Planera Mera: The perceived gaming experience of the application Planera Mera with adolescents with mild intellectual disability

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Abstract

The purpose of this study is to examine the users’ experience of the game *Planera Mera* and what parts of the game that increases or decreases their gaming experience for adolescents with mild intellectual disability. 15 adolescents in the age of 16 to 20 years with mild intellectual disability from special needs upper secondary school participated in a user study on the application *Planera Mera* for this study.

The results show that the perceived gaming experience increases when the users clearly understand how to solve the tasks, when the tasks are correctly executed and when the tasks are easy to solve properly and decreases when it is hard to understand the task, when the tasks given are to complex or when the tasks are not solved correctly. This is supported by the result that there is a correlation between the number of participants who completed each task and the average grade each task got from the participants. This suggests that the user might benefit from help in the game in the form of hints of how close the user is to a correct answer and the gaming experience might increase. This is also supported by the principle that people with mild intellectual disability benefits in their learning by physical and verbal prompting to guide correct responses (Browder & Spooner, 2005).

**Keywords** : Gaming experience; Mild intellectual disability; MID
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Chapter 1

Introduction

This chapter presents the background and the context of the study, then continues with a motivation to validate the study.

1.1 Study

This study is part of a major study made by PhD student Lisa Palmqvist that examines how the ability to plan can be trained by youths with mild intellectual disability with the help of an application.

1.2 Motivation

Mild intellectual disability (MID) involves shortcomings in the cognitive ability of abstract/theoretical thinking and other cognitive functions related to planning, memory and flexibility are also usually affected. The prevalence of MID in the Nordic countries is set to between about 0.5-1.5% (Lindblad, 2013). MID is defined according to DSM-5 (American Psychiatric Association, 2013) with three criteria: 1: Deficiencies in intellectual function; Problem solving, abstract thinking and theoretical learning, confirmed by both standardized testing and clinical assessment. 2: Lack of adaptive function (daily functioning; cognitive, social and practical skills - in relation to age and cultural group). 3: Difficulties originate during the
individual’s development period.

To give individuals with MID training in planning the application *Planera Mera* was created.

### 1.3 The application today

The application *Planera Mera* is designed on the principle Schmidt and Bjork (1992) introduced that the condition that produce the best retention performance provided added difficulty for the learner during the acquisition phase, even though this showed a poorer performance at that time, random practice serves to keep the performer from generating a stable set for a particular task. It also forces the learner to retrieve and organize a different outcome on every trial. Similarly, the spacing of repetitions may prevent superficial massed rehearsal. This means that the tasks in the game are made to be quite challenging for the user and no hints are given.

The feedback is unspecific since frequent feedback could block information processing activities that are important during the acquisition phase and lead to less effective error-detection capabilities for the children (Schmidt & Bjork, 1992). Different settings are used in the game since constant practice produces less effective capabilities to generalize knowledge than a variable practice does (Schmidt & Bjork, 1992). The settings in the application are presented as different rooms in a house.

### 1.3.1 Game play

The purpose of the game is that the user should teach the alien Hensi that has crashed on earth with its rocket, how people plan and perform different everyday chores. These chores are based in four different rooms in a house, the kitchen, the bathroom, the hallway and the bedroom. The house screen where the user can chose room is presented in Figure 1.1.
The tasks in the application are divided into four different levels of difficulty. Level 0 is the easiest tasks which contains only getting the object that is asked for by the alien Hensi, for example "get the belt" or "get something to drink with". Level 1 tasks contains more than one object and the user must place these objects in the right order for usage for each task, for example "fill bucket with water" or "pack a toy in your backpack". Level 2 and level 3 tasks contains more objects, for example "pack your bag with warm cloths and then fill the bucket with water and soap" or "lay the table for soup".

To complete a task the user have to gather the objects asked for, or needed in the activity described, by the alien Hensi. The objects have to be dragged and dropped in the cloud at the bottom of the screen, this is shown in Figure 1.2.
When the user feels satisfied with the objects gathered he or she presses the green arrow at the top right corner of the screen to submit their answer and see if it is correct. It is always possible to hear the instructions again by clicking on Hensi to make the alien repeat its request. For all levels of tasks, feedback is given at this stage, if correct on level 0 the user gets both auditive and visual feedback and if correct on level 1 or higher the user only gets auditive feedback and moves on to the next part of the task. If the answer is wrong the user only gets auditive feedback but no information about what is wrong in the answer. This is to prevent trial and error and force the user to think and try to learn (Ohlsson, 2008).

