or too hard, or because the learning material does not fit their learning style. The former case yields a bored or anxious student, whilst the latter may make it harder for students to create

a 'mental map' of the problem, making them frustrated (Csikszentmihalyi & LeFevre, 1989; Koster, 2013). Both things decrease one's ability to learn (Krashen, 1982).

Those are the issues personalised learning attempts to address. They track each student's progress, skills, and results, to construct detailed individual learning profiles. This profile can be used to personalise the curriculum to optimize the learning process (Chen, 2008). This is one way to personalise a learning experience, but there are many definitions and thus many interpretations available (Settouti, Prie, Marty & Mille, 2009). Liu, Wong and Hui (2003) for instance propose an algorithm to personalise user interfaces by analysing their usage behaviour. An application would then use this information to predict the actions a user is about to perform, in order to remove the need for them to complete the actions manually.

The module that is responsible for recommending students suitable assignments based on their profile is what PulseOn refers to as the coach and what is usually regarded as a recommender. This is a system that offers suggestions for activities it deems right for current user. Their objective is to support users in decision-making processes (Ricci, Rokach, Shapira & Kantor, 2011). The recommender implementation in PulseOn is not based on a scientific model, but we can classify it as one of the five recommendation techniques as defined by Burke (2002), being knowledge based. Lopexs' recommender knows what a student needs and what their preferences are. More importantly, this knowledge is functional, which means that it includes not only what a user needs, but also how the available items can (in part) fulfil this need. This is what allows the recommender to substantially suggest certain items to users.

PulseOn primarily applies personalisation by semi-automatically matching assignments to a learner's skill. That is, some part of the personalisation is configurable by the teacher, and an other part is derived from student performance. In practice this means the teacher should select the difficulty and learning route for the student, and that the system uses these settings to determine the units to recommend. However, it only recommends units that match the configured level of the student, and only the teacher can change this level. Therefore PulseOn tailors the assignments only to the student's learning pace; more intelligent students are not automatically given more difficult exercises, nor are for example visual learners presented with more visual material.

Even though the platform does not implement personalisation to its fullest, it is still effective compared to traditional learning. Research by Molenaar, van Schaik and Denessen (2015)[2][3] has pointed out that learners perceive PulseOn as a more student-oriented environment. This is confirmed by their teachers, whom note that students using PulseOn have more control over their learning activities. This indicates that the autonomy of the students increased. Furthermore, the study found that students are

[2]The authors have compared PulseOn to an other online environment called *Schooltas*. This is basically a digital library for students that provides no additional features.

[3]The research has been conducted using an older version of PulseOn. This version differs from the current one in that the student user interface has been rewritten. However, since Molenaar et al. did not focus on the user interface, but rather on the effects of using such an environment, we believe their results still apply.

slightly more performance oriented when using PulseOn, especially in relation to other students (i.e. they were more competitive).

Personalisation meets games in the sense that there are a number of similarities. Just like games does personalisation revolve around the user, amongst others by making the learning setting personally relevant. This results in learners taking ownership of their learning process and tools, and that these are their responsibility (Settouti et al., 2009). Likewise, some of the objectives of certain game design and personalisation elements overlap. They typically both offer users the option to move through the story (by which we mean both an actual story and a curriculum) at their own pace, aiming to improve the feeling of autonomy, and match the user's skills, fulfilling the need for competence (Deterding, 2011; Tallent-Runnels et al., 2006).

In short, personalisation increases intrinsic motivation and is thereby a step in the right direction, towards motivating education. This leads us to the main subject of this thesis. One that too stimulates relatedness, competence, and autonomy and therefore perfectly supplements personalisation: gamification.

2.2 Gamification

Gamification is *"the use of game design elements in non-game contexts"* (Deterding et al., 2011). Gamification elements are applied in many places. For example, a lot of supermarkets and other shops have some sort of loyalty card: a card that allows customers to buy certain products with a discount, or to collect points with which customers can get something extra. Due to the points and rewards to achieve, this is a form of gamification. An other, more extreme example is our education system, which does in fact contain gamification elements. There are grades to gain and certificates to achieve, challenges to take, both positive and negative feedback, and even a variant on levels. Yet, the average student would disagree with this and not experience school activities as gameful at all (Lee & Hammer, 2011; Groh, 2012). As for loyalty cards, there is no scientific consensus that they actually work, in spite of multiple gamification aspects being present (Wright & Sparks, 1999).

Clearly, there is more to gamification than applying a number of game design elements. It is no magic tool that can be implemented and just works, but instead is only lastingly effective if the underlying platform fulfils aforementioned needs. Gamification is meant to enhance user experience and engagement, not create it (Nicholson, 2012). Using the self-determination theory, Deterding (2011), has extracted a list of three innate needs that intrinsically motivate users, in the context of gamification:

1. *Meaning*: the platform has a meaning and an active community.
2. *Competence*: the platform has structured challenges and feedback.
3. *Autonomy*: the platform makes the user feel autonomous.

Not unless these needs are fulfilled is gamification effective, and lasting. Should an application that does not meet above requirements implement (extrinsically motivating)

gamification, the effects are only short-term and do not benefit the user (Nicholson, 2012). Gamification is an amplifier of motivation, it cannot create (intrinsic) motivation (Deterding, 2012). Using the self-determination theory, gamification can however help increasing intrinsic motivation. Yet, there is a reverse side as well. Badly implemented gamification yields risks that can negate the gamified experience or enable undesired side effects. Following the work of Groh (2012), we will elaborate on each of these items in the following three sections, and discuss how gamification elements can help applications meet these requirements, and how they may pose a risk. Afterwards, we use this information to derive concrete gamification elements.

2.2.1 Meaning

Gamification is most successful if users can relate to the gamified platform and if it is meaningful. This means the application still has a goal and benefits the user without the game elements. Ideally, the platform meets the users' personal goals, coincides with an interest the users have in their daily life. For example, if a learner's passion is cats, they will experience an exercise that uses these animals in its formulation more positively, compared to those that don't include cats at all. This is one way to increase meaning for the user, thereby making a platform more relatable (Groh, 2012).

The risks of using these kinds of constructs to increase meaning should however not be neglected. The same things may have different social meanings in different social contexts, or violate (implicit) social rules and norms (Deterding, 2012). There may be no harm in using cats in an example, but should an application for instance reward users points for doing other people favours, those people might find it insulting that they are only favoured because a reward was involved. In a similar way can certain jokes, rewards, or achievements be enjoyable for one audience, but offensive to the other (Groh, 2012). Thoroughly understanding the application's target audience and context helps reducing this risk (Raymer, 2011).

Without underlying meaning, gamification can only do so much. Take *Foursquare*, a service that got hugely popular by applying gamification, and caused many companies to follow and add badges and similar gamification elements to their service as well (Deterding et al., 2011). After a few successful years, Foursquare has been rapidly losing (active) users, has seen their mobile app downloads decrease drastically, and even the Google searches on the company diminished (Weber, 2014). This is because nothing benefits the user beyond the badges and mayorships (Groh, 2012).

Foursquare did however manage to build an impressive active user base, partially due to their ways to help users share their achievements with a large audience. This adds meaning to the platform by affecting the user's social status (Sakamoto, Nakajima & Alexandrova, 2012). If users can't share their achievements with others, their trophies are effectively useless. A well-gamified application has an active community of people with the same interests and goals, and helps the user to connect to it (Groh, 2012; Nicholson, 2012). This is especially important in cases where there are no physical classes, as they help simulating a classroom environment (Muntean, 2011; Farzan & Brusilovsky, 2005). A community around an education platform has as

bonus advantage that any type of social interaction – discussion, sharing, consulting, mentoring, reflecting, etc. – helps with learning. Additionally, a social platform may help students view education's activities more as a social experience. In games this is already the case: on the one hand players cooperate to complete a difficult mission, and on the other they compete with each other. Meanwhile at school there is no such profound cooperation and competition. A sound social platform may pave a way for these two elements that gamers experience as pleasuring and motivating (Gee, 2008).

When considering competition one should keep in mind that competition is an element that can both make and break engagement. In general, competition is very motivating (Gee, 2008). However, there are some downsides. Firstly, someone not as skilful as the rest will probably end up very low in the overall ranking. This can be demotivating, which can be disastrous for engagement. One way to make this less likely to happen is displaying only the top x on the leaderboard (Huang & Soman, 2013). In a similar way can it be discouraging for people that do not like competition (Domínguez et al., 2013). At the other end of the scale competition elements are capable of promoting all kinds of undesired behaviour. The car manufacturer BMW for example introduced a couple of years ago a game prototype that stimulated efficient driving. It did this by motivating drivers to drive more efficiently than the other drivers. This worked well: on average the drivers' fuel consumption dropped with 0.4l/100km. Actually, it worked so well that drivers exercised unsafe driving behaviours to save fuel (Ecker, Slawik & Broy, 2010; Deterding, 2010).

Engagement is also increased if the application has one or more clear goals. A goal that is transparent towards the students has a motivating effect (Nicholson, 2012). To reach the goals, users have to follow some sort of story. In games, this typically is a very concrete story, e.g. in the popular game *Age of Empires* victory is achieved by beating all enemies, and the player has to do this by aging up, constructing buildings and units, conducting research, and gathering resources. However, this may also be more abstract, like in education. Here the ultimate goal is to master school, and the story towards victory is given meaning by yearly classes, courses, modules, subjects, and assignments. A 'real' story however is much more effective, for example a curriculum revolving around a group of friends that experience all kinds of learning material related activities (Stott & Neustaedter, 2013). One of these activities could for instance be undertaking a city trip to a foreign country where they will learn the language of said country. Students would then follow these friends and learn with them. However, a story is not effective unless it is highly structured and contains a lot of short term and rewarding goals. A curriculum is highly structured, but it offers students only the prospect of vague long-term trophies like decent marks and a certificate, not that of immediate rewards for smaller goals. Even though this is what helps students see their activities as part of the overall picture (Lee & Hammer, 2011). One way to create such a structure is by confronting users with interesting challenges.

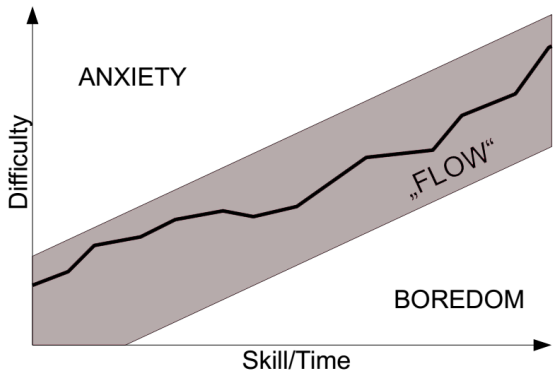

Figure 2.1: The Flow Theory: if all challenges match the user's skills, they won't experience anxiety or boredom and stay in the flow (Csikszentmihalyi & LeFevre, 1989).

2.2.2 Competence

A challenge is a task that has a clear goal, is to be completed while abiding a set of rules, and gives feedback after completion or failure (Deterding, 2011; McGonigal, 2011). Challenges are one of the most engaging aspects of a game. Well designed challenges intrinsically motivate users, and are crucial to actually make a game fun. A game where the player gains points and solve missions by pressing buttons is not engaging. To illustrate this, Jakob Skjerning created *Progress Wars*[4]. This 'game' contains many gamification elements – a fancy user interface, missions, regular feedback, levels – but there is no challenge, no skill to master, thus it is not engaging and motivating at all (Groh, 2012).

Solving challenges, thereby mastering skills, is what keeps games engaging (Koster, 2013). In fact, in the best designed games, solving challenges is rewarded with a bigger challenge (McGonigal, 2011). In a good challenge system, the challenges have clear visually represented goals and rewards, and are mutually structured in a scaffolding way (Groh, 2012). In our education system there is a clear structure, but the only rewards we offer students are a certificate – after many years of school – and a mark every couple of weeks or even months. This is not very motivating (Lee & Hammer, 2011). For this reason games are highly structured, a constructive structure is motivating (Groh, 2012). Their challenges are split to sub-challenges, and these challenges sometimes split up again (Raymer, 2011).

If defined optimally, challenges help us enter the 'flow'. A mental state of full concentration on one specific activity, making performing it more immersing. While we are in this state of mind, we are more motivated and work more optimal. We enter this flow if we are constantly presented with new challenges, with an increasing average difficulty. Figure 2.1 shows a band representing the flow. The black line in this area represents the path the user follows, and over time the difficulty of this path, of the challenges, increases. If a challenge is too difficult the user gets anxious and frustrated

[4]http://progresswars.com

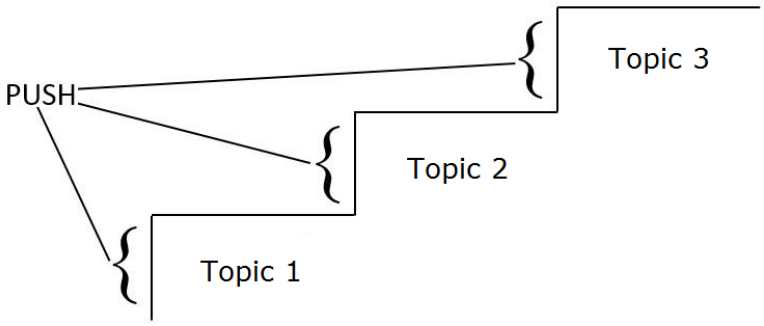

Figure 2.2: Visual representation of 'pushes'. Adapted from Huang and Soman (2013).

because they can't complete the challenge. On the other hand, if a challenge is too simple, boredom emerges and the flow is lost as well. As users' skills increase over time, so does the flow band (Csikszentmihalyi & LeFevre, 1989; Groh, 2012).

Small challenges with immediate rewards increase the likelihood of users getting into the flow, and in addition decrease cognitive fatigue (Raymer, 2011). In addition to this, smaller problems appear more organized and help us solve them. This is desirable, because if we can't find a pattern in a problem, we can't make a mental overview of it, and then we get frustrated and give up (Koster, 2013). Splitting up challenges helps motivating users, but challenges only remain interesting if they vary both in goals and complexity. If we are asked to solve the same problem over and over again, only a tad more difficult each time, we get bored as well (Groh, 2012). In this context, varying challenges means not only varying their goals and complexity, but also their difficulty. For this reason the flow line is not straight, users presented with frequent easy challenges are more likely to feel successful and therefore more motivated (Csikszentmihalyi & LeFevre, 1989; Deterding, 2011).

Education lends itself well for structured challenges, and in fact already has a structure. Usually multiple topics per course are covered, each topic ending with a test in which students prove to have sufficient knowledge of given topic. It could however be even more structured. A powerful structure through a course and its topics has milestones that build on each other (Groh, 2012). Structure within a milestone can be established by defining intermediate goals, and goals can again be divided into a set of tasks. For example, a goal could be to teach students to convert fractures to percentages. Here, we can have mastering fractures as a first milestone, mastering percentages as a second, and finally combining the two. For each of these goals we have a set of assignments, and we conclude the goals with an exam. Applying this level of structure gives us an application with different 'layers' of goals building towards mastery of required skills or knowledge, giving learners a sense of progress (Raymer, 2011; Huang & Soman, 2013). At the beginning of each milestone the subject is new, so the student will, until they begin to master the subject, have a more difficult time. This is when they need a 'push' upwards (see figure 2.2), a motivational boost to go on to the next stage (Huang & Soman, 2013). Gamification can help providing

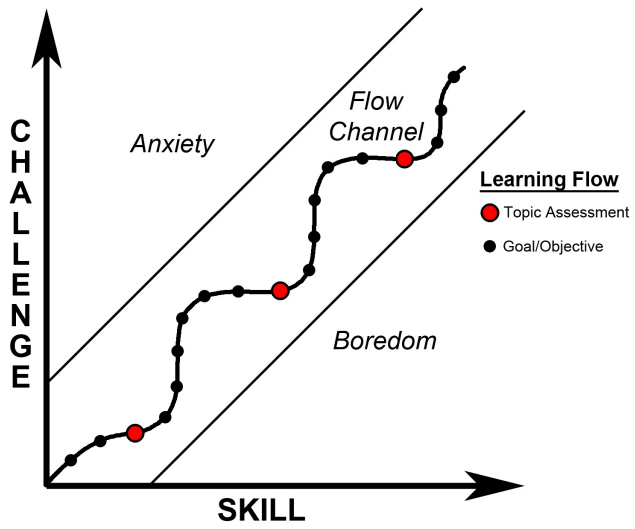

Figure 2.3: The Flow Theory applied to education: after each assessment the challenge quickly increases, at which time the learner needs a motivational boost (Raymer, 2011).

this push by adding small rewards to the sub-goals. Because of this extra push that is required to start new topics, the ideal flow graphs looks a tad different from the generic one as created by Csikszentmihalyi and LeFevre. Figure 2.3 displays the in education preferable path 'through' the flow (Raymer, 2011).

People learn best from experiences, and they do that best if they receive feedback right after failing, so that they can reflect on their actions and deduct what they have done wrong (Gee, 2008). Therefore, effective challenges have short feedback cycles and immediate rewards. Failing a task is 'rewarded' with constructive feedback. The users can then try again, and by trial and error learn. Many games even make repeated failure part of the game. Beating a challenge after having repeatedly failed it makes us feel proud and causes our body to produce adrenaline. As a result, we are more confident, energetic, and motivated (Groh, 2012; McGonigal, 2011). Balancing positive and negative emotions like this makes failure a motivator rather than the opposite, like it is the case in education. People do not associate failing in well-designed games with negative emotions. Instead, they want to try over and over again until they succeed. However, a requisite for this to work is that the stakes are low. If someone has a lot to lose, they get nervous and are reluctant to face the challenge (Lee & Hammer, 2011). Many games solve this by adding checkpoints throughout a level, a fail safe. Failing after such a checkpoint means the player will have to retry only a small part of the level, instead of all of it. Similarly, games allow players to save their progress and restore it later. This reduces the risk as well (Gee, 2008). At school it is the other way around, a student has to complete a course in its entirety and has only a limited number of tries before they have to do everything again. The price of failure is high and the feedback cycles are long, which makes failing scary and demotivates students (Lee & Hammer,

2011).

Short feedback cycles imply providing feedback constantly, for nearly every action. Part of this feedback is informative and tells users whether (and why) they failed to beat a challenge. The other part consists of rewards for successfully completing challenges. The most effective rewards are proportional to the risk and the required effort needed to master the challenge, and are presented visually in an encouraging and attractive way. For instance, if an application displays fireworks after a task has been completed, more fireworks should be presented if the task was difficult. Furthermore, well-gamified applications update the user's progress upon completion of a challenge, but do not display the current progress all the time. Instead, a user's progression is 'hidden' in a menu or dedicated window the user can access, and only the progress advancement is shown. If the progress is only explicitly shown when progress is made, progressing can feel more as a reward (Groh, 2012; Raymer, 2011).

The largest risks attached to challenges and rewards emerge from challenges less interesting than their rewards. In this case the reward becomes the user's actual goal, they do no longer care much about the task itself. This can cause two problems: unintended behaviours and overjustification (Groh, 2012; Kohn, 1999). To explain the former, let us have a look at Foursquare again. In this mobile application, users can check-in at a registered location nearby, which earns them points. If you have checked in more often at a specific place than anyone else, you become 'mayor'. This gives you a score bonus, and brings you closer to unlocking so-called (shareable) badges. One of the problems they faced is a mobile app called *Mayor Maker*. A tool that monitors nearby check in locations and checks in the user at those locations automatically. This earns the user points, achievements, and eventually the status of mayor (Groh, 2012). Similar problems exist in many online games. An increasing amount of players is relying on so-called *bots*, computer programs that play a part of the game as if they were the player, for instance by fighting monsters and collecting the items they drop upon death. Both Mayor Maker and bots are examples of players that choose not to accept the rules of the game and care only about their mastery of some in-game skill or gathering virtual goods (Golle & Ducheneaut, 2005). Such unintended behaviour is often the result of (too valuable) rewards for not very motivating tasks.

More dangerous than non-motivating tasks however, are excessive rewards, overjustification. This increases the likeliness of the extrinsic motivation becoming stronger than the intrinsic motivation, in which case users are taught to only learn when they receive a reward (Lee & Hammer, 2011). What's more, their intrinsic motivation for the task will even decrease and their association with the non-game context will deteriorate (Kohn, 1999; Nicholson, 2012). Well-implemented gamification therefore keeps the challenges interesting and the rewards in relation to the effort (Raymer, 2011; Groh, 2012).

Sometimes players are unable to complete a challenge, or do not like the path towards completing it. To prevent demotivated players, games provide multiple paths that eventually lead to the same goal, each path having different challenges (Raymer, 2011). If people are allowed to choose their challenges, they stay more motivated and

feel like they are in control (Locke & Latham, 1990).

2.2.3 Autonomy

Feeling in control increases intrinsic motivation. If people have to do the exact same task in a both mandatory and voluntary setting (e.g. at work or school versus in a game), they usually enjoy the latter more (Deterding, 2011). If we are allowed to choose our own activities, pick our own goals, and decide how we complete them (within certain bounds), the task feels less obligatory and is more engaging (Locke & Latham, 1990). This is exactly what games allow us to do. Let us have a look at the Age of Empires games again. In these games, the ultimate goal is to win, and a player can do this by beating their enemies, but the sub-goals needed to beat the challenges are not fixed. Many strategies may lead to victory. For example, there are different units available, each with a different cost and properties, and the player may choose which ones to train for their army. This freedom makes playing the game more motivating – if a player has to follow a fixed strategy, they lose their autonomy and get demotivated (Deterding, 2011; Locke & Latham, 1990; Groh, 2012).

The context in which tasks are to be completed also influences users' feeling of autonomy. There is generally nobody telling others that they have to play a game, so if someone is playing a game, this is most likely by their own choice. It being a voluntary activity, the player feels autonomous. This matches the findings of Tallent-Runnels et al. (2006), whom analysed research on the effectiveness of both online and offline learning. They found that students welcome online learning as it provides them with a feeling of autonomy. Indeed, online learning allows students to complete their tasks at the time they like. Strongly related to this is another finding of mentioned meta study: learners want to move at their own pace. They do not want to complete assignments within a fixed time, or wait until everyone else is done prior to starting the next assignments. In other words, they preferred a higher level of autonomy.

A well-gamified platform aims to enlarge this feeling of autonomy. Offering users freedom to choose what they do and when they do it is one method to achieve this. A concrete implementation of this may be allowing users to choose their own goals. An extra advantage of this implementation is that such goals typically are a better match to the user's personal interests, and provide the user with a sense of satisfaction when accomplished. This makes the platform more meaningful and increases the feeling of competence respectively (Groh, 2012; Deterding, 2011; Nicholson, 2012). Closely related to this is providing a sandbox setting to the user, meaning that the user can (in part) control the environment (Deterding, 2011). This gives the user a sense of ownership and responsibility over the application and its content. Control can manifest itself in multiple ways. One way is by allowing users to create an extensive profile of themselves, a place where they can add a profile photo, list their hobbies, etc. An other way is configuration of their private profile, like turning e-mail notifications on or off, or changing privacy settings (Seaborn & Fels, 2015). Finally there is the ability to control the environment itself: change the theme, background, or user interface. The ability to produce content, instead of only consume it increases autonomy and

stimulates deep learning (Gee, 2008). (The latter is typically the case in education.) Question & Answer platform *Sabre Town* has successfully applied this by rewarding answering questions with profile customization elements (Deterding, 2011).

Some games apply customization on a much larger scale. The immensely popular *Minecraft* even revolves about creating and changing things. Other games apply it to a lesser extent, for instance by giving the player an avatar. These in-game characters are often customizable: players can give them different outfits, change their hair colour, or upgrade them (Raymer, 2011). Players can change them as they like, providing the sandbox feeling. Avatars are however important beyond being customizable. Because they offer micro-control, users actually start imagining themselves to be their avatar, to be inside the game, and will assume its role. This makes it more likely that users will get a feel of identity within the application and start to empathize with their avatar, giving the platform more meaning. All of these things increase the emotional band users have with their avatar, and people learn best if that there is an emotional charge attached to the subject (Gee, 2006; DiSessa, 2001; Lee & Hammer, 2011). This is also true in a school setting, a strong school-based identify improves learning on the long run (Lee & Hammer, 2011).

Finally, games are transparent, in the sense that they show a lot of information to the user. This includes many of the goals that have to be reached and their rewards, but more importantly how a player's score is calculated. If users do not know what they have and can choose to do, or do not understand how rewards and scores are determined, they become suspicious towards the system. This may result in a distrust towards the application, which in turn may give the user a sense of being controlled (Nicholson, 2012).

The same feeling may be reached by challenge's rewards. Those rewards are typically of the type *if...then*, thereby promoting a pattern of thought that says *'if I complete this task, then I get that reward'*. This decreases the feeling of autonomy and may devalue the activity giving the reward (Kohn, 1999; Groh, 2012; Deterding, 2011). These risks can be mitigated by introducing other reward schemes and unexpected rewards. Other reward schemes (e.g. rewarding users only after multiple completed tasks or after a period of activity) loosen the connection between rewards and actions. For unexpected rewards (e.g. easter eggs) this is even more the case. Those do not feel controlling or devaluing at all. Indeed, they cannot make users feel like they did a task because there was a reward involved (Raymer, 2011; Deterding, 2011; Kapp, 2012). A similar mitigating effect can be achieved via shared goals. Cooperation means that challenges have to be beaten by multiple users, decoupling a reward from an individual victory (Groh, 2012).

As we indicated earlier are not all gamification elements suitable for all contexts. The most effective gamification implementations are therefore designed with their targeted context into account.

2.3 Gamification Context

Designing for the correct context is one of the key doors leading to successful gamification. Gamification is strongly related to the target audience and learning goals of the application (Deterding, 2012; Huang & Soman, 2013; Hamari, Koivisto & Sarsa, 2014). If it focusses on an other audience than that going to use the gamified application, it is likely to be ineffective (Deterding, 2011). Therefore, one cannot generically apply gamification that empowers all target audiences in all contexts to complete certain tasks (Hamari et al., 2014). In fact, misunderstanding the application's audience can not only mean a waste of implementation efforts, but it could also result in social misconceptions such as those described in section 2.2.1, or even yield negative results (Deterding, 2011). Therefore, it is advised to investigate your target audience and determine their *pain points*.

Pain points are risk factors that can influence a learner's learning process. For example, a student may be a visual learner while the course is taught in a textual way, or they are not motivated to complete a task because it doesn't give them a meaningful result. Understanding these risk factors is a prerequisite for determining effective gamification strategies. The following things are common pain points in education (Huang & Soman, 2013).

- *Lack of focus.* Especially younger students are less focussed and need education to be fun and engaging.
- *Motivation.* While younger students often have a lack of focus, the adolescents and young adults commonly lack motivation and will more often switch tasks if the the current one is not interesting enough.
- *Pride.* In another age category higher excess of pride is more common. Learners may think they already have required knowledge or skills, or in case of a younger teacher feel the need to 'boast' and choose learning materials that are too difficult for them.
- *Skills.* The tasks at hand are too hard and consequently demotivate learners and breaks their flow. Similarly can a task be too simple, yielding the same result.
- *State.* One's learning ability is directly affected by physical, mental, and emotional factors like fatigue, hunger, and sadness.
- *Learning context.* A student may for example think a course is not interesting, dislike the learning environment, or think it is too early.

These risks can be alleviated by understanding the target audience very well. This includes considering the age category and gender of the learners, their learning abilities, their skills, their motivators. To be able to fully engage a user, the user's likes and don't likes need to be mapped as well. One cannot implement effective gamification without both knowing and understanding the target audience on all aspects. Efficacious game elements are based on the aspects of the underlying activity and are thereby meaningful

to the users (Raymer, 2011; Nicholson, 2012; Deterding, 2012). With regards to the context in which the learning application will be utilized: the environment (a classroom, or at home, or at work, etc.), the group size, and the duration of the program are relevant as well (Huang & Soman, 2013).

The fact that context plays a crucial role in a learning application is confirmed by an internal research Lopexs conducted in 2014[5]. They surveyed students of three classes using PulseOn about their PulseOn courses Dutch, English, and Mathematics. They found that there are major differences between both classes and courses. For example, one class was very positive and remarks included those such as *"Earlier I found English very hard, but when we started using PulseOn I understood everything!"* and *"I think English in PulseOn and on the iPad is very enjoyable"* (translated from Dutch). Students from an other class however rated the platform for the same course with comments like *"PulseOn is not convenient for any course"* and *"You should NEVER again let a class work with PulseOn."* Similar – but less extreme – differences are found between the courses: Mathematics was unanimously rated very low, and English was consistently rated best of the three courses.

The reasons for these discrepancies are twofold. Firstly, teachers utilise PulseOn in very varying ways. Some teachers use the platform as a 'digital book', whilst others use it exactly as Lopexs intended it. Teachers in the first category generally don't understand its intended usage or added value, and therefore dislike PulseOn. Molenaar et al. (2015) confirmed that some teachers use PulseOn this way and additionally fail to see PulseOn as the platform it is meant to be. Others give students much more freedom and thereby also use the application as intended. Those teachers also indicated to like PulseOn or even prefer it over traditional methods. The platform's usage and teacher's opinion directly affect the student's experience, which explains why some classes are positive and others are negative. The second reason for observed discrepancy can be traced to how course content is implemented, which also proved to influence student's judgement. According to Lopexs' own saying was the content for Mathematics far from suitable for PulseOn; this is reflected in the surveys.

2.4 Gamification Elements

In addition to understanding the context it is necessary to define which game design elements to use. Not all of these elements can achieve the same effect, and consequently they are not all as effective. They are also not by definition enjoyable if taken individually. Take the *ten ingredients of great games* (Reeves & Read, 2013) for example: self-representation with avatars; three-dimensional environments; narrative context; feedback; reputation, ranks, and levels; marketplace and economies; competition under explicit and enforced rules; teams; communication systems; and time pressure. While some of these elements can be enjoyable on their own, others are most likely not, and others again are common in daily life and we know from experience that they are not

[5]This research too is performed with an older version of PulseOn, yet the focus was the platform in general and not the user interface. Some students have made remarks on the matter, but we have discarded these results.

Level	Description	Examples
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations	A badge or level, a leaderboard
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraints, limited resources, turns
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyse a given design solution	Enduring play, a variety of game styles
Game design models	Conceptual models of the components of games or game experience	Challenging, fantasy, curiosity; game design atoms
Game design methods	Game design-specific practices and processes	Playtesting, playcentric design, value conscious game design

Table 2.1: The levels of game design elements (Deterding et al., 2011).

per se enjoyable or gameful (Deterding et al., 2011). A communication system is typically only useful, not enjoyable. So how do we pick suitable elements? Deterding et al. (2011) suggests that gamification should only apply game elements that are characteristic to games, i.e. that are found in most games, intuitively associated with games, or fulfil a significant role in gameplay. While this approach is susceptible to discussion, any other definition would be either too specific or too broad (Deterding et al., 2011).

Game elements can be divided into five layers of abstraction (table 2.1). These levels are, from top to bottom, sorted from games' most concrete elements, the least essential ones, to their most abstract elements, the core of the game (Deterding et al., 2011). When gamifying an application, it is advised that the implementation does not only include game components like points, but also elements from the other game design levels (Deterding, 2012; Groh, 2012). All elements can be subsumed in one of the following two categories: *self* and *social*. Points, time restrictions and aesthetics are instances of self elements, whereas leaderboards, chats and cooperation classify as social elements. Which elements are most suitable and whether social ones are preferable over self ones, depends on the context and audience. This is determined when developing gamification (Huang & Soman, 2013).

2.5 Designing Gamification

Designing effective gamification is not trivial (Huang & Soman, 2013). We have seen that the effectiveness of gamification is mostly determined by meaning, competence, and autonomy in relation to the underlying platform. Additionally, the elements used to gamify the application and its context play an important role. If these aspects are not taken into consideration carefully, the effect of gamification may be other than

anticipated: ineffective or demotivating. To lower the chance that gamification implementations end up useless, Huang and Soman (2013) have, based on a number of case studies, defined a simplified five-step method to design gamification for an education oriented application.

1. Understanding the audience and context
2. Defining objectives
3. Structuring experience
4. Identifying resources
5. Specifying elements

We will have a more detailed look at each of these steps.

1. Understanding the audience and context. To get a better understanding of the student and the context of the application, a gamification engineer is wise to first analyse the platform's target audience and context. This helps the implementer to get a feeling of the users' pain points and to some extent offers the opportunity to avoid them.

2. Defining objectives. The effectiveness of gamification does not only depend on the program's target audience, but also on its objective. Note that we distinguish between gamification objectives and learning goals. An objective may be anything from improving the learners' grades to increasing their motivation and even triggering behavioural changes. A learning goal on the other hand is what we earlier referred to as a challenge, e.g. understanding fractals in mathematics. Both clear gamification objectives and clear learning goals are essential for a successful and lasting gamified experience (Huang & Soman, 2013). Objectives help determining the scope of the implementation project, whilst learning goals are key to creating a meaningful structure. This is time to choose one or more objectives of both the gamification trajectory and the learning platform.

3. Structuring experience. Following up, we break the learning program down to the most fine-grained level, to create a clear structure. Creating this structure includes analysing the assignments and identifying the parts that may prove more difficult for students. Those are the points where they need aforementioned push to continue learning, and knowing where to push is useful as those points will play a significant role in applying gamification. Finally, an implementer determines in this stage in a similar way possible pain points.

4. Identifying resources. Goals make it easier to judge if and how gamification can be applied per milestone, and to what extent. Goals are typically not reached after completing a single task. Instead, they are achieved after finishing a number of tasks, or after some amount of time. Consequently, a user progresses towards a goal, and their progress is quantified by a certain currency. This stage is meant to define this currency.

This currency may be anything measurable, e.g. points, assignments completed, or time. Additionally, this stage is used to define the rules to which students must abide when entering each of the challenges defined earlier. Time is again an example here, as an assignment can have a deadline. Finally, learning tasks typically provide the user feedback upon failure and completion, and the form of this feedback is determined in this design stage as well (Groh, 2012; Huang & Soman, 2013).

5. Specifying elements. Now that the resources and rules are known, the gamification elements can be determined. Which elements should be applied is highly dependent on the target audience and context.

2.5.1 Implementing Gamification

Finally, the gamification elements have to be implemented. It is advised to create a (preliminary) application and test it as early and often as possible. Even prototypes can already be tested by some of the students that are going to use it. During a helpful test the subject's actions and movements are monitored, and after completion of the tests the user documents their experience. An effective tracking set-up can be achieved by pointing one camera at the user and an other at their keyboard, with the computer capturing the screen continuously. This allows researchers to see the users' actions and their emotion while using the application. If an issue appears, e.g. the user gets frustrated, the recorded information can be consulted to help fixing the problem, after which the tests can be repeated (Raymer, 2011; Huang & Soman, 2013).

Next up is initiating a trial run with for example one school class. Comparing the results of the learners during and after the run to the objectives defined in the second step will give an overview of which elements are working as expected and which may need adjustment (Deterding, 2012; Huang & Soman, 2013). It is crucial that gamification implementations are tested early and often, and that resolved issues are retested to verify whether they are actually solved. Only by following this strategy an effectively gamified application can be achieved (Raymer, 2011).

3 Gamification Design

To provide an effective gamification solution, we have determined the most effective game design elements in the context of PulseOn, following the five steps described above. In this section, we will expand on our efforts for each of Huang and Soman their method's steps, working towards selecting a set of elements that are most likely to be effective.

Understanding the audience and context. The target audience of PulseOn consists of first year secondary school students of all genders and levels. Ideally, we would for these students have investigated their likes, don't likes, and pain points. However, neither did we have the resources to do this, nor was it feasible to implement gamification on an individual basis. We therefore limited ourselves to classifying said learners on their skill level, intelligence, and gender. The application is primarily used in the classroom,

although students are free to work on their assignments at home. The course we focused on is English, as of all the courses taught using PulseOn this is the most complete one (i.e. it has the most content) and it is best suited to the platform, according to both Lopexs and the students.

Defining objectives. For us gamification is a measure to increase students' intrinsic motivation. This ought to make students more engaged with and enthusiastic about the application. We expected this will persuade students to spend more time in PulseOn making assignments. That on its turn should positively affect their results. The assignments are coupled to learning goals. We did not need to define these as they are already there and above all defined by the curriculum; we were not at freedom to determine these. The same holds for corresponding assignments, units, and modules.

Structuring experience. Since the units, modules, and courses are already fully defined, we were not able to modify the structure either. In other words, we made use of the course structure predefined by PulseOn, without changes. The parts where students will need a push are therefore already (implicitly) defined as well. The students should be pushed right after having completed a module and starting a new one. At this point the students start with a new subject, and (Raymer, 2011) (2011) has taught us that learners need a motivational boost at that point. Possible pain points for us to consider are *lack of focus*, as the students will mostly be young, *skills*, *state*, and *learning context*. We can do little do about the latter two, and since the difficulty of the tasks is predefined we cannot really take care of *skills* pain points as well. As for the other pain point, this means we should pick a gamification element that helps the students focus and if possible makes it more fun and engaging.

Identifying resources & specifying elements. Finally we needed to pick the elements that are suitable for PulseOn, and identify corresponding resources. Since we lacked the time to gamify the application to its fullest extent, identifying all resources before having picked an element would have been of little added value. Instead, we analysed PulseOn to see which elements are already (implicitly) implemented, and used this information to select elements that fit the environment. During the progress, we relied both on the knowledge we gathered in our theoretical framework, and on our earlier investigations of the platform.

3.1 Selecting elements

In order to select the most promising set of gamification elements we took the self-determination theory and levels of game design into account. The former because this theory describes the key factors of intrinsic motivation, and effective gamification relies hereupon. The relevance of levels of game design manifests itself in the fact that ideally gamification covers all of these levels. Therefore we aimed to implement a set of elements that both motivates through all self-determination factors and covers all five levels of game design. To achieve this we have created an (incomplete) overview of gamification elements that may be applied. The list, found in table 3.1, is extracted from research by Seaborn and Fels (2015), Nicholson (2012), Muntean (2011), Gee (2008), Deterding (2012), and others. Additionally some of the elements were suggested

in conversations with teacher(-consultants) employed at Lopexs, and are some adapted from Chou (2015). We have merged some elements to one (rewards encapsulates points, levels, etc), and left others out. The ones left out are based on said literature and discussions not desirable or feasible in an e-learning environment. *Competition* for instance is left out, as Lopexs' teachers consider this unsuitable for an educational setting.

Element	**Description**
Avatars	A virtual personality
Bonuses	Introduce rewarding bonus material
Cooperation	Work in multidisciplinary teams
Customisation	Highly customisable environment and profile
Discussion	Discuss or examine learning material; chat with fellow students
Feedback	Often positive and informative feedback
Goal Setting	Allow students to challenge themselves
Guidance	Guide and inform students; employ distributed intelligence
Profiles	Profile information and control
Rewards	Temporary, persistent, and unexpected rewards; achievements; levels
Sandbox	Unlimited retries
Shop	Spend your persistent rewards on interesting things
Story	Weave a story through the curriculum
Transparency	Provide clear insight
Variation	Vary assignment types, levels, and sizes

Table 3.1: An overview of potential gamification elements.

Below in table 3.2 we indicated for each of these elements whether it motivates through **M**eaning, **C**ompetence, or **A**utonomy. We classified these elements based on discussed literature, and each element comes with a quick recap to motivate why we think it fits in respective motivator categories. A plus sign indicates it can motivate through respective factor, a minus sign indicates it can demotivate through respective factor, and both signs together indicate it can do either. Cells of unaffected factors are left empty.

	Motivator			
Name	**M**	**C**	**A**	**Motivation**
Avatars	+		+	Avatars increase meaning by offering a feeling of identity, and they support autonomy via micro-control and optionally customisation. Additionally can avatars be used to visualise progress, in which case they slightly motivate through competence.
Bonuses		+		Extra materials allow students to practice more, and if rewarded accordingly are a competence motivator.

Continued on next page

Name	M	C	A	Motivation
Cooperation	+	+		Cooperation is a social experience and therefore increases meaning of the platform. Because of attached shared goals it is also an effective countermeasure to autonomy devaluation caused by rewards.
Customisation	+		+	By turning the environment into a playfield, learners feel more free and thus more autonomous. They can also give the environment a personal touch and thereby make it more relevant for themselves.
Discussion	+	+		Any type of social interaction supports learning. In case these social elements revolve around a group of users with the same interests (e.g. they all have a similar goal) the effect is amplified; users can then better share experiences.
Feedback		+	−	Short cycles of positive and clear feedback reduce the negative impact of failure, supporting the competence motivator. Non-informative feedback may however decrease users' autonomy.
Goal Setting	+	+	+	Custom goals are better fitted to learners' personal goals, improving upon meaning. They also motivate via autonomy by offering the user more freedom. Finally, completing personal goals (and being rewarded for it) enhances the feeling of competence.
Guidance		+		Computer help allows us to work above our level and thereby supports competence. Guidance and information have a similar effect by reducing the 'stress of choice'.
Profiles			+	Allowing users to create a detailed profile of themselves and changing (privacy related) settings has a positive effect on their autonomy.
Rewards	+	+	−	Although too valuable rewards may harm competence, rewards in general are a competence motivator. Persistent rewards additionally can increase meaning because they are shareable. Unexpected rewards are the only rewards that can not decrease autonomy.
		−		
Sandbox		+		Assuming informative and clear feedback this greatly reduce the price of failure, motivating students to try again. Also is success more motivating after failure and do learners simply get more practice with more retries. All are related to competence.

Continued on next page

Name	M	C	A	Motivation
Shop			+	Allowing players to buy items means they will have to make choices. Making choices that are important increases autonomy. Items that are for 'sale' may of course increase motivation as well.
Story	+			Stories are a very powerful way to generate more intrinsic motivation through meaning.
Transparency		+	+	Clear and visual information of the internal working of the system (e.g. rating) decrease the chance that students will become suspicious towards the platform. Next to this is information about what the student has done and what they still have to do a competence motivator. It helps students create a mental overview of the whole which in turn stimulates a feeling of progress.
Variation		+		Varying challenges help users enter the flow, which is related to competence. An effective application does not force variation but rather guides the user to varying challenges.

Table 3.2: An overview of motivators of potential gamification elements.

Because gamification implementations ideally incorporate elements from all game design levels, we have also mapped all elements listed in table 3.1 to these levels (table 3.3). This overview too is constructed using described theory. Some of the levels assigned to elements may require some additional explanation. In multiple cases for instance do elements cover multiple levels. This can be partially explained by looking at the broad nature of some elements. Rewards for example are a game mechanic – they commonly reoccur in games and certainly concern gameplay – and depending on the implementation of rewards it may also be a typical pattern (like points and levels). Similarly do stories often take place in a specific setting (war, fantasy, etc), and also transfer some 'hidden' message.

To provide a complete and uncluttered overview we have combined the overviews of motivators and levels per element from previous tables. This overview can be found in table 3.4. Some of the elements are, to some extent, already implemented in PulseOn; these elements are highlighted in the table and expanded on below.