After the correct objects have been gathered by the user, in tasks on level 1 or higher, the object have to be placed in the correct order for the planning. If the task is to put on a t-shirt and a sweater the t-shirt is first and then the sweater. This is shown in Figure 1.3.
Figure 1.3: Screen shot from game play showing the planning order part of the task

When the user feels satisfied with the order of the objects to complete the task the green arrow at the top right corner of the screen is clicked to submit the answer. If the answer is correct the user gets both auditive and visual feedback and if the answer is wrong the user only gets auditive feedback.
Chapter 2

Purpose and Aims

2.1 Purpose and Aims

The chapter initiates with a description of the aim and the research questions this study is guided by and ends with a summary of the demarcations made in this study.

2.1.1 Aim

The aim of this study was to examine the users’ experience of the game Planera Mera and what parts of the game that increases or decreases their gaming experience for adolescents with mild intellectual disability.

2.1.2 Research Questions

The study was guided by three research questions:

- How is the gaming experience affected over time with adolescents in the age of 16-20 years with mild intellectual disability?

- How is the gaming experience affected by performance of the tasks with adolescents in the age of 16-20 years with mild intellectual disability?
- What reasons does adolescents in the age of 16-20 years with mild intellectual disability give to explain their game experience?

These research questions were answered by an analysis of the result from a user test of the application *Planera Mera* as well as interviews about the user test, that were carried out with adolescents in the age of 16-20 years who go to special needs upper secondary school.

### 2.1.3 Demarcations

Interview and observation have been used to collect data for this study and no complementing information have been gathered from the participants after the user test. Each test lasted for about one hour, the contact with the application were limited for the participants to this time. The participants did not have the opportunity to see the application before the session.
Chapter 3

Theory

This chapter starts with background and theory about intellectual disability, learning and other cognitive processes and continues with method theory about the methods used for data collection and analyzing in this study.

3.1 Background

This section starts with theories about intellectual disability, further theories about learning and planning is connected to theories about how these cognitive functions are affected by a mild intellectual disability.

3.1.1 Intellectual Disability

A person with an intellectual disability has a reduced intelligence and poorer ability in at least two of the following three areas according to Arbetsgruppen för utvecklingsstörning - Svensk neuropediatrisk förening (2015) which based their definition on the DSM-5 provided by the American Psychiatric Association (2013):

- Theoretical ability, i.e., how to read, write, count and other things that are trained in school.
• Social ability, such as how to interact with others.

• Practical ability, managing activities in daily life such as eating, washing and dressing.

Since the diagnosis requires that the adaptive ability is significantly impaired and gives a disability to the patient, the proportion that meets the diagnostic criteria for a intellectual disability will be somewhat lower than if this was based solely on intelligence (Arbetsgruppen för utvecklingsstörning - Svensk neuropediatrisk förening, 2015).

Intellectual disability is sorted in three levels. A *mild intellectual disability* means that the person can manage most things by themselves, but need help with some practical things, such as managing finances for example. A person with *moderate intellectual disability* can usually speak and understand things that are simple and connected with everyday life. They need support from people who make sure you are well and help with food, clothes, times and economics. A *severe intellectual disability* means the person cannot speak, but often show what he or she feel and what they want with their body, voice and facial expression. These people need help from an assistant to manage their life (AAMR, 2002).

In Sweden, approximately one person in one hundred has a intellectual disability, a prevalence of 1.28% was found by Fernell (1996) in a population based study among children aged 9-15 years and the prevalense of mild intellectual disabilities in the Nordic countries is set to between about 0.5-1.5% (Lindblad, 2013). Blomquist, Gustavson and Holmgren (1981) reported a prevalence of 0.38% in 8-19 year old children in a northern Swedish county. The gender distribution is uneven and more boys are diagnosed than girls, about 1,5:1 (Arbetsgruppen för utvecklingsstörning - Svensk neuropediatrisk förening, 2015).

About one third of people with a *intellectual disability* have a moderate or severe intellectual disability. There are several methods for measuring a person’s intelligence, which is measured in so-called intelligence ratio. An average is set as 100 for the entire population. A person with mild intellectual disability has an intelligence ratio of 50-69. A person with moderate or severe intellectual disability has an intelligence ratio of less than 50 (Arbetsgruppen för utvecklingsstörning - Svensk neuropediatrisk förening, 2015).
3.1.2 Learning

Learning is an essential and multifaceted phenomenon in cognitive science. Different theories of learning focus on different aspects of this phenomenon; Behaviorism focuses on the observable behavior shown by people in learning and recovery of learned knowledge; cognitivism focuses instead on the inner modules, models and thoughts that drive our learning; the sociocultural theory focuses on how different social and cultural patterns as well as artifacts affect learning; and finally the embodied view that focuses on how knowledge is rooted in the physical body but also how the body is used to communicate the knowledge. Since all these theories highlight different aspects of learning, these can together help to create a comprehensive understanding of the phenomenon of learning (Gulz, 2012).