PulseOn provides relatively fast feedback (in some cases it is immediate, in other cases the teacher has to examine the exercise), and aforementioned surveys also found that students acknowledge this. Closely related is the transparency of PulseOn. Although there is certainly room for improvement, the surveys' results show that learners already are better able to assess their skills. The platform also provides students with a sense of progress. It differentiates between the status icons (like the diamond and checkmark) and measures advancement on multiple levels. Additionally are users in-

formed of the size and value of learning objects, by showing expected duration and roughly the number of points that can be gained. The platform also guides the user through the coach, which consults a highly structured curriculum. This component advises the student on relevant and suitable learning units, although it does not vary suggested units. Because the recommendations are not binding, the learner is pushed to make assignments matching their skill without decreasing their autonomy. What is more, they may choose at any point in time which assignments they will make, even if these assignments are way above their level. They are – within bounds – allowed to make the assignments they prefer. Finally, PulseOn users can choose their own profile photo. These are all features that motivate users through competence and autonomy. Only in part meets PulseOn the need for meaning, namely by weaving a story through the curriculum. This story however exists at module level, rather than at course or school level; there is no theme that encapsulates all modules or courses.

Having analysed the platform's personalisation and corresponding 'gamification' elements, we can see that it primarily focuses on competence and autonomy, and much less on meaning (relatedness). Motivation is built on these three main factors, so PulseOn seems to lack sufficient meaning. The ability to relate with a platform is however very important in education. Ryan and Powelson (1991) agree to this by

	Level				
Name	**Patterns**	**Mechanics**	**Heuristics**	**Models**	**Methods**
Avatars		•			
Bonuses	•				
Cooperation	•	•			
Customisation	•		•		
Discussion		•			
Feedback	•	•			
Goal Setting		•	•		
Guidance		•			
Profiles		•			
Rewards	•	•			
Sandbox		•	•		
Shop				•	
Story				•	•
Transparency		•			
Variation		•			

Table 3.3: An overview of levels of potential gamification elements.

Element	Motivator			Level				
	Meaning	**Competence**	**Autonomy**	**Patterns**	**Mechanics**	**Heuristics**	**Models**	**Methods**
Avatars	+		+		•			
Bonuses		+		•				
Cooperation	+	+		•	•			
Customisation	+		+	•		•		
Discussion	+	+			•			
Feedback		+	−	•	•			
Goal Setting	+	+	+		•	•		
Guidance		+			•			
Profiles			+		•			
Rewards	+	+ −	−	•	•			
Sandbox		+			•	•		
Shop			+				•	
Story	+						•	•
Transparency		+	+		•			
Variation		+			•			

Table 3.4: An overview of motivators and levels of potential gamification elements.

deeming relatedness one of the area's three most fundamental factors. Therefore, we reasoned, elements expected to increase meaning of the platform will be most successful. This leaves us with *avatars*, *cooperation*, *customisation*, *discussion*, *goal setting*, *rewards* (assuming they are persistent and shareable), and *story telling*. We discard the last one, as implementing it would involve (partially) rewriting the curriculum and this is not desirable nor feasible for a Master's thesis. Neither of these elements has been scientifically assessed, so investigating any would be useful. To decide on the element(s) to implement, we have also mapped the elements currently present in PulseOn to the different levels as shown in table 2.1. This gave us that all levels but *heuristics* are represented. We therefore thought it would be wise to at least pick elements that both improve upon meaning and cover this final level.

The elements meeting this requirement on their own are *customisation* and *goal setting*. Only the latter focuses mainly on increasing meaning for the user, which is why we initially chose to direct our efforts here. Based on the framework for meaningful gamification Nicholson (2012) constructed, goal setting is one way to increase meaning for the user, as it allows them to make the platform personally relevant. Nicholson explicitly mentions the use of goal setting in education, arguing that constraints may be placed on the user's choices provided that the application is transparent about the goal setting process and its constraints. The underlying idea of goal setting is that users can create their own tooling to track aspects of their non-game activity. Meaning can be increased further by making this 'tooling' shareable, i.e. that other users can see and adopt their colleagues goals. This opens up the possibility for users with the same set of goals to form communities around these goals which is likely to truly intrinsically motivate.

These elements are both elements in the *self* category (save for the part where you can 'showcase' your goals). *Social* elements however, are generally considered very (and more) powerful instruments to increase relatedness, and social interaction is, especially in cases where there are no physical classes, important. Even though PulseOn is currently used only in combination with physical classes, it may be wise for us to consider social elements for PulseOn. Indeed, no social elements whatsoever are currently implemented, and the platform is not limited to solely use at school. The social elements that are 'available' to us are *cooperation* and *discussion*. These both don't cover the heuristics level, so we would additionally need to implement *customisation*, *goal setting*, or *sandbox* design elements.

To determine the best course of action, we presented our proposals to Lopexs. After having discussed the proposals, we concluded that even though goal setting would be useful to investigate, it is not realistic to implement it in such a short time span. Next to this did they happen to already have planned a similar feature which they refer to as *events*. This is planned for next school year. A similar thing holds for the sandbox mode; at the time of writing this is being implemented, and it will be released in the near future. As Lopexs expressed their preference for cooperation, this was opportune for us. Since sandbox mode covers the design heuristics level and cooperation covers the meaning motivator, the combination of the two meets our aforementioned requirements.

The final set of elements then covers all gamification levels and all intrinsic motivators. We have therefore focussed on designing and implementing cooperation elements in PulseOn. This means that eventually both the level and meaning gaps will be closed, even though we were – due to time constraints – only able to research the effects of cooperation elements.

3.2 Cooperation vs. Collaboration

Up to this point, we have been talking about *cooperation* elements. However, in the context of education this is often referred to as *collaboration*, which subtly differs from cooperation in this context. The two seem very much alike and are often used as synonyms for one another, but, in the context of learning, cooperation is mostly seen as splitting up a task and assigning the sub-tasks to the cooperating persons. This implies that the tasks may be performed asynchronously and with little communication. Collaborative learning on the other hand describes the practice of two or more persons performing the same task together, learning together. Students interact during learning and in some sense argue about their standpoint with regards to for instance an assignment (Dillenbourg, 1999). Since we will enable students to make the same assignment *together* and *at the same time* and expect students to *communicate* with each other about their answers, we will use the term *collaboration* from now on.

Closely related to collaborative learning is computer supported collaborative learning, often referred to as CSCL. As the name suggests this is about the practice of collaborative learning with the help of computers. This support typically takes the form of online communication, but it may also manifest itself in any other way that involves a computer, for example as a 'deskbook' or medium (Stahl, Koschmann & Suthers, 2006). One of the major advantages of CSCL over traditional collaborative learning is the possibility to offer accurately targeted and adaptive support during collaboration itself. Additionally well-designed CSCL can open up the possibility for learners to engage in complex CSCL practices that exceed their individual capabilities (Fischer, Kollar, Stegmann & Wecker, 2013). Of course, ideally we would fully make use of these advantages.

3.3 Feature Requirements

Together with Lopexs we have created requirements for the collaboration elements. The general idea is that the collaboration elements will be a separate 'layer' around the assignments. By implementing it in a for students mostly transparent way, they may collaborate on all assignments without the assignments itself having to be adapted for collaboration. Additionally the collaboration feature aims to prevent students from having to do the same work twice; PulseOn already has assignments designed to be made together, but every student in the group will have to fill in this assignment. The feature is designed for on-site synchronous collaboration, collaboration between people that are at the same location at the same time, e.g. during class. Since this is where and when PulseOn is mostly used, implementing the feature with this constraint will

be no problem for our research.

We designed the feature in such a way that it mostly relies on face-to-face interaction between students, i.e. instead of writing a chat system to support online collaborative learning, we expect students to interact on-site. The reason for this is twofold. Firstly, current usage records show PulseOn is mostly used in class and much less at home, so online collaboration functionality would have little added value. Secondly, implementing such a feature will take a lot of extra time which we do not have.

The feature looks as follows. When a user picks an assignment, a learning object, an option is presented to collaborate on this assignment. Should the student choose to do this, a selection window pops up that requests them to pick their partner for selected assignment. Not all fellow students appear in that list; only the students that do not yet have touched the assignment show up. Furthermore, those students that are not yet 'ready' for the assignment according to the system are grayed out to discourage them from being chosen. They are however not removed from the list as, just like it is for individual assignments, learners should always be able to work above their level, if they choose to.

In the selection window the student may choose one of his colleagues to collaborate. In practice this is expected to be their neighbour in class. After choosing the assignment, it starts as usual, with the only difference being that all actions will now be taken for both collaborators. In other words, if the student initiating the collaboration performs an action (e.g. making part of an assignment), the server will store this action for both collaborators, without them having to do anything. This means that there is no more need to fill in the assignment for both learners, allowing them to fully focus on the assignment.

If a collaboration assignment is paused halfway and continued later on, the student is presented with a choice. They may either continue the assignment together with their own partner, or continue on their own. The latter causes the collaboration to be ended, although the object progress for both students will be kept. It is not possible to start over after ending a collaboration, nor is it possible to start collaboration if one of the students has already started or finished the assignment.

Our feature on its own is not a typical instance of CSCL; it does not enable students to communicate online, nor does it support students during the assignment. It does however allow more efficient usage of the students' computers than they could before. Earlier, each student had to complete a collaboration assignment – even when collaborating. However, now the device of one students can be used as a deskbook, without having to switch application windows all the time. Furthermore unlocks the feature the possibility to much more advance collaboration practices, which can fully exploit the capabilities of learners' computer(s).

3.4 Feature Implementation

In order to implement collaboration as discussed earlier, we have first taken our high level technical overview PulseOn (see figure 1.6) and extended it with collaboration blocks (figure 3.1). In the overview we once again see PulseOn divided in five major

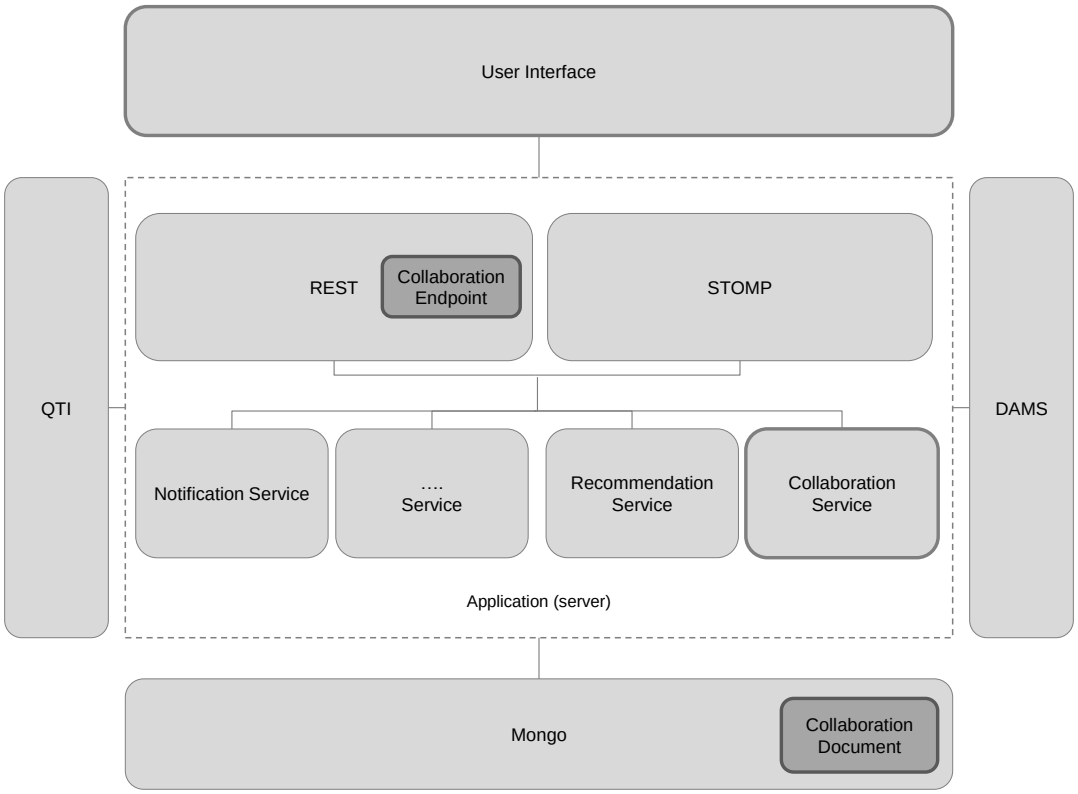

Figure 3.1: A high level technical overview of the platform that includes collaboration.

parts: *QTI*, *User Interface*, *DAMS*, *Mongo*, and *Application (server)*. Our implementation activities (highlighted) will mostly take place on the application and user interface level. On the application level we define an extra so-called *bundle* (a module) that is an independent addition to the application, by which we mean that there is no code that depends on the collaboration code (i.e. the collaboration related code may be removed without anything breaking). Additionally we add what Mongo calls a *document* in which we store collaboration related data, and finally we extend the user interface so that students may utilise the collaboration feature.

The most prominent part of the collaboration bundle is the service, which contains the code that takes care of the core logic of the collaboration feature. This includes initiating and finalising a collaboration, storing the participators of a collaboration, and exposing collaboration data that can for example be displayed to teachers. The collaboration data is stored in the application's Mongo database in a dedicated collaboration document, which is created and maintained by the service. Create, update, and delete operations with regards to the collaboration data are possible via both an internal API and a REST API. The former is used for 'internal' communication, so that other services may invoke collaboration related operations, while the latter is what the

user interface uses to communicate with the server.

The changes to the user interface are not completely independent, but can be separated and are implemented in such a way that collaboration can be turned off without it affecting the working of existing code. For the feature to work we will have to implement three additions. Each of which we will shortly describe.

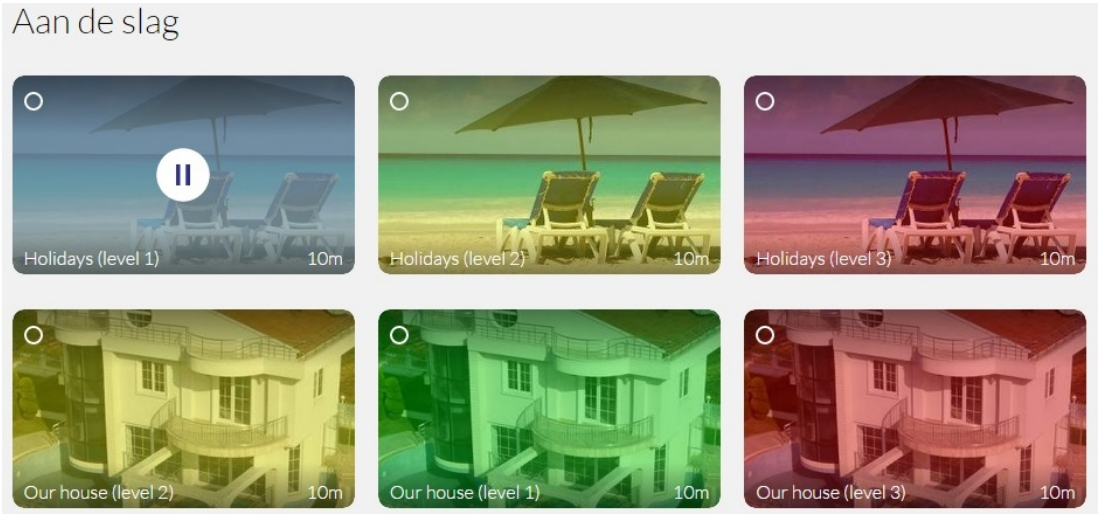

Figure 3.2: Six assignments to choose from.

The first addition is the ability for students to initiate a collaboration for a specific assignment. They can do this in the module screen. Let's say a student can choose between a number of different assignments to do (*"Aan de slag"*), for example those displayed in figure 3.2. A student can open this window as they could before. However, if they choose an assignment, for example *Holidays (level 2)*, the assignment does not start as usual. Instead, the clicked title slides away to make place for a new one that prompts the user to choose between making the assignment on your own or together with a friend (figure 3.3). The learner can now either make the assignment on their own, by selecting *"in je eentje"* (*on your own*), or collaborative, when choosing the bottom option *"met een medeleerling"* (*with a fellow student*). The arrow on the left side of the tile is the back/cancel button.

When choosing to collaborate, a user selection window pops up. This window, as seen in figure 3.4, lets students choose their partner for the assignment. Only the 'potential partners' are shown, i.e. those that are in the same group as the student, follow the same course, and have not yet started or completed selected assignment. Each student meeting these requirements is represented by their name and picture as a single option. Clicking *"Annuleren"* (*Cancel*) closes the dialog but performs no other action. Selecting a student opens up the assignment as usual, but now in 'collaborative mode'. This means that the user interface will first communicate this with the REST API, which then propagates this information to the internal API. The backing service in its turn prepares the collaboration by creating and persisting a collaboration group and

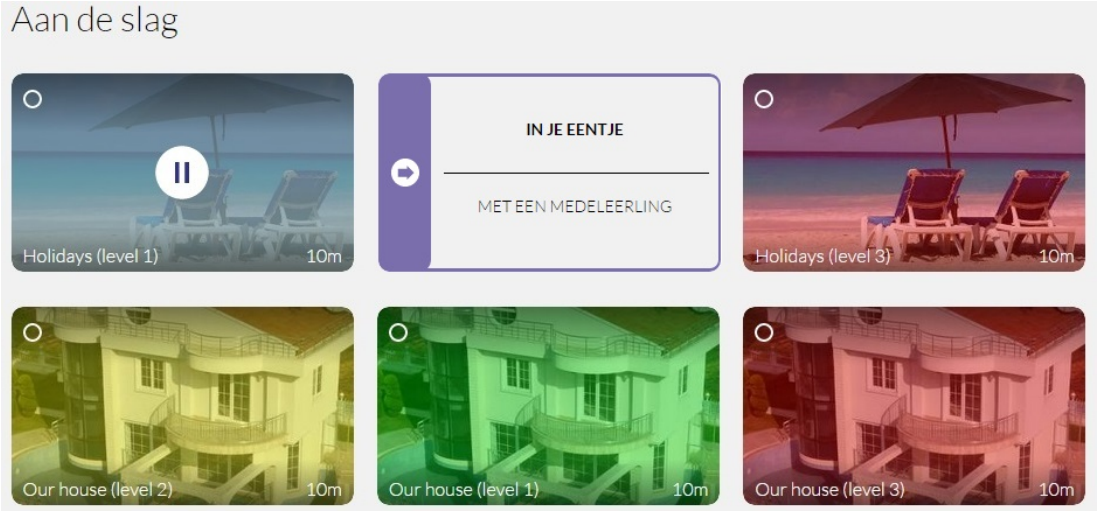

Figure 3.3: The top middle assignment is selected

initiating internal services, after which the learners can start making the assignment together. Now, each action will be 'caught' by what we call a collaboration *filter*. This filter will look at each request and, if it matches one of the group's students, propagate the request to each of its members. This effectively causes the action to be saved for all of them.

It may occur that, during a collaboration, the students take a break and close the learning environment. Now, if they resume their activities within PulseOn, they should be able to continue paused assignments with their partner (if any). Similarly, if two students want to end their collaboration, PulseOn should not force them to end the assignment. Therefore we have implemented a measure to allow learners to choose whether to continue alone or together when resuming a learning object. An example of this can be found in figure 3.5. As we see, the choice is presented using a dialog titled *"Samen doorgaan?"* (*Continue together?*). It tells the user they are currently collaboration with – in this case – Alexis Martineau and that they may either progress on their own (*"Alleen"*) or together (*"Samen"*). In the former case the collaboration is ended and the assignment opens as usual. This holds for both students, so should Alexis select the same assignment afterwards, this option is not again presented to him, and he too will continue the assignment at the point it was paused. If the other option is selected the collaboration is resumed and everything works as described earlier.

4 Evaluation

Collaboration has two 'approaches' that are relevant to us. We can look at the concept both from a gamification and an education perspective. Although this thesis is on gamification, collaborative learning is a large research field on its own and especially in relation to education (of children) it should have a structured and validated approach.

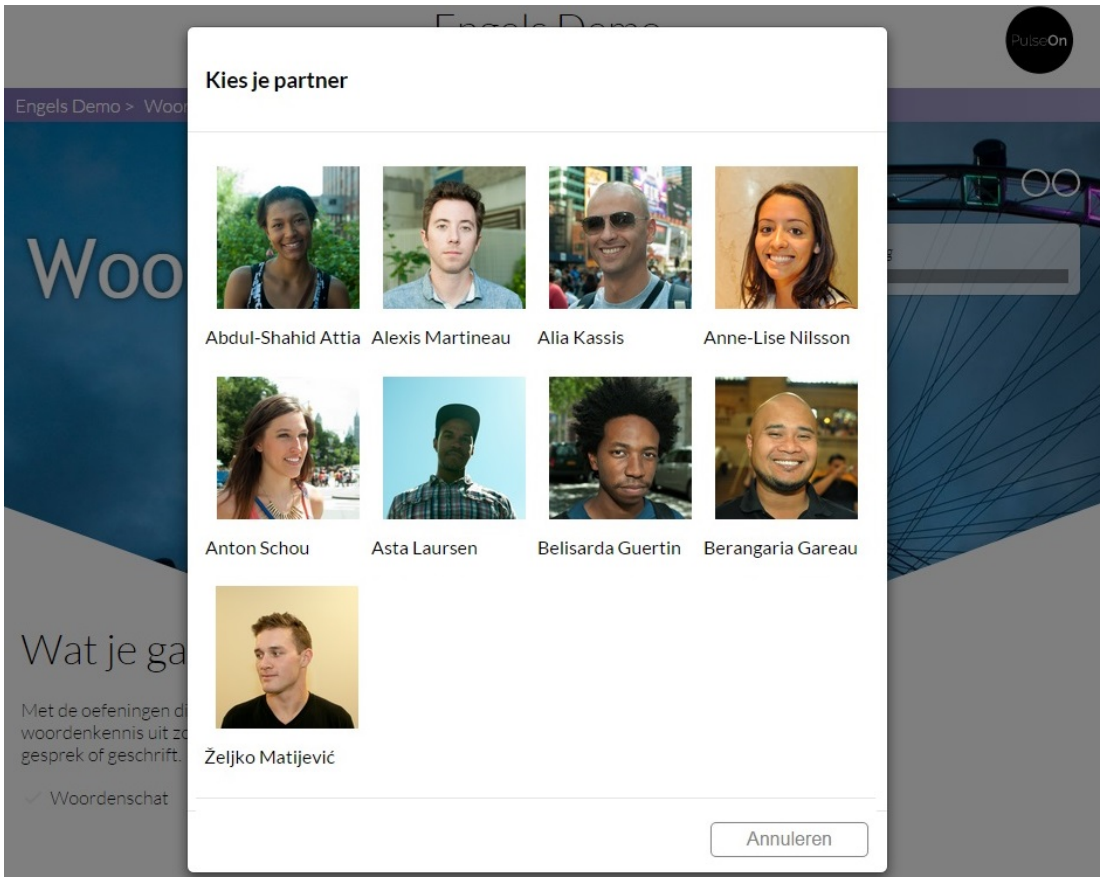

Figure 3.4: The learner chose to collaborate and can now select their partner.