Learning is the incorporation of new knowledge, beliefs and behaviors. Learning must also be part of the attention, it is important that the individual has a desire to learn new things (Johansson & Pramling Samuelsson, 2003). Learning happens when experiences or situations leave some kind of lasting trace in an individual or system, which in turn leads to the likelihood that different actions, behaviors or thoughts that in some way relate to these experiences or situations will increase. These traces can be internal and in the brain, or external, in the form of external representations, they can also be both parts at the same time, where the combination of the internal and external gives the learning (Gultz, 2012).

There are fundamental cognitive processes that make a person unable to avoid learning, or learning. An example of this is imitation, play, or other interaction between several individuals. The ability to imitate is innate, infants mimic movements such as lip movements, facial expressions and some vocal sounds. At about one year, children can imitate both goals and means in an action. This means that the child understands that when the action ”pushing the lamp button” is imitated, this is done to turn off the lamp and not just for the sake of pushing the button (Gultz, 2012).
People have developed principles, methods, artifacts and techniques to facilitate learning. Examples of such are: pens and papers, books, lectures and student-teacher relationships. In addition to these, there are also methods for communicating knowledge between people, such as notes, astronomy, physics, math, and more. With the help of these methods, it is possible to learn through shortcuts and thus avoid experiencing all the experiences themselves or seeing someone else experiencing them, instead they are indirectly communicated (Johansson & Pramling Samuelsson, 2003).

3.1.3 Mild Intellectual Disability and Learning

With appropriate aid in place, people with MID can achieve a high quality of life in many different aspects. While these people will have limitations in some adaptive behaviors, these limitations will exist alongside strengths in other areas. Independence and self reliance should always be primary goals of all instructional strategies employed with people with MID (Agaliotis & Kartasidou, 2005).

Breaking down larger tasks into their specific component parts can be an effective technique for teaching any number of skills to people with MID. More complex activities can this way be taught over time, and as the person masters one component of the task, a new is added to the task. This type of task analysis can be taught using a variety of instructional supports, from physical and verbal prompting to observational learning (Browder & Spooner, 2005). It is, however important that the strategies and materials used with the student fits to the persons own interests and strengths (Agaliotis & Kartasidou, 2005).

Browder & Spooner (2005) Mention that there are som useful strategies for teaching people with intellectual disabilities. They include, but are not limited to, the following techniques:

- Teach one concept or activity component at a time.
• Teach one step at a time to help support memorization and sequencing.
• Teach people in small groups, or one-on-one, if possible.
• Always provide multiple opportunities to practice skills in a number of different settings.
• Use physical and verbal prompting to guide correct responses, and provide specific verbal praise to reinforce these responses.

3.1.4 Executive Functions

Executive functions (EF) include a range of strategic, goal-directed behaviors that are widely used to achieve our aims in everyday situations when behavioral responses are not automatic. A commonly used division of EF is between initiation, inhibition, task switching and monitoring (Purves et. al., 2008) in these you can also count planning and problem solving (Elliot, 2003). EF concern the flexibility in the brain, meaning that if you have reduced EF you have a harder time to change your way of thinking (Purves, et. al., 2008). Elliot (2003) presents EF as an umbrella term used for different cognitive processes and sub processes.

EF in general includes the ability to create goals, plan, and carry out the plans in an efficient way. These definitions has led to and come from a range of different tests, aiming to test higher cognition such as planning and problem solving (Purves et. al., 2008). Some of the examples of EF tests concerning planning ability are Tower tests (Tower of London, Tower of Hanoi), Stroop test, Trail marking test and Verbal fluency test. These tests aim at investigating the ability of different subcomponents of EF like inhibition, shifting, rule detection and planning (Purves et. al., 2008).

3.1.5 Mild Intellectual Disability and Executive Functions

It is known that people with MID have problems with different executive functions (Danielsson et al., 2010), but how these problems manifest
themselves and if there is a problem with general EFs or just some of their possible subcomponents is still not clear. For individuals with MID, previous research has indicated a weakness in their prospective memory that affects adaptive behavior in everyday life (Danielsson et al., 2010).

A study of an extensive range of EF, in children with MID, done by Danielsson et al. (2011) presents results showing a lower performance on planning related tasks by the children with MID, compared to control groups matched on mental age. The study showed that children with MID preformed on the same level with the control group matched on mental age on verbal executive-loaded working memory, switching and most fluency tasks. The results also showed a worse performance by the MID group, compared to the group matched on mental age on EF in tasks involving inhibition, planning, and non-verbal executive-loaded working memory, suggesting children with MID have a specific profile of executive functioning (Danielsson et al., 2011).

Planning is used more as an example of EF and is not a specific EF (Elliot, 2003), which could indicate planning being a combination of different EF, since it requires cognitive flexibility.