Therefore we have primarily looked at collaboration (or cooperation) from the education point of view.

This section consists of two major parts. In the first part we introduce our case study's method, explain the data capture techniques, and make clear how we will analyse collected data. The second part revolves around the results. First we present them, and then we analyse them as explained in the first part. Before all of this however, let us have a closer look at collaboration and how we can detect and measure it.

4.1 Measuring Collaboration

Roschelle and Teasley (1995) define collaboration as *"a coordinated, synchronous activity that is the result of continued attempt to* ***construct and maintain a shared conception of the problem****."*. The last part of this definition (in bold), is key to successful collaboration. With successful collaboration, learners' conversational turns are smooth, build upon each other, and contribute to the problem solving activity

Figure 3.5: A dialog to ask whether the object should be continued alone or together.

by them explaining, justifying, and evaluating their own and other's ideas. Collaboration is often accompanied by conflict, but this is acceptable as long as conflicts are followed by one or more attempts to resolve it. This is part of the collaborative process (Roschelle & Teasley, 1995; Cobb, 1995). These actions are all intended to maintain said shared conception of the problem, the 'Joint Problem Space' (JSP), and this requires meaningful communication between the collaborators. This communication includes five categories: *turn-taking*, *socially distributed productions*, *conflicts and repairs*, *narrations*, and *language and action*. Together, these categories encompass the methods to build and maintain a Joint Problem Space as given by Roschelle and Teasley: *"introducing and accepting knowledge into the JSP; monitoring on-going activity for evidence of divergence in meaning; repairing divergences that impede the progress of the collaboration."*

Turn-taking refers to taking conversational turns. The flow and (communicative) content of the turns, together with the structure of the turn-taking sequence, indicate whether the communicators actually share a (Joint) Problem Space. So-called 'collaborative completion' turns are particularly useful to determine this. They yield a socially distributed production, which means as much as participants completing each other's turn. For example: one person starts with an antecedent *"if ..."*, and the other completes their turn with a consequent *"then ..."*. Such turns are especially useful for constructing shared knowledge and are therefore a valuable contributor to the Joint Problem Space. Not all turns are as smooth as this however. Some produce disagreement rather than agreement: a conflict. This does not indicate a breakdown of the collaboration, providing that it is followed by a successful repair. In that case the collaborators usually start by attempting to persuade each other of their own right, or trying to find a different solution that they both agree on, and eventually find a solution that satisfies both of them. For (dis)agreements to arise, the partners need to know of each other what they are doing, and why exactly they are doing that. Especially in collaboration environments where only one of the collaborators can perform the actions necessary to complete their task, the other may have a hard time interpreting these actions. That is why partners narrate their intentions, it allows the other to join their reasoning and if necessary respond to it. Continued attention to one's narrating usually

indicates acceptance and shared understanding. Yet, this cannot always be achieved by narration alone. In some cases, especially with CSCL, gestures and other actions can serve as a variant of narration. What is more, collaborators understanding each other through this confirms a shared understanding of the task, since narrations are often (highly) ambiguous and thereby not understandable by people not on the same page (Roschelle & Teasley, 1995; Cobb, 1995; H. H. Clark & Schaefer, 1989).

4.2 Evaluation Method

Two data collection methods dominate the evaluation studies regarding gamification: metrics and questionnaires (Seaborn & Fels, 2015). Other methods used are assessments, interviews and usability tests, but these are applied in much fewer cases than the former two quantitative ones. Questionnaires are used to determine the students' experience with the system. This includes their satisfaction when using the gamified platform, their motivation, their understanding of the learning goals and structure, and their engagement in general. Metrics are used in a much broader sense. Studies investigated the response speed, quality, and number of completed assignments, level of compliance, results of both practical and written exams, participation in class, and more. Collaborative learning studies typically focus on qualitative aspects, resolving to observation and interviews. Often these techniques are applied in small case studies (e.g. (Roschelle & Teasley, 1995; Cobb, 1995)), as collaboration requires participants to visibly display their learning, and observations require the researcher's continuous attention. This makes larger case studies much more time consuming and harder to conduct (Stahl et al., 2006).

We have followed this approach and conducted a *micro case study* to assess the quality and effectiveness of PulseOn's new collaboration feature, ultimately targeting to answer our second question: *How do our elements influence learners' motivation and learning?*. We have selected two students from a VWO 1 class (highest level of secondary school, year one) to use the feature. These students collaborated using PulseOn on their iPads for the duration of one English lesson (1 hour), during which we filmed and observed them. After the lesson we group interviewed the students to get a deeper understanding of their actions during the collaboration. Due to the small number of students and short duration we did not collect any statistics on the students' usage of PulseOn during the lesson, but instead touched upon this during the interview. We will have a detailed look at both of these data collection methods in the next sections.

4.2.1 Observation

The reasons for observing the students are twofold. Firstly, observation allows us to measure the level of collaboration among the students. If learners do not use our feature, or only use it minimally, most of our measurements would be irrelevant to our research. Indeed, they would apply to PulseOn itself instead of to the collaboration feature. Knowing to what extent students collaborate using our feature would mitigate

this risk, making the results more reliable. Also, as PulseOn now provides some level of support for collaboration, it is valuable to know the quality of the collaboration among the students. For example whether typical collaboration patterns occur, and the extent to which they indicate successful collaboration. Secondly, observing the participants gives us insight into how they use our feature, and whether they use it as expected.

To measure the former, we build upon the research of Strijbos, Martens, Jochems and Broers (2007). They found that there is scientific consensus on interaction being the key aspect of collaboration, in the context of education. They deduce that this should be the primary process to study when assessing performance and learning benefits of collaborative learning environments. Thus even though the aim of this thesis is not understanding how collaboration manifests itself with respect to learning performance, we can build on their findings to get an indication of the level of collaboration, and whether the students actually collaborate in practice. To know what type of interaction to focus on, we rely on the research of Roschelle and Teasley. They constructed a framework for analysing collaboration, which subdivides interaction to aforementioned five categories: *smooth conversational turns*, *distributed productions*, *conflicts and repairs*, *narrations of actions and intentions*, and *gestures and actions*. We direct our efforts on these events to get an indication of the level and quality of collaboration among the participants (i.e. if and how often all types of interaction occur), and to see how the collaboration (intensity) evolves throughout the hour.

For this purpose we applied *systematic observation*, as described by Oates (2005). We are only interested in whether and to what extent collaboration occurs, and how it evolves; not as much in how exactly the collaboration manifests itself. Therefore we chose to measure the frequency of aforesaid communication events, with five minute intervals. The used frequency observation table (based on the pupil observation form by Chesterfield (2015)) is added as appendix A.

We observed the usage of PulseOn using the CSCL Design Evaluation Framework by Vatrapu, Suthers and Medina (2008). This framework has been developed in order to provide a measure for CSCL encompassing more than only the effect on learning performance, as is historically the case. It consists of three components: usability, sociability, and learnability. Usability is about the extent to which a product can be used to accomplish certain goals with effectiveness, efficiency, and satisfaction. Sociability assesses the added value of the product in terms of learning support: does it help the learners with their learning in some (social/collaborative) way? Finally, learnability encompasses the learning quality and process.

Due to the small sample size and short case study duration, we could not verify learnability of collaboration in PulseOn and have instead focussed on the other two components. Regarding usability, we wanted to know whether the students understood what they had to do and did not become confused or frustrated. Sociability includes the actual usage of the system and the extent to which this matches our expected usage. We are particularly interested in the cases listed below – which we thought might occur – that do not fit intended feature usage. The items are ordered by what we thought is their likeliness to occur. Additionally have we looked out for behaviour we did not

anticipate but thought worth noting.

- The students do not use the other iPad at all, or do not use it to help them with the assignment.
- One of the students does not perform activities that contribute to the collaboration or making of assignments.
- Instead of collaborating with each other, both students choose to 'tell' PulseOn they collaborate with each other. They then both make assignments simultaneously, so that – in total – they can complete more assignments in the same amount of time.
- A student chooses to 'collaborate' with a student that is not the other under observation.
- The students 'take turns', such that one students makes assignments at a time, while the other is not involved.
- The students do not collaborate.
- The students circumvent the collaboration feature.

To get our results on this we have also conducted *participant observation* with us as a *complete observer* (Oates, 2005). Although it is usual for this type of observation to note as much as possible about the occurrences, we have concentrated our noting efforts around aforementioned evaluation framework. We have created an observation form, based on the items in above enumeration (appendix B). The *Usability* table contains five levels of 'usability', to write down the level of frustration/satisfaction the students express, combined with the optimality of the path they take through the feature-related parts of the application. For each level there is room to indicate if it holds for one of the students, and if applicable place a remark. The three other tables are all meant for sociability areas, to find out whether the students used the feature as we thought they will. Table *iPad Usage* shows five ways of using the iPad during the lesson, and again a remark area. An iPad may be employed for assignments, as a deskbook or to find information, for game-related applications, for non-assignment related browsing activities, or simply not at all. We have supplemented these options with a sixth one, for ways we had not foreseen. *Student Activities* offers the possibility to select per student in what activities they engaged in: making assignments, picking which assignments to make, helping the other student, none, or something else. Finally, we employed the *Collaboration Forms* table to note if students actually collaborated together, with a student not present, switching turns, or if they worked on the assignments on their own.

Did it go well?
Did this go as you expected?
How did this differ from how you're collaborating normally?
Did you like working like this?
Do you work together often?
Do you often collaborate for English? Can you tell me what this typically looks like?

Table 4.1: The prepared introduction & context questions.

4.2.2 Interview

We have interviewed students through a *semi-structured stimulated recall interview*, split up to three parts. The first part of the interview was meant as an introduction, to make the students feel comfortable. Additionally did it aim to provide us insight about the modus operandi with respect to collaboration, to give us a context in which we could place the students' answers to the other questions. Secondly there is the stimulated recall part, in which we wanted to gain an in-depth understanding of their motives and feelings with respect to collaboration in PulseOn. Specifically regarding any questions on the matter of usability and sociability. Had (one of) the students for example become frustrated, or not collaborated with their partner, an interview is useful to pinpoint the reason for this. Lastly, the interview targeted to get a 'global' understanding of the students' feelings with respect to English and collaboration, both in general and in the context of PulseOn, from a gamification point of view. More specifically, they aim to figure the intrinsic motivation of the students, by mapping the motivation emerging from three basic motivation needs.

The first part of the interview is structured, although additional questions may be asked depending on earlier answers. The questions were prepared beforehand and are independent of the students' actions during the lesson. The original questions can be found in appendix D, and the translated questions are listed in table 4.1. They ought to provide some context as to whether the students usually collaborate, how they do this, and if they like this.

Did you understand the working of the feature well? *If not:* Why not?
You only used only one of the iPads (every now and then), why not the other?
You used / did not use the other iPad to look up material, did you like this / why not?
Why did you use the other iPad <way they used it>?
You did not collaborate, but did tell PulseOn you do. Why?
Incidentally you were working on different assignments at the same time. Why?
You chose to work together with an other student than your partner. Why is that?
Why did one of you (incidentally) did all of the work?
Why did you not collaborate?
You did not use the collaboration feature, but did collaborate, why?

Table 4.2: The prepared stimulated recall questions we thought might need asking.

The next part, the one treating the usability and sociability questions, is unstructured. Its questions were mainly 'made up on the flow', while observing the students. In order to, if necessary, stimulate the student's memory recall, we have filmed them during the lesson. To prepare the interview (as far as possible), we have created a set of questions corresponding with the behaviour we thought might occur. These questions formed the basis for the actual questions we asked during the interview, and can be found in table 4.2 (the original questions are included in appendix D). This part of the interview dives into the questions that arose during the collaboration. The questions prepared may not all apply, whether they do depends on the collaboration process.

The final part of the interview is based on a questionnaire we originally created for this purpose. On the most basic level the survey's questions aim to measure the students' motivation to learn English using a personalised learning environment, while distinguishing between the three basic needs. Therefore it contains three sections: meaning, competence, and autonomy. Each of the sections contains questions that are meant to measure intrinsic motivation to respective motivator. As far as we are aware, no other study on gamification of education has used (and published) such a questionnaire at the time of writing, so we could not draw on their efforts. Instead we have based our questionnaire on one proposed by Broeck, Vansteenkiste, Witte, Soenens and Lens (2010), the *Work-related Basic Need Satisfaction* scale (W-BNS), and the *EGameFlow* scale designed by Fu, Su and Yu (2009). Neither are specifically meant for gamification (of education) or collaboration (in education), but we think there are enough similarities to partly base our questionnaire on these scales.

For example, even though school is of course not a workplace in the common sense of the word, there is still some overlap. W-BNS' survey is created with the intent to introduce a validated measure for the self-determination theory situated at the subjects' workplace. It consists of three (mixed) parts that are designed to map the subject's feeling of relatedness, competence, and autonomy, and these are the three values our three needs for intrinsic motivation are based on. The scale's questions are grounded in measures from earlier research and theory. Its relatedness questions focus on social relations: whether the subject (at work) feels part of a group, can share their feelings, and feels understood and respected. The competence questions aim to understand whether the person thinks they are good at what they do and feel like they are doing a good job, whereas the questions for autonomy check if the worker feels free to make their own choices, express their opinions and like the tasks they (have to) do. Since these questions are designed to find the motivator values matching the self-determination theory, they should provide us with some of the answers we need.

The questions that W-BNS can help us with, do not cover the entire spectrum of meaning, competence, and autonomy. This is because in the context of games and education, meaning for example also includes relation to and opinion of the subject, whereas the original theory focusses mainly on social aspects. This is why we chose to make use of the EGameFlow scale as well. Based on GameFlow, developed by Sweetser and Wyeth (2005), it can be used to determine learners' enjoyment of e-learning games. The original scale heavily relies on aforementioned flow theory by

Meaning
I don't really feel connected with other students at English class[w]
At English class I feel part of a group[w]
I don't really mix with other students at English class[w]
I feel collaborative towards other classmates[e]
I strongly collaborate with other classmates[e]
The collaboration in PulseOn is helpful to the learning[e]
PulseOn supports social interaction between students[e]
English is one of my favourite subjects at school[o]
Competence
I don't really feel good at English[w]
I really master my assignments for English[w]
I achieve high marks for English[ow]
I think the English assignments are hard[o]
It know why I am taught English at school[e]
I have the feeling that I can accomplish even the hardest assignments for English[w]
The difficulty of assignments match my skill level[e]
I understand what I have to do to achieve my learning goals for English[e]
Autonomy
What I am taught at English feels sensible[eo]
I know what I have to do for English[e]
I feel a sense of control over what I am going to learn for English[ew]
I feel that I can work at my own pace[e]
I am never in doubt about what I have to do next for English[e]
I am free to choose which assignments I make before I try a test[ew]
I feel somewhat connected to PulseOn[w]
PulseOn does what I expect[e]

Table 4.3: The survey questions to measure intrinsic motivation. The superscript letter(s) indicate where a question is taken or adapted from. A `w` indicates a W-BNS question, `e` refers to EGameFlow, and `o` means a question of our own.

Csikszentmihalyi and LeFevre. Not only do we build on this theory as well, e-learning games are closely related to our platform. They aim to let users learn while playing, and we aim to let users play while learning. EGameFlow divided its questions in eight different categories. We have taken questions from the following four:

- **Goal clarity:** is it clear to the player what they can do and why?
- **Challenge:** are new challenges available at a fitting pace, and do they match the player's skill level?
- **Autonomy:** does the player feel in control over the environment?

- **Social interaction:** does the platform support social interaction such as collaboration and communities?

Based on described theory we can easily map these categories to the three needs. Goal clarity and challenge are competence motivators, social interaction a meaning indicator, and autonomy trivially fits the autonomy need.

These scales have inspired us with our own questions, and building upon these studies and our own research, we have constructed the questionnaire (each question should be answered on a five-point Likert scale) displayed in table 4.3. Most of the questions are adapted from either W-BNS or EGameFlow. In some case we have added a question of our own, because we believed there was a gap that should not be left unfilled. In cooperation with two (former) teachers, now teacher-consultants at Lopexs, we have simplified all questions to be understandable by first year secondary school students. This version can be found in appendix C.

As we said, the interview questions are based on the survey's questions. To construct the interview's questions therefrom, we have taken those from our questionnaire, removed the control questions, and to some extent made the questions more open. This left us with the interview questions as displayed in table 4.4 for this part (for the original (Dutch) questions please refer to appendix D).

	Meaning
1	To what extent do you feel connected with other students at English class?
2	Do you mix well with other students at English class?
3	To what extent do you collaborate with other classmates?
4	Do you like collaborating with other classmates?
5	Does PulseOn help you to collaborate? If so: how?
6	Do you like English?
	Competence
7	Are you good at English?
8	What do you think about the difficulty of the English assignments?
9	Do you know why you are taught English at school?
10	Is it clear to you how to achieve your learning goals for English?
11	Does PulseOn make this clear to you, or does the teacher?
	Autonomy
12	Does what you are taught at English feel sensible?
13	Are you able to work at your own pace?
14	Are you able to work on the assignments you like?
15	To what extent do you feel connected to PulseOn?
16	Does PulseOn do what you expect? If not: how does that show?

Table 4.4: The motivation related questions.

4.2.3 Analysis

We have analysed the observation results in a deductive way, taken from theory. For this we following the method best fitting the two tables we introduced earlier. Regarding the frequency observation table, this is naturally frequency analysis. We did this as follows. First, we counted how many times aforementioned events occur, and checked if they all occur at a high enough frequency for successful collaboration. Would this not be the case, we would then know our other measurements are orthogonal to the collaboration feature. We expect the collaboration to be not very intensive in the beginning (when the students just started collaborating), or even 'unsuccessful', but that this will quickly increase over time and remain roughly stable for the rest of the session.

The participant observation results were also analysed by looking at the frequency of the events. As explained earlier, we have a set of events that ideally should not occur at all, and additionally we looked out for anything unexpected that we thought worth writing down. In the interview we inquired after these events, in an attempt to understand why they occurred. We did this for both the events that did occur and those that did not occur, so that we could explain why our assumptions were (in)correct. To analyse the usability and sociability results, we cannot use the framework by Vatrapu et al., as it does not provide explicit guidelines, and their case study uses statistical analysis, which would have little added value for us. Instead, we assessed the two using the observation tables we introduced earlier. The first table is on usability, and its ratings straightforward map to a level of usability. In addition to this table, there are three more that are on sociability, which all relate to the seven unintended usages listed above. The sociability is highest if all of the filled in cells correspond to a collaboration- and assignment-related activity. We further expand on usability and sociability using the interview, in which we have attempted to gain further insight into the students' feeling on the usability and sociability of the platform's collaboration support.

As for the first part of the interview unrelated to the observation, those questions are mainly meant to create a common ground during the interview and give us information on their 'usual' collaboration situation (and related areas). We then can place the answers to our other questions in better perspective. The second part of the interview is of relevance to our observation, so we have used the answers to this part while analysing the relevant observation results. For the last part, we followed the questions defined above. We first identified all relevant interview parts per question, and then answered the questions on a five-point Likert scale, as originally intended, by looking at the phrasing and explanation of the student's answers. For example, should one of the interviewees answer a question using a wording similar to "very much", this would give five points for respective question. Following this strategy we can rate each questions reliably, and also include an explanation for the answers. These answers can then be used to draw a substantiated conclusion on the level of intrinsic motivation per basic need and in general.

4.3 Evaluation Results

We have analysed and processed the pilot data we collected during the pilot using the analysis techniques described in the previous section, following the same structure we handled in our method. First, we have a look at the observation results. We will present and explain the information we collected using frequency observation, followed by a more detailed view on the students' collaboration on the basis of the participant observation results. Afterwards, we dive into the interview and both discuss the oddities and other events we found noteworthy during the collaboration observation, and the feature from what is more of a gamification point of view.

4.3.1 Observation

As described earlier, we observed the students in two ways. We used both systematic frequency observation, to measure the level of the collaboration activities, and complete observer participant observation, to value the learners' CSCL practices.