Prospective memory can be connected to planning, since it is defined as the process and skills that are required to be able to fulfill an intention or a goal – to pursue future actions and plans. It gives us the ability to use our cognitive capabilities to coordinate actions and plans in everyday life activities, that cannot be done right away. It is important to be able to recall what to do, as well as when to do it, when the time of the action or plan comes (Purves, et. al., 2008). This is because the memory for the future is strongly connected to the past and builds on previous experience as well as your cognitive capacity and what context you are in (Pramling Samuelsson & Sheridan, 1999).
3.2 Method Theory

In this section the different theories about the methods used for data collection and analysis of data in this study are described.

3.2.1 Controlled Observation

In Controlled observation, each participant is individually invited to a controlled environment (i.e. not a real context) to test for example colors or audio of a system. The target with this method is to gain insights of design details that would be hard to test in a real context (e.g. controlled lighting conditions, background noise). Data can be collected in different ways during this method, videotaping facial expressions of users is one example. The strength of this method is that it is possible to collect experiential data on design details without expensive field studies (Jordan, 2000).

3.2.2 Interview

Interviews are often described as varying between the structured and the unstructured interview. In between these is the semi-structured interview which means that it is structured to a point but leaves room for the participant to talk about something that is not in the planned manuscript of the interviewer. Qualitative interviews are often referred to as semi-structured, since it is almost impossible to conduct an interview with no preparation at all (Howitt, 2010).

The researcher usually has a list with areas to explore during the interview but the structure is not rigid as it is in a structured interview rather flexible and open questions are used to make the participant explain the reasons for each answer instead of just answer the question (Howitt & Cramer, 2008). The ideal circumstances to use a qualitative interview is when the experiences, thoughts and feelings of an individual are the primary focus in the study (Howitt, 2010).
3.2.3 Self-Reported Metrics

Measuring and tracking usability is a continuous challenge for organizations that work with users’ experience and want to improve the users experience. A popular and cost-effective method for usability testing is standardized surveys (Finstad, 2010). There is a large number of self-reported metrics that is used in usability testing. This is an easy way to learn about the usability of the tested system since it depends on the users of the system telling you what they think the biggest problems are and why they are problems. Self-reported metrics can be collected through rating scales, such as the Likert scale in a Semantic Differential Scale (Osgood, Suci, Tannenbaum, 1957) or Self-Assessment Manikin (Bradley & Lang, 1994). Other types of self-reported metrics can be to assess some specific attributes of the product, website or service that are evaluated (Tullis & Albert, 2013).

3.2.3.1 Self-Assessment Manikin

Self-Assessment Manikin, (SAM), is an emotion assessment tool that uses graphic scales, depicting cartoon characters expressing three emotion elements: pleasure, arousal and dominance. SAM has been used often in evaluations of advertisements, and increasingly also in evaluations of products. SAM is based on the PAD emotion model of Mehrabian. The SAM questionnaire is filled in after the user is familiar with the stimuli, e.g. the product being evaluated (Bradley & Lang, 1994). SAM is very quick to administer, can be used in different settings, ranging from testing the appeal of advertisements and commercials to products, interactions, etc. The method has same drawbacks as all subjective scales; the dominance scale is not always easily understood by participants, and also not easy to apply in certain settings (Tullis & Albert, 2013).

3.2.3.2 Semantic Differential Scales

The semantic differential scales technique is used by two pairs of bipolar or opposite adjectives which is presented at either end of a scale, it is developed to provide the researcher with information about a user’s attitude
on a predetermined scale towards a system (Osgood, Suci, Tannenbaum, 1957). The scale is commonly on a five- or seven point Likert scale and truly opposites are used to mark the two extremes on the scale. A pairing of Friendly/Unfriendly may have a different connotation and therefore generate a different result from Friendly/Not friendly or Friendly/Hostile (Tullis & Albert, 2013).

3.2.4 Performance Metrics

All user behaviors are measurable in some way and behaviors that achieve a special goal for the user is especially important to the user experience. This means that it is possible to measure if the users clicking on a website led them to their goal, the time it took to reach the goal or how many clicks or interactions it takes with the system to get to the goal (Tullis & Albert, 2013).

3.2.4.1 Task Completion

By measuring how many of the participants who completed each individual task, problems in the system can be identified. To measure task success, each task the user have to preform must have clearly formulated goals. To measure success first success have to be defined, you can use binary success where the user either passes or fails the task or levels of success which can be divided into complete success with or without assistance, partial success with or without assistance and failure with or without assistance (Tullis & Albert, 2013).

In this study, binary success was used. This score is dependent on whether the participant completes the task or not and it does not count as a success if the user do not fulfill all the criteria that is set for the task, getting close is not a success. The only thing that matters is whether the participant manages to fulfill all criteria for completing the task or not.
3.2.4.2 Efficiency

To measure efficiency time on task can be used, another way to measure efficiency is to see what amount of effort it took the user to reach his or her goal. This is typically done by measuring the number of actions or steps it took the user to perform the task in hand. There are two types of efforts; cognitive and physical. Cognitive effort includes finding the right place to perform a task, deciding what to do next and interpreting the result of the action. Physical effort involves the physical activity required to complete the action, such as moving your hand, inputting text on a keyboard or turning on a switch (Tullis & Albert, 2013).

Efficiency in this study is measured by number of trials the participants used on each task. Each click on the green arrow to turn in your answer counted as a trial for the participants. The game has a limit of 9 trials for each task, if the person that plays the game have not turned in the correct answer after 9 trials the task is aborted and next task is given to the player.
Chapter 4

Method

A pilot test was made to ensure the tasks were understandable and the time for the test were reasonable. 17 participants in the age 15-20 participated in the full study. The result of the interview about the perceived gaming experience were analyzed using methods of analysis from Content Analysis and the data collected on task completion and numbers of errors were statistically analyzed.

4.1 Participants

Children between 16 and 20 years old with mild intellectual disability participated in the main study. The participants were chosen based on the teachers’ recommendation among students in their classes.

15 participants in the age 16-20 ($M = 18.00$, $SD = 1.25$) with MID. There were 9 young females ($M = 18.33$, $SD = 1.00$) and 6 young males ($M = 17.50$, $SD = 1.52$) in the study. The participants were recruited using snowball sampling using email, telephone and personal contact with their teachers who forwarded the information about the study to the students in the class and their guardians. The participants were all in national special needs upper secondary school.
4.2 Researcher’s role

In this study, the researcher assumed a more observing role on the participant-observer continuum (Bogdan & Biklen, 2003). However, the researcher’s role depended on each person and how much interaction he or she initiated. If the person only answered the questions directly and did not give any further motivation to the answer, follow up questions about the underlying reasons were asked.

4.3 Tasks

It is important that users understand exactly what kind of information that is sought in the study and why this information is asked for (Tidwell, 2011). Because of this, the pilot study are of great importance as it shows which questions that give the best type of data and how the collected data looks depending on how the questions and information is formulated. How the questions are formulated can influence the participants responses and it is rarely a good idea to cancel a task. To prevent disturbances, natural breaks were created between the tasks were it was possible to request information from the participant (Tidwell, 2011).

The tasks that were chosen for the study were based on their difficulty level. Tasks that were solved by a few number of participants during the pilot study were not used in the main study. To force the participant to explore all four rooms in the house the first 6 tasks were located in all 4 different rooms. Since it is important to not overwhelm the participants and the participant got the possibility to learn and get familiar with the one concept or activity component at a time (Browder & Spooner, 2005) the first 6 task were on level 0.

To help the participants learn, the difficulty of the task rose slowly one step at a time to support memorization and sequencing for the participants (Browder & Spooner, 2005) and a higher level task were presented as task number 7 out of 20 during the study.
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<th>Task</th>
<th>Difficulty</th>
<th>Room</th>
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<tr>
<td>1</td>
<td>get toaster</td>
<td>0</td>
<td>Kitchen</td>
</tr>
<tr>
<td>2</td>
<td>something to drink with</td>
<td>0</td>
<td>Kitchen</td>
</tr>
<tr>
<td>3</td>
<td>get umbrella</td>
<td>0</td>
<td>Hallway</td>
</tr>
<tr>
<td>4</td>
<td>get towel</td>
<td>0</td>
<td>Bathroom</td>
</tr>
<tr>
<td>5</td>
<td>get washing liquid</td>
<td>0</td>
<td>Bathroom</td>
</tr>
<tr>
<td>6</td>
<td>get belt</td>
<td>0</td>
<td>Bedroom</td>
</tr>
<tr>
<td>7</td>
<td>wash clothes</td>
<td>2</td>
<td>Bathroom</td>
</tr>
<tr>
<td>8</td>
<td>put on t shirt and sweater</td>
<td>1</td>
<td>Bedroom</td>
</tr>
<tr>
<td>9</td>
<td>pack toy in backpack</td>
<td>1</td>
<td>Bedroom</td>
</tr>
<tr>
<td>10</td>
<td>pack bag for school</td>
<td>2</td>
<td>Hallway</td>
</tr>
<tr>
<td>11</td>
<td>fill bucket with water</td>
<td>1</td>
<td>Hallway</td>
</tr>
<tr>
<td>12</td>
<td>lay the table for soup</td>
<td>2</td>
<td>Kitchen</td>
</tr>
<tr>
<td>13</td>
<td>fry an egg</td>
<td>2</td>
<td>Kitchen</td>
</tr>
<tr>
<td>14</td>
<td>toast with cheese</td>
<td>3</td>
<td>Kitchen</td>
</tr>
<tr>
<td>15</td>
<td>get dressed for rain outside</td>
<td>3</td>
<td>Hallway</td>
</tr>
<tr>
<td>16</td>
<td>pack warm clothes then fill bucket water &amp; soap</td>
<td>3</td>
<td>Hallway</td>
</tr>
<tr>
<td>17</td>
<td>get mop</td>
<td>0</td>
<td>Hallway</td>
</tr>
<tr>
<td>18</td>
<td>shower</td>
<td>3</td>
<td>Bathroom</td>
</tr>
<tr>
<td>19</td>
<td>use washing machine then use tumbler</td>
<td>1</td>
<td>Bathroom</td>
</tr>
<tr>
<td>20</td>
<td>get shampoo</td>
<td>0</td>
<td>Bathroom</td>
</tr>
</tbody>
</table>

Table 4.1: Tasks chosen in this study with difficulty and room presented.