Systematic Observation. The filled in frequency table can be found in appendix E. We have used tally marks to display an indication of the number of occurrences for each of the events. Although this makes it harder to determine the exact amount, it gives us a rather visual overview of the level of collaboration and the process, which is exactly what we're interested in. The table clearly shows that, at the beginning of the lesson, the students just started to collaborate. There are relatively few turn switches, no conflicts or repairs yet, and only one distributed production. The students first discussed which assignment to make and how to start them, and then started reading the subject matter. After a couple of minutes they started their 'actual' collaboration. They collaborated with increasing intensity, until around 32 minutes they were interrupted by fellow students. After a couple of minutes however they could continue working and continued doing so for the remaining time. As the table makes clear, the students collaborated intensively for the entire hour, apart from the beginning and the interruption. They switched turns very often, completed each other, and engaged in (occasionally slightly heated) conflicts. The learners narrated almost all of their actions, read the assignments aloud, and often used gestures to attract the attention of their partner or show them a specific item on their iPad.

Participant Observation. This high level of collaboration is confirmed by the

Person	Text/Action	Application
Student B	Shall we switch?	
	Grabs Student A's iPad to get their attention	
	Now you are going to search and now can... no, err...,	
	you type now –	
Student A	Yes.	
Student B	So you will fill in now.	

Table 4.5: Student B 'asks' Student A to fill in the assignments from now on

results of the participant observation occurrence tables (appendix F). None of the ('negative') events we had prepared for occurred, nor have we seen an other remarkable event that negatively impacts collaboration. We will discuss the data we collected for each of the aforementioned tables below.

Collaboration Forms. This table shows that the students were working together for the whole session. After roughly fifteen minutes, when they had finished their first module, they switched iPad usage. Student B asked their partner if they could use Student A's iPad for assignments, and their own as a deskbook (table 4.5, appendix G.1 for the original transcript). We inquired after this in the interview, so will get back to this shortly. They did not switch again, meaning that one of the students was filling in the assignments for about a quarter of an hour, and the other for three quarters.

IPad Usage. We find the same behaviour in the iPad usage table. Initially, Student B's iPad was used for assignments, and Student A's as a deskbook. After around fifteen minutes this changed. The devices were not employed for anything other than assignment-related activities, and were only put aside during assignments that asked the students to converse.

Student Activities. The activities results table shows that both students were making assignments while they were in control of the 'assignments-iPad', and that they

Person	**Text/Action**	**Application**
Student B	Wait a minute. I think... *Outloud reads an answer he think is correct*	
Student B	*Attempts to select an other answer*	
Student A	*Presses the 'next' button*	*Next assignment loads*
Student B	I think - wait. Go back. –	
Student A	No.	
Student B	No. Go - no, seriously, I, I think I just saw something. *Grabs iPad*	
Student A	*Releases iPad and draws back his hands*	
Student B	*Selects the 'back' option* *Points at Student A's iPad* Don't tell me this is their name. [referring to the assignment]	*Previous assignment loads*
	Attempts to scroll further down thrice	*Browser window 'bounces' as there can't be scrolled down any further*
	Presses the 'next' button Alright, fortunately. Because this happens sometimes. *Gives control back to Student A*	*Next assignment loads*

Table 4.6: Student B taking control of Student A's iPad to check an answer.

were helping the other when their partner was. An exception to this is Student A, who on a regular basis attempted to seize their partner's iPad to apply a correction (mostly related to spelling), press 'reload' if they thought an assignment loaded too slow, or ensure an answer matches their own envisioned answer. An example of the latter case can be found in table 4.6, the original excerpt is in appendix G.2. Other than this, none of the students showed especially noteworthy behaviour.

Usability. Overall, the students used the collaboration feature as if they were experienced users. The first time they selected an assignment to make, they out loud read the two options (*"in je eentje"* and *"met een medeleerling"*), but after that they did not bother reading the options again but – out of habit – selected the collaboration option. Similarly did the students wonder the first time what they had to do, but afterwards knew exactly which steps to perform. Table 4.7 shows a translated excerpt from the observation covering the first-time starting of a collaboration. The original excerpt is added as appendix G.3. For each assignment, the students had to tap two times extra (one to tell PulseOn they wanted to collaborate, the other the select their partner), but this did not bother them at all. However, the students required some effort to use PulseOn itself, and one of the students expressed frustration via sighs and complaints. Partially this can be traced to collaboration unrelated issues in PulseOn, which we will get back to next section. However, the cause of majority of the required effort has its roots in the fact that the platform was hosted on the researcher's computer. A machine not as powerful as is (officiously) required to run PulseOn, making the environment slower than the students were used to. Student A commented on this while waiting for an assignment to load: *"Arg, dit is echt zo irritant."* (*Argh, this is really annoying.*) Furthermore, it turned out the server was not configured properly, which corrupted the hyperlinks in the client. Instead of them pointing to the address of the server, the links referred `localhost`, giving the students `404 NOT FOUND` errors. Manually substituting the host with the server's IP address successfully circumvented the issue, but it did require unnecessary extra effort, although the students did not really seem to care about this. Save for this, we have observed no sub-optimal usage.

4.3.2 Interview

The interview is in practice split to three parts. During its first part we first asked the students some general questions to get a better understanding of their context. Afterwards, in the stimulated recall part, we asked them to explain their actions we thought noteworthy. Finally, we presented them with the questionnaire based interview questions we prepared in order to find out what motivated them, and why. The full original transcript can be found in appendix D.

Introduction & Context. Both students indicated it went well, but immediately after that expressed their frustration caused by PulseOn (see table 4.8). They thought some multiple choice questions were unclear on the fact that the same answer may be used multiple times. Another major point of frustration was PulseOn's case sensitivity. Say an assignment asks the user to differentiate between *don't* and *doesn't* for a number of sentences, and one of the sentences is *"... he like sunny weather?"*. The correct answer

Person	Text/Action	Application
Student A	*Reads bottom option aloud:* With a fellow student	
	Selects option "With a fellow student"	*Selection window opens*
	Reads title and user aloud: Pick your partner... Student B.	
	Selects user "Student B"	*A browser popup opens*
Student B	Hey, it is possible to select <fellow student 1> and <fellow student 2>.	
Student A	*Reads popup aloud:* This websites attempts to open a popup window.	
Student B	*Asks researcher:* Should we allow this?	
Researcher	Yes.	
Student A	*Selects option "Yes"*	*Assignment window opens*

Table 4.7: The first-time opening of an assignment in collaboration mode, translated.

here is *doesn't*. However, if the user forgot to capitalise the first letter, their answer is rated incorrect. The students complained about this multiple times, both during the lesson and the interview.

The participants told us they collaborate often, at classes for both English and other courses. This typically looks like follows. They both open the assignment they have to do in one browser tab, and open the course material in an other. While making assignments, they switch between these tabs to access the assignment and deskbook respectively. For each assignment, the students discuss corresponding theory, and then make the assignment individually, followed by a comparison and discussion of their answers. Finally, they pick the answer they deem best, make sure they both have filled in the exact same answer, and submit it. In case they could not reach consensus, they either ask the teacher or each submit a different answer and wait for the teacher to examine it to see who had it right. The students like to work this way, as it allows them to effectively correct mistakes and faults. What's more, Student A told us that it *"is somewhat nicer to collaborate that way"* compared to using the collaboration feature, for exactly said reason. When asked what they think of having to fill in the answers once now instead of two times, as they are used to, the answer was *"I didn't see it as something more or less"*. Student B concurred.

Stimulated Recall. The interview confirmed our observation, in that the feature is very simple to use (apart from the bug they encountered). Student B for example, said *"it is very ea - very easy to understand."*. Their partner confirmed this and added that they think that the partner selection window (see figure 3.4) clearly displays their fellow students. However, they did take the opportunity to voice another complaint about PulseOn, being that the learning unit's progress bar is broken; in some cases it tells the student they are done (i.e. 100% progress), even though they have not finished all exercises and tests.

When asked why the students switched iPads after fifteen minutes, they told us

Person	Text
	...
Student B	Err, I think it, in principle it went fine, but errr like my friend just said, err, sometimes you fill in something, but that's not in the course material. In the explanation of the course material.
Researcher	Hmmhmm.
Student B	And err sometimes you have to add a capital letter, to a sentence, and if you don't do that it is PulseOn sees an error, even though the answer is right.
Student A	Yes.
Student B	And err, rarely but that doesn't have often, you can choose between multiple answers...
Researcher	Uhu.
Student B	Say you have six words; you can add them to the sentence...
Researcher	Yes.
Student B	And you can... but than they're often, they're more than once usable for a sentence, can you use them. Well err, say you have this sentence, than you.. you can only use each word a single time.
Researcher	Yes...
Student B	But multiple words fit there. And say you have entered that word but it should be that word, than it's automatically an error, you know. That's a bit of a waste.
Researcher	Yes, so it isn't always clear how err everything works?
Student A	Well, it is for most things but for some small things I am like well...
Student B	But it has, it really has an effect.
Student A	Yes.

Table 4.8: An excerpt in which the students express their frustration.

that was purely for pragmatic reasons; Student A, who started making assignments, their iPad has a broken standard, making it a little awkward to use it to enter the answers. They did not mention a specific reason to switch at that precise time, but did say they *"forgot"* to switch back afterwards.

While the students did not use the collaboration feature to make two assignments in collaboration mode at the same time, as was one of our concerns, we did ask what they thought of this idea and why they did not make use of this 'exploit'. It turned out that they had not thought of this possibility, and did not consider actually doing this. On the contrary, the students cared about actually collaborating, instead of letting the system think they collaborated to make assignments at a higher pace. This is made clear by the interview excerpt displayed in table 4.9. We have not asked about the other collaboration-related events we listed in the Observation section some pages back, as these are all about avoiding to collaborate, and the students made clear that not avoiding it is important to them.

We should note that during the interview the students told us that not everyone in

Person	Text
Researcher	If you can select a student to collaborate with at any time, it is of course possible to select, to select someone you don't actually collaborate with.
Student B	Hmmyes.
Student A	Yyyes but in the en... yes a teacher can eventually ju... hmmyes that's actually pretty clever, the teacher can't actually see that. Because then they have to.. yes, in any case... I'm not sure how I should say this... You? *looks at Student B*
Student B	Well.. not entirely. What do you mean like... you just do it with someone you can't well collaborate with, or just with yourself or –
Student A	Do you mean for example like that we two for example collaborate and then he sits for example err, next to err, someone else, instead of you really collaborating with him.
Researcher	Yes, for example. Or you enter each other's name but work at the same time on an other assignment.
Student B	Ooh, like that.
Researcher	Those are things you... can do, but would you.. do that? Or, err, is that just to other –
Student B	Well... I think I would just make it for myself.
Student A	That's just, that's just awkward actually.
Student B	Yes I would rather just..
Student A	I would rather just enter the person you collaborate, just do it with him or her.
Researcher	Yes because you just want to perform the actual collaboration.
Students	Yes.

Table 4.9: An excerpt in which the students react to a way to 'fraud' collaboration.

their class are as skilled and enthusiastic as they are, and some probably would exploit explained flaw. Some assignments in PulseOn are collaboration assignments, which means that two students should converse and rate each other. However, since PulseOn can not enforce this, the students can simply submit a 100 percent score. Table 4.10 shows an interview excerpt in which the students explain this 'exploit'. The students can do the same thing for PulseOn's open questions, by evaluating themselves very positive. However, in this case the teacher can still see the submitted answers, so fewer students do this. On an other matter, the students said that there are students who stop making assignments and learning in general as soon as they reached a 60% score (while they themselves aim to ace the assignments). Other students again do not like working in PulseOn and try to avoid it as much as possible, making assignments mostly in their workbook. Similarly, there are students who do not like making assignments at all and make the absolute minimum number of assignments in order to avoid imposition, and sometimes not even that.

Finally, since the students also use PulseOn at home, we also asked their opinion on 'interactive collaboration', which in this case means the ability to collaborate without

Person	Text
Researcher	Yes, and there are collaboration assignments in PulseOn. Do you already have...
Student B	No.
Student A	Yeeess, well, sometimes there are, sometimes you have to have little conversations with the other. But err, the annoying bit is, see, err, well in PulseOn you can rate yourself one hundred percent, having right everything you know.
Student B	Yes, without having done that. That's what, that's with <their teacher> also said two days ago. Then she was like "Yes, but I see a lot of people who never did this but I have heard nothing regarding this in my class. How is that possible?" You see?
Student A	Yes, so, yeess.
Student B	That is, that is, that children just fill in correctly, just perfect even though they have not even done that. So yes, that is, that is one of, one of the... –
	...
Researcher	Yes, so err so it does happen that people fill in things they have not done.
Student B	Yes.

Table 4.10: The students tell about other students forging high scores.

the necessity of being in each other's direct vicinity. They applauded such a feature, and think it is especially useful if they could do exactly the same as they could in class. That is, they came with the idea to support this by adding voice chat and screen sharing to PulseOn. This way, they would be able see each other's screen (as they are used to) and discuss their answers. We also asked them about a Google Docs-like feature: instead of sharing a recording of each other's screen, sharing the actions and cursors and screen itself. This means for instance that if one of the students types their answer in a field, the other sees this text appear on their screen in such a way that it is clear whose answer it is. Answers are submitted for both collaborators. The students said they would find this feature handy, but did not seem too enthusiastic. Instead, they suggested the screen-sharing feature explained above.

Motivation. The final part of the interview was on motivation, and we created corresponding questions based on the survey questions, and thus they are split up to a meaning, competence, and autonomy part. Below we have extracted the answer for each question based on the interview.

1. To what extent do you feel connected with other students at English class?
They feel very connected, and indicated their class is very close.
2. Do you mix well with other students at English class?
The students mix well with others in their class. They feel at home and think their class *"is just a very nice group"*, although they are not positive about all students.

They also complimented their teacher for being very nice.
3. To what extent do you collaborate with other classmates?
Their English classes require a lot of collaborating, they collaborate nearly every lesson. Usually they work together with each other, both for English and for other courses. However, sometimes this is either not possible, because one of the two is for example ill, or they just don't feel like collaborating with each other again. In these cases they don't seem to have a second regular partner, but they do avoid some of the students whom they do not think too highly of. Summarizing, they collaborate a lot with each other (as they put it, *"ninety out of one hundred times"*), but little with others, which they think is fine.
4. Do you like collaborating with other classmates?
The students are very positive about collaborating together, both with each other and with other classmates. It helps them to motivate the other and supports a strong mutual connection. Furthermore, as we saw in the results on *Introduction & Context*, they think collaboration is very handy to discuss each other's answers and visions. Sometimes they even make some sort of game out of it: when they don't reach consensus on the answer, they submit different ones to see who was right (see table 4.11). They especially like working with each other, and told us they work better together than with anyone else, which shows mainly in their far above average 'assignment making rate'. Overall, they value the collaboration itself, both because they think it is useful and because they simply like doing it.

Person	**Text**
Researcher	And do you sometimes fill in, ehh a different answer, or is it always the same answer?
Student B	*laughs* Not always. Sometimes –
Student A	Rarely.
Student B	we fill in something different, and then we check who is right or who is wrong and then, then is is really like, ehh, "Well eh, so yours is not right, mine is," like ehm, "Ik had it right so you did not" –
Student A	But the nice thing is of course you can always immediately examine your answers. The next time you then can not make that mistake again.
Student B	Yes.

Table 4.11: The students explain (why) they sometimes submit different answers.

5. Does PulseOn help you to collaborate? If so: how?
The students say PulseOn helps them collaborate, although they could not pinpoint the reason for this. They did bring up that there are assignments that require you do collaborate (for example an assignment that tells students to converse). While we observed them they also encountered and completed such assignments, supporting their assumption that PulseOn promotes collaboration in a way. Finally, they mentioned that their teacher also wants them to collaborate using PulseOn.

6. Do you like English?
Student B rather likes the language, and Student A really likes it. Both students speak the language every English lesson, as the teacher mandates this, and both think this is nice.
7. Are you good at English?
Both students excel at English. To Student B's own saying, they usually score 80% or higher on the tests. They work ahead regularly and get high grades for the assignments as well.
8. What do you think about the difficulty of the English assignments?
As we see in the excerpt in table 4.12, the students think some assignments are hard enough, while others are too simple or don't increase in difficulty over time. Especially assignments on subjects which re-appear in a later chapter are often too simple. Student B also noted that usually the assignments are not difficult enough after they have already studied for corresponding test, and that some tests introduce a (type of) question they do not know the answer to because they have not seen something similar before.

Person	**Text**
Researcher	Yes, and then, then you sometimes reach the assignments that... then err, do the assignments get harder while you get better, or do they keep a little stable? Are they even hard enough in the first place?
Student B	Wellll some assignments do get harder, but some assignments I think like "Well, that could be somewhat more difficult." Because then I do feel that, that for example I have already studied for a test, and than I make some more assignments, and than you sometimes think like "Yes, I know that now," and than maybe it could be more challenging. Something that gets difficult to test you. If you for example for such a test a more difficult question ge-gets, and you didn't really get that one before, than it actually is harder than when you uh, that question for example... would get a question like that. And than know the answer.
Researcher	Yes.
Student A	Yes...
Researcher	And for you they could be somewhat more difficult to then?
Student A	Yes, they do actually because –
Student B	Not all, some already are hard, but I think, some –
Student A	Yes, for instance, at some chapters you sporadically see for example, for example *The Present Simple*, something like that, you more like get that at the beginning of the school year in chapter one and two. And then you get exactly the same again at chapter six and seven. And while it is exactly the same, they could make that more difficult with extra details.
Student B	Yes.

Table 4.12: On the difficulty of the assignments.

9. Do you know why you are taught English at school?
Why they are taught English is crystal clear to both students. According to them English is very important, being an internationally used language. The students also note English is – in practice – required for games, movies, interviews, and YouTube. Finally, they are aware fluent English is necessary in order to fulfil their ambition of studying abroad.
10. Is it clear to you how to achieve your learning goals for English? and *11. Does PulseOn make this clear to you, or does the teacher?*
This is made rather clear to the students, both by PulseOn, which shows a list of learning goals per module (see figure 1.5), and by the teacher, whom voices the goals and tells them which assignments correspond to the targeted objectives. However, the students did not show thorough understanding of the structure of the learning goals and attached assignments/chapters in PulseOn. They did not seem to comprehend why multiple chapters handle the same learning goals, and also showed no awareness of why a certain chapter handled specific learning goals.
12. Does what you are taught at English feel sensible?
They know why they are taught English and feel their skills have increased significantly over the school year. From that point of view they think what they are taught is sensible. The students are also obliged to speak English during the English lessons, and while this took some time getting used to, they understand why this is important.
13. Are you able to work at your own pace?
Only to some extent is this possible. Usually, the teacher defines some milestones for a module, in the form of a number of assignments that are to be completed at a given point in time. The class of the students we interviewed for example was told to have completed 25 assignments that week. All students are allowed to work at their own pace, as long as they have completed at least said number of assignments by the end of the week. Working too slow is, after a warning, met with consequences.
14. Are you able to work on the assignments you like?
For some modules the teacher merely requires their students to make some number of assignments. Which assignments for that module the students then choose to make is fully up to them. For other modules however the teacher wants the students to make 'the first row' or simply all assignments.
15. To what extent do you feel connected to PulseOn?
The students did not show or word any emotional attachment to PulseOn. Although they really like working in it, they thought they could go back to the 'old way' of learning English without to much trouble, albeit with regret. There is some attachment however, as Student B did indicate that in this case he would actually *"miss"* PulseOn.
16. Does PulseOn do what you expect? If not: how does that show?
The application in general acts as one would expect. Over the course of a year, either student had only one serious problem (PulseOn failed to start), and according to Student B, this was solved within ten minutes. A less critical problem the students encountered is that in some cases the application 'forgets' their session after not having

used their iPad for a while. Apart from again expressing discontent on the case sensitivity of PulseOn, the interviewees could not recall other issues.

4.3.3 Analysis

Here we will analyse stated results as described in section 4.2.3. We summarise and analyse the results systematically, per separate part. For each part we start with a very short conclusion, followed by an elaboration on how we came to this conclusion.

Systematic Observation. The collaboration was successful. Looking at the results from the systematic observation, we can safely conclude this. As we expected did the collaboration not reach its most intensive level right away, but rather did so gradually. At its peak, the collaborators switched turns very often, resolved conflicts quickly, made their actions clear to each other, and used gestures to attract their partner's attention or reinforce their actions. These are all indicators of successful collaboration.

Participant Observation. Regarding participant observation, we were interested in a set of events that could occur, complemented by noteworthy events we did not anticipate, whether our feature has a decent usability, and the sociability of the feature.

Events. Both the students showed expected usage behaviour. That is, neither one of the anticipated events occurred, nor did an other 'game-breaking' one. The only notable event was the students switching collaboration tasks, but since this was purely for practical reasons we do not deem it important for the assessment of the collaboration (feature). Other than that, the students used the feature fully as intended. Both iPads were used, both students actually collaborated with each other the whole time and contributed to the collaboration, neither of the students circumvented the collaboration feature, nor was one of the students idling during the hour.

Usability. The usability of the feature is high. Tasks can be accomplished effectively, without too many steps to make doing so inefficient, and without dissatisfaction. None of the students had trouble using the collaboration feature (or PulseOn) at all, and they did not bother the extra actions they had to perform to start an assignment in collaboration mode. Both students followed – without having needed any support – optimal paths through the application, reinforcing the usability of the feature. Also during the interview they indicated the feature is easy to use and its design is clear. The only expressed complaints are those on having to manually substitute the hostname when opening an assignment, and those on the performance of the server. Both issues however can be addressed to the case study's setup, and are unlikely to occur in practice. Finally, as the interview made clear, even though completing an assignment with two persons now requires far fewer steps than it would without the collaboration feature, the students said it doesn't really matter to them. So, from a collaboration viewpoint, the usability of the new feature compared to the old situation is not higher, but rather equal.