The tasks that were chosen in this study and their difficulty are listed in Table 4.1 above. The tasks are sorted on the order they were presented during the user test in the study.

### 4.4 Procedure

The study were composed of a initiating pilot test, a main data collection folowed by an analysis of the collected data.
4.4.1 Pilot Test

In order to ensure that the formulation of the questions in the questionnaire was understandable and that the answerers gathered during the interview answered the research questions of the study a pilot test was conducted (Howitt, 2010). 2 persons participated in the pilot test, both of them had MID but did not fit into the target group of the study since one of them were younger than 16 years old and the other were 16 years old but still goes to special needs comprehensive school and have not yet started at special needs upper secondary school. The participants were recruited from a selection of convenience where several schools were contacted and those who had time available for their students during the weeks to set aside for data collection got to participate. The result from the pilot test showed that the number of tasks were in line with the time that was set aside for the sessions.

4.4.2 Test Procedure

The data collection in this study was made as a semi-structured interview with open ended questions about the gaming experience to provide an opportunity for the participants to develop their answers further and not force them into standardized answers.

First of all, the participant got an information letter about the study before they decided to participate. After the participants agreed to take part in the study a consent form were sent to them, in this the participants got information about who is doing the study, why the study is made, what the result will be used to and what information will be collected in the survey (Dumas & Loring, 2008). The consent form could be signed by the participant if he or she were 18 or older otherwise the legal guardian signed the consent form.

When the session begun the researcher first told the participant about what would happen during the test, what kind of data collection would be used and the researcher also insured the participant that the most important part of the study was to collect information about the
gaming experience and not the specific individual performance during the test. The researcher created an individual semantic differential scale with each participant, by asking them what they thought was the most fun thing to do and what they thought was the most boring thing to do. These two answers were then used as representations for the two extremes on the scale from 1 to 10 that were used after each task to measure the gaming experience during the study. The participant then got to play uninterrupted for 10 minutes to get to know the game and the different actions available in the game.

After the participant had played the game freely for 10 minutes the researcher reloaded the game with the predetermined tasks in correct order for the test and the test begun. The questions that followed each task were: “on a scale from 1 to 10, where 1 is (the most boring thing you can think of) and 10 is (the most fun you can think of) where would you say this task was ranked?”. By letting the participant adapt the two extremes to themselves the participant had an easier time to understand and use the scale. If the number had drastically changed since the last task the researcher asked the participant if there was a specific reason behind the change. The manuscript used during the data collection in this study can be found on Swedish in Appendix A.

Since the participants have MID an easy language without unnecessarily advanced words were used to make sure the language in the questions was adapted to the group that was tested in the study (Howitt, 2010). If the participants had trouble understanding a task the researcher helped to explain the task further.

### 4.1.5 Analysis

The result of the interview was analyzed using methods of analysis from Content Analysis which is a collection of qualitative and quantitative methods for collection and analysis of spoken and written communication (Kondracki, Wellman, & Amundson, 2002). The method has been developed to create an objective picture of a specific area through the analysis of con-
Content Analysis is commonly used to collect and analyze interview data through interviewing, transcription, coding and analysis. The method can also be used for the collection and analysis of data from surveys with open ended questions if the parts inspired by Thematic Analysis is used. The greatest benefit of the collection and analytical techniques from Content Analysis is that these can be used to evaluate a service by analyzing collected data and compare this with the previous known issues to check whether these have been resolved satisfactorily (Kondracki et al., 2002). A list of the most common answers the participants gave as reasons for raising or lowering their experience of the application were created. The results were ranked according to how often they are mentioned by respondents during the test. A reason may have been raised by the respondents both as something positive and as something negative during the interview (Blomquist et al., 2014). One increase or decrease might have been affected by several different reasons and therefore be placed in different themes.

Kondracki et al. (2002) describes the drawbacks of the analytical techniques drawn from Content Analysis is that sometimes the intuitions and feelings underlying the respond can be missed during the analysis of the data. It can also, in some cases, be difficult to draw conclusions about the outcome based on the groups outside the specific group that is the participants of this study. This is, however, better in open ended questions like the one used in this study.