Sociability. The sociability of the feature is low. Although the students behaved as expected and thereby did not abuse possible exploits of the feature, the interview made clear that they see little added value of the feature. What is more, one of the students

preferred their old way of collaborating over that using our feature, as it allows them to compare and discuss their own answers, instead of discussing the assignment and coming up with an answer together. This is unexpected, especially because the students already feel that PulseOn helps them collaborate, even though nothing to explicitly do this is implemented. This may explain why the students do not see the new collaboration feature is a significant improvement, compared to the the current situation. It does however indicate that collaboration in itself does have expected positive effects. This also shows by the fact that the students said collaborating helps them motivate each other and themselves, and helps them answering questions correctly.

Interview. Since we have already included the first two parts of the interview, regarding the observation, above, we will directly skip to the motivation part here. Additionally, since the interview also provided us with some additional information and suggestions, we will also include these in our analysis.

Motivation. The intrinsic motivation of PulseOn is reasonably high. For each of the basic needs of intrinsic motivation, we have presented the students with five or six questions. Based on their answers and other relevant fragments from the the interview, we have assigned each question a Likert-scale score from 1 (not at all), to 5 (very much so). For all questions, 1 is the lowest score and 5 is the highest. There are no negatively phrased questions. Based on the scores and the maximum achievable score for the set of questions corresponding to the motivators, we have calculated the 'percentage score'. This equals 0% in case there is no motivation at all for respective need, and 100% if we see a lot of motivation originating there. Since the minimum score for a question is 1, the percentage is calculated by (*score* − *minimum score*) / (*maximum score* − *minimum score*). The scores are displayed in table 4.13. Question 10 and 11 are strongly related to each other and are therefore treated as a single question. For each of the motivators, we will elaborate on the score.

Looking at the *meaning* motivator, we see that they are quite motivated. Motivation

Meaning							**Score / Max**	**Percentage**
Question	1	2	3	4	5	6		
Score	5	4	4	5	4	5	27 / 30	88%
Competence							**Score / Max**	**Percentage**
Question	7	8	9	10 & 11				
Score	5	4	5	3			17 / 20	81%
Autonomy							**Score / Max**	**Percentage**
Question	12	13	14	15	16			
Score	5	3	2	2	4		16 / 25	55%
Totals							**Score / Max**	**Percentage**
							61 / 75	77%

Table 4.13: The Likert-scale scored motivation related questions.

through meaning is build mainly by social aspects, but also increases if the user has affinity with the subject (English in our case), and the subject's goals coincide with the user's own. Our results showed that all of this applies to the students we observed and interviewed. On the matter of social aspects, they feel very connected to others in English class, mix well with them, and also think highly of the teacher, even though there are exceptions. They and their classmates collaborate very often, but they prefer doing so and mostly do so with the same partner. Their feeling on collaboration in general is very positive; they like doing it and also value the practice. The platform also supports motivation through social aspects, as the students believe PulseOn helps them collaborate. Next to this, the assignments (in PulseOn) and, we think, the fact that PulseOn is digital also supports collaboration. The former because there are assignments that require students to collaborate, and the latter because it allows users to easily review and change their answers, whereas this is harder using the traditional pen-and-paper way. Next to the platform, the environment also supports collaboration, as the teacher promotes it and allows the students to collaborate often. Finally, meaning is increased by the students liking English, and the fact that they want to master the language for a variety of reasons, thereby having common goals.

Regarding *competence*, the students are also rather motivated. Both students are very good at English. In fact, the assignments are too simple, and assignments unsuited to one's skill level negatively impacts motivation through competence. Similarly, some tests introduce a new (type of) question the students have difficulty with and think are too hard. As we have seen, an other powerful competence motivator is a clear and for the user sensible goal, subdivided to smaller goals, all fit in a clear structure. In our students' case, the goal is very clear to them. They have showed they are fully aware of why they are taught English. The students understand that the learning goals PulseOn offers them contribute to this goal, and it is clear to them how they are to achieve this smaller goals. Both PulseOn and the teacher provides them with this understanding. However, although all goals and chapters are structured, the students did not seem to see this structure. Neither the learning environment nor the teacher make this clear to them.

Finally we have *autonomy*, which does not contribute much to motivation. The students do know why they are taught English, and think this is sensible. Also, the study material is meaningful to them, and so is the way they are taught and the assignments they have to make. This increases perceived autonomy and is thus motivating. The students are also motivated by the stability and technical quality of PulseOn, but not very much. Although the application rarely breaks down, there are smaller issues that really annoy the students, neutralising the positive effect. Motivation is decreased by the freedom the students (do not) have. They can only work on their own pace and choose which assignments they make to some extent, and are required to make assignments, speak English, and collaborate at fixed times.

If we average all scores, we see that PulseOn scores '77%' on intrinsic motivation. This implies that PulseOn including our collaboration feature intrinsically motivates learners to a reasonably high level. The score matches both the enthusiasm the stu-

dents showed during the collaboration and interview with regards to PulseOn, and their remarks on the positive and negative parts of the application. The most powerful motivator is meaning, while we expected it to be the least contributing. This can be explained by the fact that, when building our expectations, we had not taken into account that learners would already collaborate a lot and also like doing so. Additionally, the students complained about PulseOn's case sensitivity and about some of the assignments being too vaguely worded or ambiguous. Since the relatively high frequency of these remarks, we think it significantly impacts autonomy and, to a lesser extent, competence motivation. We had not foreseen this either.

Suggestions. During the interview, we also inquired after possible adaptations of current implementation of collaboration, and as an example proposed Google Docs-like features. The students did see added value in such a feature, as it would enable them to share one screen with two persons and collaborate at home. Yet, they favoured their own idea: old-style collaboration at a distance. This means screen capture sharing and voice chat, just as they have now 'implicitly' when collaborating during class. We think they prefer this because they are used to collaborating this way and do not want to abandon it. Other students might of course (dis)agree with them.

5 Conclusion

In this thesis we conducted a literature review and analysed an existing personalised learning platform, in order to find elements that would be most suitable to the platform at the time of writing. Based on our research, discussion, and current application features, we distilled four sets of elements that would suite PulseOn best. After deliberation with Lopexs, we designed and implemented *cooperation* elements, which in the context of learning is better known as *collaboration*. Finally, we evaluated the new feature via a case study that encompassed both observing and interviewing students. We found that the collaboration functionality does not significantly support student learning or motivation, although its usability was high and usage as expected. However, the collaboration itself did support student learning and motivation.

During our research we focussed to ultimately contribute knowledge to the gamification of personalised learning area. To steer ourselves towards a useful contribution, we have formulated two research questions, which we can now both answer.

Q1 *Which elements are most suitable in a personalised learning environment?*

This question cannot be answered generically for all learning environments. As we have seen, the elements already present heavily influence the expected effectiveness of any new elements. We will therefore provide an answer in the context of PulseOn. Of all investigated elements, we found that the following ones are the most promising: *customisation*, *goal setting*, *cooperation & sandbox*, and *discussion & sandbox*. After deliberation with Lopexs, we chose to implement *cooperation* elements, referred to *collaboration* in the context of learning.

Q2 *How do these elements influence learners' motivation and learning?*

> Collaboration influences learners' motivation and learning positively; it helps them motivate each other and themselves, and supports the learning process. It does this by allowing (requiring) social interaction, which reinforces social connections between students and motivates through meaning, and by allowing students to help each other with questions they cannot as easily answer on their own, which benefits skill level and competence motivation. The feature we implemented was mostly met with indifference both during the observation and interview, and did not have any added value on the matter of motivation and sociability. Because of the case study's small scale we have not assessed the learning differences caused by the collaboration feature. Yet, we believe that little effect will be visible on this area as well, since motivation and learning are related.

We now do know that, to increase the effectiveness of personalised learning, supporting collaboration is a wise decision. However, if this is already the case, collaboration as a gamification element as we have implemented is not enough to improve upon a 'physical' collaboration situation, even if its implementation is good. At the very least, it should support collaboration without the need of being right next to one's partner. The students indicated that they would applaud such a feature, for example in the form of screen sharing and voice control. Regarding motivation, the students are rather motivated (77 out of 100 'points'), of which a small portion can be accounted to collaboration, but the interview made clear that the collaboration-related motivation does not originate in the collaboration feature. Rather do its origins lie in the 'old-fashioned' collaboration the students were already used to.

5.1 Discussion

We do not think it likely that we can generalise above results and conclusion to all students. As the interview showed, the students we piloted with are intelligent and enthusiastic, while some of their classmates are much less so. Whereas these students do not mind writing and submitting their answers each instead of once for both of them, other students may find this feature much more interesting and thereby more motivating. However, the opposite is possible as well. These students did not mind the extra steps needed to initiate the collaboration, and did not even mind the bugs they found, but for others this could cause frustration. Similarly could it be that other students do not care about collaboration itself and will happily make use of the exploit to fool the teacher. We do believe our results hold true for all students similar to the ones we interviewed, but can only speculate about others' opinion.

This brings us to the case study we conducted. One could argue that we only observed and interviewed two students, and that it would have been much more valuable had we targeted one or more classes of students instead. This is true in the sense that those results would indeed have been less biased by learner intelligence and the like, and thus more generalisable to other students. Yet, we do think our study is at least as valuable. The larger a case study is, the harder it is to keep up a high level as detail, which means large case studies often imply either quantitative studies, or

relatively shallow qualitative ones. While such research may reach a conclusion of the form *"students probably do (not) like collaboration elements"*, it often cannot say why exactly that is case, nor how this result can be amplified or improved in an other way. As this information would be very useful to the research area as a whole, we believe our small case study is certainly of value.

Because of the (unexpected) small scale of our case study, we have not thoroughly investigated our target audience. Similarly were we due to aforementioned circumstances unable to beta-test and pilot our product adaptations, leaving us with two bugs that showed up during the case study. In the end however, we do not believe any of this has seriously impacted our research. The bugs still left in the product were inconvenient, but proved no problem because of the study's small scale. Finally, we have 'compensated' the smaller scale with a much more qualitative study, so even though we were forced to move the focus of our research, its value is still as high as before.

5.2 Future Work

To our opinion, one of the most valuable follow-up researches would be one that investigates the effects of collaboration for a greater number of students and on a longer term. While our research gave insight in what students do and do not like and care about on this matter, such a research could prove useful to confirm (or reject) these results for students in general. Furthermore should the long term effects be interesting as well. The students we interviewed did not mind the extra steps they had to complete to start an assignment, and similarly did not care about having to answer questions only once now, instead of (effectively) twice. On a longer term, the former may start to annoy students, while the latter may end up doing the opposite.

An other thing we think could be investigated, is the teacher's and other learner experts' opinions on collaboration of this form. This includes both the ability to collaborate on almost every assignment, and the work of the teacher involved to guide this. In principal, our collaboration feature should reduce the workload for teachers, as it enables them to evaluate and rate the answers of two or more students at the same time. However, it also limits them, since it is now impossible to see whether the students actually collaborated and which of them did most of the work. This prevents teachers from giving their students extra support if needed, which could clash with the *personalised* part of PulseOn. In addition to mapping experts' opinions, future research could determine whether this is a valid concern and identify any other potential problems.

Finally, as we have seen, gamification is much more than just supporting collaboration. Since there has been little qualitative research on the effects of single gamification elements, especially in personalised learning environments, and much more quantitative oriented research, we believe research aiming to further fill this gap will be very valuable. And, as the effectiveness of gamification elements is related to other elements present in an application, research focussed on a combination of elements should be welcomed as well.

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Appendices

A Systematic Observation Frequency Table

Time	**Communication Event Frequency**					
Start - Stop	Turn Switch	SDP	Conflict	Narration	L&A	Other / Remark
0 - 5						
5 - 10						
10 - 15						
15 - 20						
20 - 25						
25 - 30						
30 - 35						
35 - 40						
40 - 45						
45 - 50						
50 - 55						
55 - 60						

B Participant Observation Occurence Tables

Usability

Usage	Student A	Student B	Remark
Unusable			
With effort			
With frustration			
Fine			
Excellent			

IPad Usage

Usage	Student A	Student B	Remark
Assignments			
Deskbook			
Gaming			
Browsing			
None			
Other			

Student Activities

Activity	Student A	Student B	Remark
Making assignments			
Picking assignments			
Helping the other			
None			
Other			

Collaboration Forms

Form	Student A	Student B	Remark
Together with the other			
On their own			
'Together', on their own			
On their own, simultaneously			
Other			

C Original Survey Questions

Meaning
Ik voel me niet echt verbonden met andere leerlingen bij Engels
Tijdens de Engelse les voel ik me onderdeel van een groep
Ik kan niet echt goed opschieten met andere leerlingen bij Engels
Ik help mijn medeleerlingen graag met Engels
Ik kan goed samenwerken met andere leerlingen bij Engels
Met andere leerlingen samenwerken in PulseOn helpt mij met leren
PulseOn helpt mij met samenwerken of overleggen met anderen
Engels is één van mijn favoriete vakken op school

Competence
Ik denk dat ik niet goed ben in Engels
Ik maak de Engelse opdrachten goed
Ik haal hoge cijfers voor Engels
Ik vind de opdrachten van Engels moeilijk
Ik weet waarom ik Engels leer op school
Ik denk dat ik zelfs de moeilijkste opdrachten voor Engels kan maken
De opdrachten van Engels passen bij mijn niveau
Ik weet wat ik moet doen om mijn leerdoelen bij Engels te halen

Autonomy
Wat ik leer bij Engels voelt zinnig
Ik weet altijd waar ik aan verder kan werken bij Engels
Bij Engels heb ik altijd de keuze over wat ik wil leren
Ik kan bij Engels op mijn eigen tempo werken
Ik twijfel nooit over wat ik kan gaan doen voor Engels
Ik kan kiezen welke opdrachten ik maak voordat ik begin aan een toets
Ik voel me wel een beetje verbonden met PulseOn
PulseOn doet wat ik verwacht

D Original Interview Questions

Introduction & Context

Ging het goed?
Vonden jullie het leuk?
Was dit anders dan hoe jullie normaal samenwerken?
Vonden jullie het fijn werken?
Werken jullie vaker samen?
Wordt er vaak samengewerkt bij Engels? Kun je vertellen hoe dat typisch gaat?

Stimulated Recall

Snapten jullie goed hoe het in elkaar zat? *Indien nee:* waarom niet?
Jullie gebruikten (af en toe) maar één van de iPads, waarom de andere niet?
Jullie gebruikten de andere iPad (niet) om dingen op te zoeken, beviel dat / waarom?
Waarom gebruikten jullie de andere iPad op <this way>?
Jullie werkten niet samen, maar gaven dat wel aan in PulseOn. Waarom?
Af en toe waaren jullie tegelijk aan een verschillende opdracht bezig. Waarom?
Je koos ervoor om samen te werken met een andere leerling dan je partner. Waarom?
Waarom deed één van jullie (af en toe) al het werk?
Waarom werkten jullie niet samen?
Jullie gebruikten de samenwerkingsfeature niet, maar werkten wel samen. Waarom?

Motivation

Meaning

1 In hoeverre voel je je verbonden met andere studenten van Engels?
2 Kun je goed opschieten met andere leerlingen bij Engels?
3 Vind je dat je goed samen kan werken met je medeleerlingen?
4 Vind je het leuk om samen te werken?
5 Helpt PulseOn je nu met samenwerken? Zo ja: hoe?
6 Vind je Engels een leuk vak?

Competence

7 Ben je goed in Engels? Haal je hoge cijfers/wel voldoendes?
8 Wat denk je van de moeilijkheidsgraad van de Engelse opdrachten?
9 Waarom krijg je eigenlijk Engels op school, denk je?
10 Is het je duidelijk hoe je je Engels-leerdoelen kan halen?
11 Helpt PulseOn je hiermee, of doet de docent dat?

Autonomy

12 Vind je dat het zinnig is wat je doet voor Engels?
13 Kun je op je eigen tempo aan Engels werken? Wat vind je daarvan?
14 Kun je aan de opdrachten die je leuk vindt werken?
15 Voel je je op een manier een beetje verbonden met PulseOn?
16 Doet PulseOn wat je verwacht? Zo nee: waar ligt dat aan?

E Systematic Observation Frequency Table Results

Time	**Communication Event Frequency**					
Start - Stop	Turn Switch	SDP	Conflict	Narration	L&A	Other / Remark
0 - 5	7	1	-	3	6	
5 - 10	12	5	1	5	4	
10 - 15	17	7	2	7	9	
15 - 20	26	2	4	11	3	
20 - 25	19	5	3	7	5	
25 - 30	17	5	2	1	6	
30 - 35	5	1	-	2	3	
35 - 40	-	-	-	-	-	Interrupted
40 - 45	18	6	3	2	6	
45 - 50	22	5	5	10	8	
50 - 55	24	4	3	10	11	
55 - 60	20	4	5	10	7	

F Participant Observation Occurence Tables Results

Usability

Usage	Student A	Student B	Remark
Unusable	-	-	
With effort	Yes	Yes	The students found two bugs, working around them required effort
With frustration	-	Yes	The environment was slow
Fine	-	-	
Excellent	Yes	Yes	

IPad Usage

Usage	iPad A	iPad B	Remark
Assignments	Yes (16 - 60 min)	Yes (0 - 15 min)	
Deskbook	Yes (0 - 15 min)	Yes (16 - 60 min)	
Gaming	-	-	
Browsing	-	-	
None	-	-	
Other	-	-	

Student Activities

Activity	Student A	Student B	Remark
Making assignments	Yes	Yes (0 - 15 min)	Student B took control of A's iPad incidentally after 'their 15 minutes'
Picking assignments	Yes	Yes	They followed predefined structure
Helping the other	Yes (0 - 15 min)	Yes (16 - 60 min)	
None	-	-	
Other	-	-	

Collaboration Forms

Form	Student A	Student B	Remark
Together with the other	Yes	Yes	They switched iPads after 15 minutes
On their own	-	-	
'Together', on their own	-	-	
On their own, simultaneously	-	-	
Other	-	-	

G Collaboration Excerpts

Italic text indicates an action a student or the application performed, and regular text signals an utterance. Text between angle brackets refers to a persons whose name has been anonymised by replacing it with a short description, while text between square brackets denotes a remark from the researcher. A single dash means the person corrected themselves, and a double dash signals an interruption by the other person.

G.1 Switching iPad tasks

Person	Text/Action	Application
Student B	Zullen we ff wisselen?	
	Grabs Student A's iPad to get their attention	
	Nu ga jij opzoeken en nu kan.. nee, ehm... nu typ jij –	
Student A	Ja.	
Student B	Dus nu ga jij invullen doen.	

G.2 Taking control

Person	Text/Action	Application
Student B	Wacht eens even. Volgens mij... *Outloud reads an answer he think is correct*	
Student B	*Attempts to select an other answer*	
Student A	*Presses the 'next' button*	*Next assignment loads*
Student B	Ik denk - wacht. Ga 's ff terug. –	
Student A	No.	
Student B	Nee. Ga - nee, ff serieus, ik, ik zag hier volgens mij iets.	
	Grabs iPad	
Student A	*Releases iPad and draws back his hands*	
Student B	*Selects the 'back' option*	*Previous assignment loads*
	Points at Student A's iPad	
	Zeg niet dat dit de naam is. [referring to the assignment]	
	Attempts to scroll further down thrice	*Browser window 'bounces' as there can't be scrolled down any further*
	Presses the 'next' button	*Next assignment loads*
	Oké, gelukkig. Want soms heb je dat.	
	Gives control back to Student A	

G.3 Opening First Assignment

Person	Text/Action	Application
Student A	*Reads bottom option aloud:* Met een medeleerling.	
	Selects option "Met een medeleerling"	*Selection window opens*
	Reads title and user aloud: Kies je partner... Student B.	
	Selects user "Student B"	*A browser popup opens*
Student B	Ha, je kan ook <fellow student 1> en <fellow student 2> doen.	
Student A	*Reads popup aloud:* Deze website probeert een popupvenster te openen.	
Student B	*Asks researcher:* Moeten we die accepteren?	
Researcher	Ja.	
Student A	*Selects option "Ja"*	*Assignment window opens*

H Interview Transcription

A dash indicates the person corrected themselves, a double dash (–) means the person was interrupted by an other, and an ellipses signifies a sentence that was left unfinished or stopped 'slowly'. Text between square brackets indicates a note from the researcher, and if text is between asterisks it symbolises an action for there-mentioned person. Finally, text between angle brackets refers to a persons whose name has been anonymised by replacing it with a short description.