When compared with other types of methods, Content Analysis is often a very inexpensive alternative. The costs of the method are dependent on techniques chosen during the study, equipment and personnel costs, and the size of the study, which make cost comparisons valid only on a case-by-case basis. Once the material to be studied has been gathered, it is relatively inexpensive to perform additional analyses to clarify findings or further explore areas of interest with the help of Content Analysis (Kondracki et al., 2002).

Pearson’s correlation coefficient were used to measure the strength of relationship between the mean rating each task got from the participants
and (1) the number of participants who completed each task and (2) the mean number of trials each task took. A paired sampled t-test were used to see if there was any statistical difference of the mean score for the first task and the last task the participants got during the user test.
Chapter 5

Results

In this study, data regarding perceived gaming experience, task completion, as well as task success on each task was collected. In total 15 participants tested the application, none of the participants of the study were excluded from the statistical analysis after the data collection were done.

How is the gaming experience affected over time with adolescents in the age of 16-20 years with mild intellectual disability?

In Figure 5.1 the mean rating on each task is shown together with a trend line to show the scoring based on how many tasks the participants had executed.
There was no statistical significant correlation between the number of tasks the participants had executed and the average grade each task got from the participants $R = 0.31$, $N = 15$, $p = 0.26$, the result is not significant at $p > 0.05$. The gaming experience is not raised during the time the participants used the application in this study.

The mean rating all tasks combined got from the participants were 7.16 ($SD = 1.07$). The first task had a mean rating of 6.33 ($SD = 2.02$) and the last task had a mean rating of 8.87 ($SD = 1.19$).

*How is the gaming experience affected by the performance of the tasks with adolescents in the age of 16-20 years with mild intellectual disability.*

In *Figure 5.2* below the task success rate is shown for each task the participants executed in the study. 100% means that all participants completed the task successfully.
As shown in Figure 5.2 above the task success rate for the study is low for task 16. To do this the participant have to complete the two different tasks in one setting and sort the order of the two tasks correctly. The two participants who did not succeed with task 8 missed that the instruction did not include other than t-shirt and shirt and took a whole set of clothing. Task 18 were solved by 60% of the participants and had the lowest success rate of all tasks.

There was a statistical significant correlation between the number of participants who completed each task and the average grade each task got from the participants $r = 0.72$, $N = 15$, $p < 0.001$, the result is significant at $p < 0.05$. 

Figure 5.2: Task completion rate for each task by the participants
As shown in Figure 5.3 above the efficiency of each task is measured as the mean number of trials per task. After 9 wrong answer the task counted as a fail and next task were given to prevent the participants from getting stuck at one task for a longer amount of time. The number of trials for task 7 is the highest and this is the first task on a higher level the participants got. The number of trials for the task 18 is high, this is since to do this the participant have to complete the two different tasks in one setting and sort the order of the task correctly. Task 3 had a participant who clicked the green arrow with an empty cloud and therefore used two trials to complete the task. The participant who struggled with task 6 did not know what the instruction asked for but when given a synonym of the item got the task right. Task 15 had a participant who did not get the umbrella at first and said that this was since the rain jacket made the umbrella unnecessary. One of the participants who struggled with task 14 missed a part of the instruction. All of the participants who did not successfully complete task 17 at their first trial confused the instruction and gathered the mop, the bucket and water instead of just the mop as the instruction said.

There was a statistical significant correlation between the mean number of trials it took the participants to complete each task and the average
grade each task got from the participants $r = -0.60$, $N = 15$, $p = 0.02$, the result is significant at $p < 0.05$.

*What reasons does adolescents in the age of 16-20 years with mild intellectual disability give to explain their gaming experience?*

In *Table 5.1* below it is listed what underlying reasons the adolescents in the age of 16-20 years with MID gave for the increase of their gaming experience in this study.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand</td>
<td>42</td>
</tr>
<tr>
<td>Correct answer</td>
<td>29</td>
</tr>
<tr>
<td>Easy tasks</td>
<td>29</td>
</tr>
<tr>
<td>Hard tasks</td>
<td>16</td>
</tr>
<tr>
<td>Clearly formulated tasks</td>
<td>14</td>
</tr>
<tr>
<td>No reason given</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 5.1: Increases the gaming experience

As shown in *Table 5.1* above the most common reason for an increased gaming experience given in this study are when the participant understands what to do in the task and when the task is correctly executed by the participant.

Along with the most common reasons given by the participants there were some of the answers that came in pairs. Several participants commented on tasks that they had have trouble solving but eventually solved after a few trials that their gaming experience increased. This were according to their answers during the interview since they managed to complete the task despite the tasks complexity.
In Table 5.2 below the underlying reasons adolescents in the age of 16-20 years with MID gave for a decrease of their gaming experience in this study is listed.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex task</td>
<td>31</td>
</tr>
<tr>
<td>Wrong answer</td>
<td>22</td>
</tr>
<tr>
<td>Hard to understand the tasks</td>
<td>16</td>
</tr>
<tr>
<td>Too easy</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 5.2: Decreases the gaming experience

As shown in Table 5.2 above the most common reason for a decreased gaming experience given in this study are when a task is too complex or when the task is not solved correctly.
Chapter 6

Discussion

This chapter begins with a discussion concerning the result and what these might imply connected to previous research, after this there is a discussion on the method, participants and analysis and how the selection of these might have affected the result of the study.