Person	**Text**
Researcher	Hoe ging het? Om maar even als eerst te vragen.
Student A	Super. Ik vond 't wel goed gaan. Ehhmm, we hadden bij sommigen dingen hadden we wel een beetje dat 't niet helemaal was zo... en 't stond ook niet in de helpdesk, maar verder ging het... vond ik wel goed. Jij?
Student B	Ehhh, ik vond het, het ging in principe wel goed, maar ehhhhm zoals net wat mijn vriend zei, ehm, dan geef je iets aan, maar dat staat niet in de stof. In de behandeling van de stof.
Researcher	Hmmhmm.
Student B	En ehm soms moet je ook zo'n hoofdletter bij toevoegen, bij een zin, en als je dat niet hebt is het werd het fout gerekend, ook al heb je het goed.
Student A	Ja.
Student B	Ennehh, heel soms maar dat gebeurt niet vaak, maar dan heb je mogelijke keuze uit antwoorden...
Researcher	Uhu.
Student B	Dan heb je uit zes woorden; kun je ze in de zin toevoegen...
Researcher	Ja.
Student B	En kun... maar dan ze vaak, dan zijn ze vaker in de zin gebruikelijk, zijn ze dan bruikbaar. Nou ehm, dan heb je zeg maar zo'n zin, dan kun.. dan mag je elk woord maar één keer gebruiken.
Researcher	Ja...
Student B	Maar er kunnen meerdere woorden er in passen. En stel dan heb je die woord gedaan en dan is het die woord, dan heb je het automatisch al fout soort van. Da's ook een beetje zonde.
Researcher	Ja, dus het is niet altijd duidelijk hoe uh alles nou in elkaar steekt?
Student A	Nou, bij de meeste dingen wel maar ben sommige kleine dingetjes denk ik dan van ja...
Student B	Maar het heeft wel, heeft wel echt invloed hoor.
Student A	Ja.
Researcher	Ja. En ehhh, het samenwerken zelf, doen jullie dat al vaker in ehm, op deze manier?
Student B	Dat doen we al vaker. We..

continued on next page

Person	**Text**
Student A	Met heel veel vakken werken we al samen, en ook met Engels werken we eigenlijk bijna altijd wel met PulseOn samen.
Researcher	Ja. En eh, als je dan samenwerkt, dan vul je het dan ook in op één iPad of doe je dat op twee iPads, of...
Students	Allebei.
Student B	Allebei eigenlijk ja.
Student A	Dan vul je het, vul je het op eh allebei dan open je dan dezelfde opdracht en dan vul je dan hetzelfde in en dan heb je hetzelfde goed. Dus ja, dat is meer gewoon allebei.
Student B	Hetzelfde goed? *laughs*
Student A	Hetzelfde.
Researcher	Ja.
Student B	Dezelfde antwoorden.
Student A	Ja.
Researcher	Dus het was wel wat anders dan jullie normaal doen want nu hoeven jullie het nog maar één keer in te vullen. En ehm...
Student A	Ja, maar ik vond het niet echt iets minders of iets meer invullen of zo, ik vond het allemaal hetzelfde als –
Student B	Ja ik had eigenlijk hetzelfde.
Student A	Ja.
Researcher	Ja, oké.
Student A	Ja.
Researcher	En eh, jullie gebruikten nu dus de hele tijd één iPad uh om in te vullen...
Student A	Mhm.
Student B	Ja.
Researcher	En de andere om ehh om gewoon te kijken.
Student B	Ja.
Researcher	Eh, hoe doen jullie dat normaal?
Student A	Ehm dan –
Researcher	Want nu hoefden jullie dus niet telkens te wisselen, en normaal dan wel, of heb je 'm twee keer open, of...
Student A	Nou ik, eh ik doe in ieder geval altijd ehm, mijn opdracht open en de helpdesk open en dan switch je tussen de vensters en dan druk je op de ene, in het venster druk je op de ene link, en dan ga je daar weer naar toe en dan ga je weer naar de opdracht en dan weet je weer wat je daar moet invullen en dan ga je weer terug, en dan doe je... eigenlijk steeds heen en weer.
Student B	Ja 'k doe eigenlijk gewoon precies hetzelfde.
Researcher	Ja, oké. Ehm... even kijken. Eh, dat vinden jullie dan wel een fijne manier van werken denk ik?
Student A	Ja, ik –

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Person	Text
Student B	Jawel.
Student A	vind het wel handig. Ik heb niet echt problemen d'r mee... 'k kan gewoon rustig wel in tijd gewoon doen, gewoon maken.
Researcher	Ja, dus eigenlijk met eh, hoe dit normaal gaat was het niet zo heel veel verschil?
Student A	Nee.
Researcher	Het enige was dat je het niet dubbel moet in te vullen, maar dat maakt jullie niet zo veel uit.
Student A	Nee.
Student B	Volgens mij wat kleine details dat fouten waren maar het voordeel, het het ehm, het grote voordeel aan PulseOn is, voorbeeld eh het werkboek, waar je normaal in hoort te werken...
Researcher	Mmhm.
Student B	Kun je dan nakijken en zo, maar dan kun je niet je fout er aan aan zien. Want je wil niet dat elke docent je iPad gaat pakken en de hele tijd gaat nakijken. Want eh PulseOn, wanneer je dus je opdracht inlevert krijg je dus een hele goei - goeie overzicht van al je opdrachten bij elkaar.
Researcher	Ja.
Student B	Als je goed en fout hebt, wat je volgende keer beter kan doen...
Student A	Ja, en je kan ze terugsturen.
Student B	En je percentage. Je kunt ze ook gewoon terugsturen altijd.
Student A	En dan kan je dat overnieuw maken wat je niet echt goed gemaakt hebt.
Student B	Ja.
Researcher	Ja. En ehh, na ongeveer een kwartier. Eh, jij *points to Student B* begon met de opdrachten invullen en jij *points to Student A* had dan het ehm, het eh deskbook open.
Student A	Mhmm.
Researcher	En na ongeveer een kwartier wisselden jullie, en daarna wisselden jullie niet meer.
Student A	Ja.
Researcher	Eh, was dat eh opzettelijk? Of waarom eh waarom deden jullie het op die manier?
Student B	Eh, omdat de stand.. eh, ja. Student A deed hem aan de standaard en die was een beetje kapot, merkte ik. Dus dat gaat moeilijk vasthouden en typen dus dan dacht ik we wisselen effe om.
Student A	En daarna zijn we het vergeten denk ik.
Student B	Ja.
Student A	Qua wisselen met opdrachten, denk ik, ja.

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Person	**Text**
Researcher	Ja, en hoe doen jullie dat, hoe doen jullie dat normaal? Hebben jullie dan ook beiden de eh, het tabje open met eh, de extra informatie zodat je beiden kan kijken en zo.
Students	Ja.
Student A	En dan, als ik dan bijvoorbeeld iets niet weet... Uh nou meestal uh soms is het ook wel dat.. als ik iets niet weet, dat hij dan even kijkt; dan lees ik het op zijn iPad of.. dan m'n eigen, maar meestal is het dat we allebei gewoon kijken en dan zeggen van "Nou, dit is mijn antwoord, en van hem dat is 't antwoord," en dan gaan we even kijken van welk antwoord het beste is en dat vul je dan –
Student B	Ja.
Student A	in. Dat is wel wat fijner samenwerken, want soms heb ik of heeft <an other student> of iemand anders wel eens wat fout en dan ga jij [Student B] kijken "Is dat zo?" en dan heb je een ander antwoord en dan kijk je er naar en dan, dan eh dan heb je toch misschien een ander antwoord wat misschien klopt, en wat je dan in kan vullen.
Researcher	Ja, dus normaal bekijken jullie samen uhhh de theorie en daarna ga je 'm allebei los maken en dan ga je daar weer kijken wat het beste antwoord is.
Student A	Ja, dat is met de moeilijke opdrachten of als we iets niet snappen doen we dat wel weer.
Student B	Eh.. ja. Ja.
Researcher	Ja, en dat zou op deze manier natuurlijk niet kunnen.
Student A	Ja.
Researcher	Oké. Wat betreft de manier die jullie nu hebben gebruikt. Eh, s-snapten jullie hoe dat, uh, nou ja dat, jullie weten het natuurlijk wel te snappen. Jullie snapten hoe dat werkt; je moet iemand selecteren, en dan eh samen maken.
Students	Ja.
Student B	Ja het is, het is heel makke - heel makkelijk te begriijpen.
Student A	Ja-a. Als je d'r ook op klikt kon je wel zien van een medeleerling of alleen iemand anders.
Student B	Ja, maar ehh, één ding is wel zo, bij zo'n PulseOn-opdracht, nou opdracht, ehm... dan heb je zo'n bepaalde voortgang –
Researcher	Ja.
Student B	En stel uhhm, uh je hebt de helft van de opdrachten alleen maar gemaakt...
Researcher	Ja.
Student B	Eh, van zeg maar al die blokjes en zo, en dan heb je de helft al gemaakt, dan staat je voortgang op helemaal honderd procent.
Researcher	Oooh, uh –
Student B	Weet je dat nog?

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Person	Text
Student A	Ja, uh, ja dan had ik dan had ik maar vijf van de opdrachten van de tien gemaakt of zo en toen stond er al honderd procent klaar. Van het hele, het hele hoofdstuk.
Student B	Ja...
Researcher	Ja, dat dat balkje is gebaseerd op uh, op je score.
Student A	Ja.
Student B	En eh dan zeggen vaak leerlingen van "Ik heb het helemaal af, kijk zie mijn voortgang op honderd procent." Maar ja dan klopt het eigenlijk niet.
Researcher	Nou ja dat is gebaseerd op je score dus als je het goed doet, dan eh gaat die snel of, eh loopt die snel vol. Ehhh, af en toe, als je jullie samen opdrachten maken, was vooral in het tweede deel, dus na jullie gewisseld hadden, eh nam jij *points to Student B* even de iPad van hem *points to Student A* over om even te scrollen of wat aan te klikken of zo.
Student B	Ja toen wou ik ff wat verbeteren ofzo, soms zag ik bijvoorbeeld een heel rare –
Student A	Nou ja, mijn iPad heeft heel veel dat 'ie... corrigeert erin en dat zie ik dan niet altijd, dus dan ziet hij het wel en dan pakt hij de iPad van mij "Neeee niet doen niet doen".
Student B	*laughs*
Researcher	Ja ja dat dat dat is dus gewoon normaal hoe je dat uh –
Students	Ja ja.
Researcher	Dus jij *points to Student A* zit dan ook altijd als jullie samen je opdracht maken en dan beide iPads invullen kijk kijken jullie met elkaar mee om –
Student A	Ja, of dat het goed is ja.
Student B	Ja.
Researcher	Oké. Eeen uhm. ... Even kijken. Stel dit eh, stel dit wordt dan in uhh, in PulseOn ingevoerd.
Student B	Mmhm.
Researcher	Als je dus altijd een leerling zou kunnen selecteren waarmee je 'm samen kan maken, dan kun je er dus natuurlijk ook voor kiezen, dat je iemand kiest waarmee je 'm eigenlijk niet samen maakt.
Student B	Hmmja.
Student A	Jjjja maar uitein... ja dat kan een docent ten slotte ge... mjjaaa dat is eigenlijk best wel slim, dat valt de docent niet op eigenlijk. Want dan moet de.. ja, in ieder geval... ik weet niet hoe ik dat moet zeggen... Jij? *looks at Student B*
Student B	Nou.. ook niet helemaal. Hoe bedoel je qua.. dat je het gewoon met iemand dieee je niet zo goed mee kan samenwerken, of gewoon met alleen of –

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Person	Text
Student A	Bedoel je bijvoorbeeld zoals dat wij twee bijvoorbeeld samenwerken en dan en dan zit hij bijvoorbeeld eh, naast uh, iemand anders, in plaats van dat je er echt mee samenwerkt.
Researcher	Ja, bijvoorbeeld. Of jullie zetten elkaars naam neer maar werken tegelijk aan een andere opdracht.
Student B	Ooh, zo.
Researcher	Dat zijn dingen die dan wel.. kunnen, maar zou je zoiets... doen? Of, eh is dat alleen maar om andere –
Student B	Nouuu ik denk dat ik het gewoon onder mijn eigen naam zou maken.
Student A	Da's alleen maar, da's, dat is gewoon onhandig eigenlijk.
Student B	Ja ik zou eerder gewoon..
Student A	Ik zou ik zou eerder gewoon met die persoon die je samenwerkt, gewoon met hem of haar doen.
Researcher	Ja want je wil dus gewoon echt het samenwerken zelf doen.
Students	Ja.
Researcher	Oké. Eehhhh. Even kijken.. Eh, ik ga nog even wat verder doorvragen over hoe jullie normaal samenwerken. Want wat me nu opviel was dat eh..... jij *points to Student B* typte dus heel veel.
Student B	Mmmhm.
Researcher	En uh, jij gaf verbeteringen bij –
Student A	Ja en soms liet ik ook nog wel eens zien bijvoorbeeld eh stel jij hebt iets verkeerd ingetypt dan liet ik dat aan hem zien.
Student B	Ja.
Researcher	Ja, en jij *points to Student A* was geloof ik, ik heb het niet precies bijgehouden, maar jij was ook degene die ook het meeste aan de op – de antwoorden zei.
Student A	Ehmmm.
Researcher	Dat jij, dat je vaker zegt dat dat het antwoord is en dat hij dat dan invult. Is dat toevallig of... denk je denk je denk je dat dat wel klopt?
Student B	Nou... so - soms wel, maar soms heb ik ook van dat hij dan wat invult en dan zeg ik "Nee dat is niet zo, dat is zo" en dat kijken we er naar en het is eigenlijk meestal een wisselwerking van wie wat zegt.
Student A	Ja.
Student B	Nu was hij iets meer dat 'ie dat zei of en dan denk ik van "Oh ja dat is eigenlijk het goeie antwoord," en dan was het ook wel goed, alleen 't is meestal meer... 't is misschien is iets van toeval dat hij nu wat meer had maar meestal is het gewoon van dat we allebei wel zeggen van dat dat het is.
Researcher	Ja, denk je dat het er mee te maken heeft dat ehh, dat alleen jouw *points to Student B* iPad gebruikt werd om dingen in te vullen?

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Person	Text
Student B	Uuhm, nouu misschien wel want als, als ik in mijn eentje, als hij, als we allebei ons antwoord invullen dan doen we eerst ons eigen antwoord invullen en dat dat één van de twee kijkt en dan zegt de ander van "Hee dat heb ik niet en dat heb jij wel, misschien is dat niet goed". Ik denk dat het iets anders zou lopen dan dat het nu loopt, zo qua invullen.
Researcher	Ja, dus je werkt op een iets andere manier samen eigenlijk.
Student B	Ja, iets ietsjes niet heel veel afwijkend maar misschien een paar kleine detailpuntjes wat anders.
Student A	Details ja.
Researcher	Ja, en er zijn ook samenwerkingsopdrachten in PulseOn. Hebben jullie daar al...
Student B	Nee.
Student A	Jaaaa, nou, er zijn soms, soms moet je gesprekjes voeren met de ander. Maar ehh, het irritante daar is, kijk, ehh, nu in PulseOn mag je honderd procent geven, zeg maar alles goed hebben.
Student B	Ja, zonder dat 'ie dat gedaan heeft. Dat zei, dat zei <their teacher> twee dagen geleden ook. Toen zei ze van "Ja, maar ik zie allemaal mensen die dat gedaan hebben maar ik heb helemaal niks in mijn klas daarvan gehoord. Hoe kan dat?" Snap je?
Student A	Ja, dus, jaaa.
Student B	Dat dat, dat is, dat dat kinderen gewoon goed invullen, gewoon perfect terwijl ze het helemaal niet gedaan hebben. Dus ja, dat is, dat is wel één, één van de... –
Student A	En soms is het moeilijk om te leren want dan zit iedereen ook te praten allemaal.
Student B	Ja...
Student A	Daarom.
Researcher	Ja, dus eh dus het komt wel zeker voor dat mensen dingen invullen die ze niet gedaan hebben.
Student B	Ja.
Researcher	En is dat ook zo met de zelfevaluatie eigenlijk?
Student A	Ehhhhm dat is, ehhm, bij grammaticadingen dan gaat PulseOn het gewoon voor je kij - nakijken. Ook bij de woorden. Bij de zinnen moet je wel ff goed kijken want soms, ehhm, soms zit er een klein verschiltje in, ehmm, en daar moet je goed naar kijken want soms kan het goed en ook weer fout. En-ehm, ehm, hmm, ze kunnen ook gewoon alles goed maken ook al hebben ze het dan fout. Maar ja, stel je doet dat, en de docent kan ook gewoon door jouw opdracht heen zien wat jij hebt ingevuld en je hebt –
Student B	Ja, dan spreekt ze je wel aan van eh, "Dat kan je niet doen zo, dan moet je echt goed" –

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Person	Text
Student A	Daar wordt je wel voor aangesproken. Je kan wel goed evalueren maar dan moet wel, ehhhh –
Student B	Het wordt wel gezien door je docent dus dat is eigenlijk –
Student A	Bijvoorbeeld je kunt wel opgeven waar het bijna even goed als het antwoord is.
Student B	Ja als het bijvoorbeeld één of twee woordjes anders zijn en de, je hebt bijna precies hetzelfde, dan is het gewoon ook goed.
Student A	Ja, dan is het ook gewoon goed.
Student B	Dat staat ook bij de evaluatie van "nul punten: niet afwij - afwijkend," –
Student A	Juist afwijkend.
Student B	"twee punten: bijna hetzelfde antwoord als de opgave".
Student A	Het is to - het is toch juist afwijkend?
Student B	Ja, maar verder dan, dat dat zie je ook wel aan je... daaronder staan, van nul of één punt...
Researcher	Ja. Er zijn ook opdrachten die bestaan uit meerdere stappen. Komt het voor dat jullie die opdrachten halverwege afbreken of maken jullie de opdrachten wel bijna altijd helemaal af?
Student B	Nou, meestal als wij in de les zitten en we maken die en de bel gaat bijvoorbeeld, dan ruimen we altijd wel op, en dan maak ik, dan maak ik het meestal thuis af, de opdracht. En dan laat ik het gewoon in mijn venster staan en dan klik ik het aan en dan, als er bijvoorbeeld huiswerk staat van "maak hoofdstuk twee af" dan druk ik daarop en dan maak ik de opdracht verder.
Student A	Eh, even mopperen op bij PulseOn hoor. Eh, stel dat jij, je kunt ze in het venster bewaren hè, maar stel je na een uur en dan je opent 'm dan gaat je venster weer weg en dan gaat hij fouten geven. Ten minste dat gebeurt wel bij mij soms. Maar die vensters blijven niet open.
Student B	Bij mij niet, als als ik –
Student A	Bij mij wel.
Student B	Ik ik, bij mij ik heb het gewoon keer twee dagen bewaard en dan was het huiswerk en dat maak ik gewoon verder. Dus... ja daar heb ik niet echt problemen mee.
Student A	Ja...
Researcher	Oké. Ehm, jullie hadden ook uhm, een paar keer, uhm, een onenigheid tijdens de samenwerking. Dat jullie het niet eens konden worden over een antwoord.
Student A	Ja, dat zag, soms zag ik fouten bij hem, bijvoorbeeld 'Doesn't', maar dan moet daar nog 'Doesn't she' bijkomen. En zulk soort dingen. Dat soort kleine foutjes.

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Person	Text
Student B	Soms zijn wij zo van dat we niet echt een antwoord de beste vinden. Dan.. puzzelen we net zo lang en dan worden we soms ook wel van "Nou dat is mijn antwoord en dat is goed," maar... nee, de ander vindt weer dat en als je dan uiteindelijk kijkt of je vraagt het even aan de docent welke goed dan, dan, dan klopt het wel. En dan kan je ook gewoon weer verder, ehm, met de volgende opdracht.
Student A	En anders kijken we gewoon in 't theorieboekje.
Student B	Ja.
Researcher	En vullen jullie wel eens dan ook, ehh een verschillend antwoord in, of wordt het altijd wel hetzelfde antwoord?
Student B	*laughs* Niet altijd. Soms –
Student A	Heel soms.
Student B	vullen we wel eens wat anders in, en dan kijken we wie het goed of wie het fout heeft en dan, dan is het echt van ehh, "Nou eh, jouwne is dus niet goed, mijne wel," van ehm "Ik had hem wel goed en jij niet dus" –
Student A	Maar het fijne is natuurlijk je kan ook gewoon je antwoorden direct nakijken. De volgende keer kun je die fout dan niet meer maken.
Student B	Ja.
Researcher	Ja. Maar het is dan niet zo dat het uhhh, dat eh jullie het zo erg onenig worden dat jullie gewoon stoppen met de –
Students	Nee, nee.
Student B	Zo erg komt het niet.
Student A	Ja. Nee.
Researcher	Nee. Oké, dat is goed om te horen. Even kijken, eeehmmm, oké. Nou, dan heb ik ook nog wel wat eh, wat standaard vragen. Ik denk dat ik nu alles wel heb gehad over het eerste deel. Tenzij jullie zelf nog opmerkingen hebben of iets willen, of iets kwijt willen.
Student A	Hmmmmm nniet echt.
Student B	Nee.
Researcher	Misschien een idee hoe je beter zou kunnen samenwerken in PulseOn?
Student A	Nee..
Student B	Nou, ik denk dat het wel goed gaat zo. Dat je gewoon, we maken iets van elf, of tien, elf opdrachten tijdens de les en dat is echt heel veel. Dus dat.. gaat wel.
Student A	Nou, niet zo veel want –
Student B	Jawel want wij hadden wel twee dagen geleden het meeste van iedereen gemaakt.
Student A	Oh ja.
Student B	Dus ja, dan is het toch wel vrij goed. Dus onze samenwerking vind ik erg goed gaan zo en ehm wil 't wel zo houden.

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Person	Text
Researcher	Ja.
Student A	Ja, eh, over iets anders over samenwerken. Sommige kinderen in de klas vinden het fijn om in hun werkboek te werken. Dus die doen niet al te veel met PulseOn. En eh gaan ze dan helemaal zo zeggen "Ja maar ik weet toch alles al, ik hoef helemaal niet te leren, waarom moet ik dan zoveel opd - PulseOn-opdrachten maken?"
Student B	Ja maar dan heb je al toen, bijvoorbeeld dan hoor je het cijfer van diegene en dan denk je van "Ja was het dan toch niet beter om gewoon in PulseOn te gaan oefenen?" Want –
Student A	Ja, want heel gauw bijvoorbeeld –
Student B	ik had dan bijvoorbeeld een.. vrij hoog cijfer, en een ander had dat dan iets later maar die had dat dan weer minder gedaan in PulseOn, of juist weer heeeel veel.
Researcher	Ja.
Student B	En die had dan weer een lager cijfer dan mij, terwijl ik het gewoon wat minder had gedaan. Gewoon, gewoon leren.
Student A	Soms, soms is het niet fout maar wel laag. Dan heeft hij maar zestig procent. Dat is nog wel net voldoende in PulseOn, maar ik zou die fouten eruit halen. Want ik ken wel sommige kinderen in de klas die doen dat niet, die hebben dan nog zo'n fout ofzo, maar die laten ze niet toekennen.
Researcher	Ja, als het kan moet je dat natuurlijk doen.
Students	Ja.
Student B	Daar leer je ook het meest van.
Student A	Van fouten... leer je ja.
Researcher	Ja.
Student A	Het is echt zo.
Researcher	En ehhm eh zouden jullie er iets voor voelen om op afstand, bijvoorbeeld thuis met elkaar samen te kunnen werken?
Student B	Dat zou ik wel leuk vinden.
Student A	Dat lijkt me wel handig. Maar daar, kijk je hebt wel FaceTime, maar dan kun je niet –
Student B	Dan kun je niet naar PulseOn terug.
Student A	naar je apllicaties of zo.
Researcher	Dus als er iets in PulseOn zou zitten waarmee je dat kan doen, dan –
Student B	Ja, ik zou het wel heel leuk vinden.
Researcher	In ieder geval praten. En.. en jullie kennen Google Docs denk ik?
Student A	Google Docs? Dat is een document denk ik hè?
Researcher	Ja, maar jullie kennen dat systeem met die kleurtjes van de cursors en zo?
Student B	Ik niet helemaal...
Student A	Ik wel.

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Person	Text
Student B	Ja, hij wel.
Researcher	Nou, dat is dus dat je... ehh, een schermpje hebt, bijvoorbeeld zo'n zo'n, zo'n tekstschermpje waar je zinnen moet invullen.
Student B	Ja, ja.
Researcher	En dan zie je dus ook waar de cursor, het streepje van de aandere leerling staat.
Student B	Oooooh, zo jaa.
Researcher	Zou je dat handig vinden of denk je dat het gewoon goed genoeg is om ehh.. samen te kunnen praten en dat je dan PulseOn invult?
Student A	Dat is wel handig eigenlijk, maar uhhhh het lijkt me ook best wel handig dat je dan je scherm deelt en dan kun je zeg maar je antwoorden gewoon praten tegelijkertijd. Dat je ook gewoon in PulseOn dat kan zien.
Student B	Ja.
Student A	Als je bij de ene helft van het scherm gewoon die andere persoon's scherm kan zien. Dan kun je daar die fouten eruit halen. Maarrr dat gaat nog wel moeilijk worden hoor. Want het is niet zo makkelijke, dat is niet zo makkelijk als je denkt.
Researcher	Ja, oké. Dan nu dus uhhm een paar een paar uh standaard vragen. Eh, in hoeverre.. één voor één, één voor één beantwoorden graag... –
Student A	Oké.
Researcher	Nou, eerst jij *points to Student B* dan, en daarna jij.
Student A	Ja.
Researcher	In hoeverre voel je je verbonden met de, de andere studenten bij, bij Engels? Mag je ze, voel je je thuis daar, of..?
Student B	Uhhhh, nouja als ik in de les zit dan heb je gewoon wel de medeleerlingen en dan vraag ik soms ook wel eens van "Wat heb jij?" Of wat anders? En thuis, ja dan maak ik het gewoon meer alleen. Dan is 't niet echt dat ik denk van "Oh, wat zou nu een ander hebben?" Denk ik dan vul ik gewoon eerst mijn eigen antwoord gewoon in. Gewoon zelf.
Researcher	Ja.
Student A	Nou... ik denk gewoon..., ik vul het gewoon zelfstandig in en soms ja, werk ik gewoon met hem samen, maar vaak vul ik het wel gewoon zelfstandig in en niet echt met alle studenten.
Student B	Ja, je bent eigenlijk of met je buurman of buurvrouw of je leerling die naast je zit en verder heb je niet echt heel veel met de andere leerlingen te maken.
Student A	Niet zo nee.
Researcher	En voelen jullie je op je plek daar... –
Students	Ja.
Researcher	in de klas? Leuke klas?

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Person	Text
Student B	Heel erg ja. Hele hechte klas.
Student A	Ja.
Researcher	Ja, dat is gewoon echt een goeie groep om eh –
Student B	Ja. Ja.
Researcher	om mee samen te werken?
Student A	Ja.
Student B	Niet iedereen, maar meest... de meesten wel.
Researcher	Nee, oké.
Student A	Ja.
Researcher	Werken jullie altijd samen samen, of ook met andere mensen?
Student A	Eh, ja –
Student B	Eh, bijna altijd werken we samen, maar soms hebben we ook wel, als één van de twee, dat we even met iemand anders willen. Gewoon één of twee lessen en dan gewoon weer met elkaar samenwerken.
Student A	Ja, inderdaad. Ja... ja ja.
Student B	Of als ik bijvoorbeeld ziek ben, of hij, dan moet je wel met een ander samenwerken.
Student A	Ja.
Student B	Maar meestal werken wij negentig van de tien, honderd keer werken we wel samen.
Student A	Negentig van de honderd keer... je zegt negen van de tien.
Student B	Ja, negen van de tien.
Researcher	Jullie werken ook gewoon beter met elkaar samen dan, dan met anderen?
Student A	Jaaaa.
Student B	Ja, want wij, ook bij wiskunde bijvoorbeeld, werken wij heel, heel ver naar voren. Wij kunnen echt heel goed van, ja, snel werken, dus ja dat eh –
Student A	Ja, ook daar moeten we in PulseOn, dat –
Student B	Ja, daar werken we ook wel veel mee, met PulseOn, en dat is ook wel leuk. En dan werk je ook vrij gauw en snel samen met elkaar.
Student A	Je kan elkaar ook motiveren.
Student B	Ja.
Student A	Op een bepaalde manier.
Researcher	Ja. En ehh, vind je dat PulseOn je bij eh, d-dat PulseOn je nu helpt bij eh, samen te werken?
Student B	Ja, want het is wel bij Engels dat je dan bijna elke les wel doet, en dan kun je wel samenwerken dus dan maak je het eigenlijk nog beter met die samenwerking dat je elke keer wat beter met elkaar gaat samenwerken.

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Person	**Text**
Student A	Ja.. ja, eh, ja, eigenlijk wel. Want eh, er zijn dan ook opdrachten bij eh, die je ook, die je dan ook met z'n tweeën moet doen en dat maakt ook weer zo'n sterkere band met elkaar.
Researcher	Ja, maar dat ligt dan ehh, ligt het aan PulseOn als programma, dat je daarmee kan helpen, of is het echt de opdrachten en uh, de docent die jullie samen wil laten werken?
Student A	Hmmmm mmm.
Student B	Denk beide.
Student A	Denk beide ja.
Student B	Het is PulseOn die je echt samen wil laten werken met een ander, dus die opdrachten, en de docent die wil ook wel dat je leert met elkaar samenwerken of –
Student A	Ja.
Student B	wat met elkaar samen doet, of dat ze ook wil zien hoe dat gaat. Ook die na, eh nameting nakijken.
Researcher	Ja. Vinden jullie Engels een leuk vak?
Student B	Jawel.
Student A	Ja, 't is heel fijn.
Researcher	Ja?
Student B	Ja, ik speel ook veel Engels...e games en al die dingen. En ik kijk ook wel wat Engels, dus het is wel fijn dat je steeds meer leert. Want als ik bijvoorbeeld terugkijk. Twee jaar geleden, toen ik nog niet zo goed Engels kon, en nuuu, dan zie ik al een hele vooruitgang qua Engels. En dan denk ik van "ja, dat is toch de wereldtaal op 't moment, –
Researcher	Ja.
Student B	en als je dat goed leert, dan kan je gewoon overal praten." Dus dat is, dat, dat is vind ik wel fijn aan Engels. Dat je er ook gewoon kan leren, en ik vind het wel ook een fijne taal.
Researcher	Ja, je je weet echt waar je het voor doet.
Student B	Ja, ja. Ja.
Researcher	En dat geldt voor jou ook dan?
Student A	Ja, want Engels is heel belangrijk en je hebt het nodig. En, en, in bijna alles heb je wel echt Engels nodig. Zowel spelletjes als films dan moet je kijken, of bij interviews als je internationaal bezig bent...
Student B	Ja. als je internationaal bezig bent. Als je gewoon in Nederland bezig bent dan is alles gewoon Nederlands, en dan heb je Engels niet echt nodig, maar als je echt over de wereld kijkt, bijvoorbeeld YouTube of andere dingen, dan is het echt bijna negentig procent is gewoon Engels.
Researcher	Ja.
Student B	Dan is het wel fijn dat je het gewoon geleerd hebt.

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Person	**Text**
Student A	Met Engels kan het zo zijn, ten minste ik weet me eh, is de kans vrij groot dan je je studie in het buitenland kan uitvoeren.
Researcher	Ja, ja klopt.
Student B	Ja, want als je goed Engels kan kun je sowieso naar het buitenland.
Researcher	En jullie praten ook Engels in de klas. Hoe bevalt dat?
Student B	Dat vind ik wel leuk, alleen bij de eerste keer zoals... geldt dat dat dat, dat 't wel even wennen was. Dat je wel even, want je praat natuurlijk het eerste half jaar gewoon Nederlands, en nou opeens wordt het Engels dus dan moet je wel even wennen. Maar nu praat ik gewoon standaard Engels. Meestal is de eerste zin die ik in de klas uitspreek Nederlands, alleen dat hoort ze dan meestal niet, dus het is wel fijn dat ik dan niet wordt gehoord.
Student A	*laughs*
Researcher	Ja. En uh, julle zijn allebei goed in Engels begreep ik.
Student B	Ja.
Student A	Ja.
Student B	Ja, sowieso wel acht punten en hoger haal ik wel. En ik, ik ik begin iets minder, maar daarna gaat het, het gaat steeds hoger, steeds beter, want je weet hoe je moet leren met Engels en dat je meer leert, dus..
Student A	Inderdaad ja.
Researcher	Ja, en dan, dan kom je soms bij de opdrachten uit... dan eh, worden die moeilijker als jullie beter worden, of blijven ze een beetje constant? Zijn ze überhaupt moeilijk genoeg?
Student B	Nouuu sommige opdrachten worden wel wat moeilijker, maar sommige denk ik ook van "Nou, dat zou wel iets moeilijker mogen." Want dan heb ik wel dat, dat ik bijvoorbeeld al geleerd heb voor een toets, en dan maak ik nog wat opdrachten, en dan denk je soms wel van "Ja, dat weet ik nu," en dan zou dat misschien iets uitdagender mogen. Iets wat moeilijk wordt zodat je getest wordt. Als je bijvoorbeeld op zo'n toets een moeilijker vraag ke-krijgt, en die heb je niet echt gehad, dan is het toch wel wat lastiger dan als je uh, die vraag bijvoorbeeld... een soort vraag daarvan zou krijgen. En die dan zou weten.
Researcher	Ja.
Student A	Ja...
Researcher	En voor jou zouden ze ook wel wat moeilijker mogen dan?
Student A	Ja, eigenlijk wel want –
Student B	Niet alles, sommige zijn al moeilijk, maar ik denk, sommige –

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Person	**Text**
Student A	Ja, bijvoorbeeld, bij sommige hoofdstukken kom je bijvoorbeeld ook heel soms, bijvoorbeeld *The Present Simple*, zoiets, kom je meer in het begin van het schooljaar tegen bij hoofdstuk één en twee. En dan krijg je precies hetzelfde weer bij hoofdstuk zes en zeven. En terwijl je dat precies hetzelfde is, dat mogen ze wel wat moeilijker maken met extra details.
Student B	Ja.
Student A	En ehhhh, ff tussendoor. Hoe laat is het eigenlijk?
Researcher	Het is nu twaalf uur.
Student A	Kunnen we tot één uur doorgaan?
Researcher	*laughs* Dat wordt wel heel lang. Ik heb nog vijf vragen of zo.
Student B	Welke les hebben we hierna eigenlijk dan?
Student A	Mentorles, met mevrouw <last name other teacher>. Ik mag haar niet, dus daarom wil ik er niet bij zijn. *laughs*
Researcher	Aah. Is het eh, is het jullie duidelijk hoe je de leerdoelen voor Engels kan halen?
Student B	Jawel. 't Is veel.. als je nu een hoofdstuk hebt zie je wel deze worden moet je voor die, dit hoofdstuk kennen, deze grammatica, waardoor je dat kan toepassen in de taal, en dan eh, dat je dan eigenlijk, als je op de iPad kijkt en het schoolboek, dan heb je één hoofdstuk en daar staat alles in wat je voor dat hoofdstuk moet leren, en dan weer het volgende hoofdstuk –
Student A	Ja gewoon heel makkelijk, ja.
Student B	Vrij duidelijk.
Researcher	Ja, dus PulseOn helpt je daar al wel erg mee.
Students	Ja.
Researcher	En krijg je d'r ook ondersteuning in uhh van de docent? Dat die dat vertelt.
Student A	Ja, ja.
Student B	Ja, die wil dat we dat maken –
Student A	Stel uh –
Student B	in de les vooral.
Student A	Stel... stel we hebben zo'n ma.. eh zo'n vak, die opdrachten, dan kun je die dingen gewoon terugsturen en opnieuw maken.
Student B	Ja, die kun je dan wel opnieuw maken. Die maak je dan gewoon weer goed omdat je dan weer wat meer geleerd hebt daarvan.
Student A	Ja.
Student B	Dan kun je het zo beter leren. Beter... begrijpen.
Researcher	Ja. Gebruiken jullie PulseOn ook thuis?
Student B	Ja.
Student A	Thuis, ja. Als je hui eh je hui ehh ja, kun je al h –

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Person	Text
Student B	Kun je al huiswerk maken, maar soms denk ik ook gewoon van “Laat ik het gewoon eerst maken”.
Student A	Ja, anders moet het in de les weer maken..
Researcher	Maar je vindt het ook leuk om in PulseOn te werken dan?
Student B	Jawel, ik vind ‘t wel leuk. Het is wel veel lerend, het is veel, eh eh, het is, je leert er veel van.
Student A	Ja, het is zoals, uh precies hetzelfde als de werk- werkboek maar dan met extra functies. Wat ook wel handig uitkomt voor je –
Student B	En ik vind dat je ‘t daardoor beter leert voor de toets dan dat je ‘t gewoon uit je... leer - leerboek, of uit je schoolboek leert. Ja.
Student A	Ja, dan moet je ze allemaal nakijken en bij PulseOn werkt het beter.
Researcher	En en, voelen jullie je dan ook, misschien een beetje een vreemde vraag. Voel jullie je op een bepaalde manier een beetje uh uh, verbonden met PulseOn? Ik bedoel, zou je d’r zonder kunnen om eh, Engels te leren, of uhhh...
Student B	Nouuu, ik... voor een toets daarvoor leren zou ik misschien wel kunnen, maar ik denk voor veel nieuwe dingen niet echt. Dat zou ik dan wel moeten herhalen, maar, maar eeeh, dingenn die worden herhaald zou ik dan wel gewoon kunnen. En ik, ik, ja, verder zou ‘t wel gewoon kunnen als ‘t gewoon herhalende dingen zijn die we net hebben gehad bijvoorbeeld. Ik denk als ik een jaar geleden, wat we een jaar geleden voor het eerst geleerd hebben, dat ik dat nog wel een beetje zou weten, maar gewoon, beetje omhoog halen.
Student A	Ja, eigenlijk precies hetzelfde.
Researcher	Ja. Dus, ‘t is... j-jullie vinden PulseOn heel fijn, maar je zou wel zonder kunnen, het is niet –
Student A	Ja, ik denk ‘t wel.
Student B	Ja ik zou wel zonder kunnen maar het is wel fijn om bijvoorbeeld een, een iets te leren ervan. Wat je nodig hebt.
Student A	Ja.
Researcher	Ja, zou je het van de ene op de andere dag kunnen, kunnen mee kunnen stoppen? Of zou je het dan missen.
Student B	Ja, ik denk het wel.
Student A	Ehhh –
Student B	Ik denk dat ik het ‘t ook wel, tijdens de Engels les bijvoorbeeld vind ik het wel leuk om PulseOn te maken, en daardoor soms ook wel... maar ik denk dat ik het soms ook wel zou missen maar ik zit ook wel ehm...
Student A	Ja, het ‘t ge, ‘t ge, het eh ehmm...
Student B	Een beetje beide... Ja
Student A	Ja.

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Person	Text
Researcher	Ja. En uh, kunnen jullie binnen PulseOn werken aan de opdrachten voor Engels die je zelf leuk vindt? Mag je kiezen wat je doet, of –
Student B	Nou ja je wel ehm eh ehm in eh, in een, in een hoofdstuk, met eh een row, of eh, nou ja in het hoofdstuk moet je in ieder geval kiezen maar dan kan je gewoon alle opdrachten die je wil maken kan je wel kiezen.. Maar je moet alsnog die niet leukere toch maken –
Student A	Ja, uiteindelijk wel –
Student B	maar dan maak je in ieder geval eerst de leu –
Student A	Ten minste het gaat om wat de docent zegt. Want bijvoorbeeld soms zeg je, bijvoorbeeld onze docent zegt "Dan moet je de hele rij afmaken, met inclusief de niet leuke opdrachten en dan de leuke opdrachten die je zelf vindt." en s - bij de andere, is een beetje verschillend per docent. Want een ander zegt dan weer "Jaaa, maak tien opdrachten met PulseOn, die je zelf leuk vindt".
Student B	Ja, en dan kan je weer naar de volgende, ga je naar de tien die je zelf leuk vindt.
Student A	Ja dus.. ja het is afhankelijk wat de docent als huiswerk je geeft.
Student B	Ja.
Researcher	En letten docenten daar dan op, ehhh, dat je bijvoorbeeld de *Test Jezelf*-opdrachten goed kan maken of is het echt ehm "Maak nu gewoon vijf opdrachten"?
Student B	Nou je eh ziet wel, ze heeft wel een schema van hoe veel diegene gemaakt heeft van dat hoofdstuk en hoe veel die dag, daarvoor bijvoorbeeld. Dus ik had bijvoorbeeld laatst dat eh, dat ze zei "Nou Student B heeft er 28, dat is goed", maar ik hoorde ook wel dat kinderen gewoon twee of zes van dit hoofdstuk, terwijl je er al op bijna 25 moet zitten. Dus die hebben dan gewoon niets gemaakt en dat kan zij dan zien en dan kan ze gewoon zeggen van "Ja, nou wil ik morgen dat jij dat allemaal gemaakt hebt, anders mag je strafwerk gaan merken of nakomen." –
Student A	Nou, strafwerk, dan gaat ze maatregelen doen of zo.
Student B	Ja, dan, dus je moet, dus je moet, je moet ook niet denken van "Ach, dat maak ik wel binnen één dag." Nee, vijftien per da - één, één dag is vrij veel.
Researcher	Ja.
Student B	Je kan het beter verspreiden.
Student A	Ja.
Researcher	Enn ehm, de opdrachten die je dan, uhm, de de de toetsen die binnen PulseOn zijn...
Student B	Mmhm.
Student A	Ja.

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Person	Text
Researcher	Als je die allemaal goed maakt, moet je dan ook nog de opdrachten maken?
Student A	Ehhhhh –
Student B	Ja, als je, ik denk als je het goed begrijpt, dan hoeft het niet meer, –
Student A	Nee.
Student B	maar als je het nog niet zo goed begrijpt is het beter om de opdrachten toch nog te maken.
Student A	Ja... 't is...
Researcher	Ja. En ik hoorde jullie net ook een beetje klagen over PulseOn met die hoofdletters en dergelijke en ehh –
Student A	Eh jaa.
Researcher	Dat soort dingen de de.. doet PulseOn een beet-, over het algemeen wat je verwacht dat het zou moeten doen? Of uh, gedraagt het zich raar op sommige punten?
Student A	Sommige punten.. doet 'ie best wel raar, want eh –
Student B	Soms, want ik vind dat 't vrij... goed 't doet, maar sommige punten denk ik van "Dat zou... misschien nog ietsjes anders mogen." Zoals die hoofdletters of die andere dingen, dat 't dan dat 't dan toch goed wordt gerekend, maar wel dat je dat je ernaast zet van "volgende keer een hoofdletter gebruiken als je dat niet gedaan hebt maar 't wel moet." Dat zou ik dan beter vinden, dat je dan denkt van "Oh ja, die hoofdletters moeten erbij." Zo denk ik dat je 't beter leert dan dat je 't fout wordt gerekend en dat je het opnieuw moet doen terwijl je alleen maar een hoofdletter bent vergeten.
Researcher	Dus wat duidelijker zeggen wat je dan fout doet.
Student A	Nou dat –
Student B	Ja.
Researcher	En het crasht niet of zo dan?
Student B	Nee.
Student A	Ehhhhm –
Student B	Ik heb 't één keer gehad dan, –
Student A	Ja één keer maar. –
Student B	toen wou die niet opstarten, alleen toen moest je gewoon je iPad opnieuw op - opstarten, en weer aan doen, en dan wou, dan wou het wel –
Student A	Ja, één keer, maar dat wordt wel binnen een dag opgelost, zo... –
Student B	Ja dat was eh, sowieso binnen, bij mij binnen tien minuten opgelost.
Student A	Ja.
Researcher	Oké. Eh, dit was het denk ik. Ik heb niks meer staan. Hebben jullie nog uhh... zelf nog vragen of opmerkingen?
Student B	Nee. Ik heb alles wel gezegd.

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Person	**Text**
Researcher	Ja?
Student B	Ja.
Researcher	Jij ook uhh, alles gezegd –
Student A	Ja, ja.
Researcher	wat je wil, wat je wil zeggen.
Student A	Ja.
Researcher	Bedankt voor jullie tijd.