6.1 Result

A small rise in the mean rating of each task were visible, there were however no statistical significant correlation between the number of tasks the participants had executed and the average grade each task got from the participants. This might be since the participants graded their gaming experience of the application high, \( (M = 6.33) \), already from the beginning and left little room for improvement of the score during the session.

The data showed a statistical significant correlation between the number of participants who completed each task and the average grade each task got from the participants. It also showed a statistical significant correlation between the mean number of trials it took the participants to complete each task and the average grade each task got from the participants. This suggest that the complexity and difficulty of the task has an
effect on the perceived experience of the game as long as the participants manages to complete the task at hand.

According to the answers from the interviews made in this study adolescents in the age of 16-20 years, with MID, experience that the game is more fun and engaging when they clearly understand how to solve the tasks when the tasks are correctly executed, when the tasks are easy and when the tasks given are clearly formulated and cannot be misinterpreted. The tasks also got a higher score by the participants when they had solved a harder task successfully. Comments gathered in the theme Hard tasks also mentioned the fact that the participants executed the task correctly which indicates that the participants enjoy their successfully solved tasks more if they have to work harder for it.

This along with the principle that the application is designed on to increase learning by provide added difficulty for the learner during the acquisition phase, indicates that the application is more fun if it is harder and focused on learning but not so hard that the task is not solved correctly. It is according to Browder and Spooner (2005) preferable to teach students with MID in small groups, or one-on-one, if possible the application is designed so that the user plays by themselves without interference or help from any teachers or other students. With help from the game in the form of hints of how close the user is to a correct answer the gaming experience might increase. This is also supported by the principle that people with MID benefits in their learning by physical and verbal prompting to guide correct responses (Browder & Spooner, 2005).

The interviews made in this study showed that adolescents in the age of 16-20 years with MID experience that the game are less fun and engaging when the tasks given are to complex, when the tasks are not solved, when it is hard to understand the task or when the task is to easy. This implies that the tasks should challenge the user and present more difficult tasks as long as the user manages to complete the tasks given.
6.2 Method Discussion

The results gathered with a qualitative approach can be considered as subjective since both the result and the data collection is affected by what the researcher finds important (Howitt, 2010). Had the study instead been conducted with a quantitative approach, the results would have been easier to generalize and apply to a broader group than the tested group. It is, however, hard to measure the individual experiences through any quantitative methods which supports the choice of a qualitative approach in this study.

To let the participants chose their own words to represent the two instead of using predetermined words as antonyms in the semantic differential scales might have affected the result and the data that got collected in the study. The participants might been affected by their own wording and raised or lowered their score depending on their scale instead of their experience about the application. This was made so that the participants had their own thoughts about the two extremes and could more easily relate to the scale which overweights the risks of the choice.

Participants who choose verbs that were connected to gaming or the usage of computers might have had a different thought on the scale than the participants who for example chose an activity outdoors that strongly differs from the activity of using the application. Since the participants used their own scale through the whole session they kept their baseline intact and continued to compare each task with their scale and not previous tasks so this should not be a problem that affected the result of this study.

The use of a semi structured interview has an impact on the results of the study. Since no strict manuscript were followed, complementary follow up questions could be asked during each user test to create as rich data as possible. The semi structured interview technique makes it possible to compare the answers between different participants since the content of each discussion revolves around the same topics for all participants.
6.3 Participants

The participants were requited through email and telephone contact with their teachers and no validation was made to ensure that the participants had MID. All participants go to special needs upper secondary school. Special needs upper secondary school is directed at adolescents in the age between 16 and 20 years with an intellectual disability. They have been assessed as unable to achieve the goals of upper secondary school and you are not allowed to attend this school without intellectual disability (18 kap 2§ Skollagen (2010:800)).

The participants of the study conducted the test during school hours which also might have affected their rating of their perceived gaming experience. To conduct the user test the participants got to skip regular class and sit in a room and play on a tabloid instead, this might be one contributing factor to the high mean score the application revived already from the beginning of the study.

6.4 Analysis

As Kondracki et al., (2002) discusses, a disadvantage of analytical techniques drawn from Content Analysis is that the coding carried out during the analysis of the data collected in some cases can lead to the intuitions and underlying feelings with the participants are ignored or missed. It can also, in some cases, be difficult to draw conclusions about the outcome based on the groups that go over the specific tested group. Since this study aims to tell what adolescents with MID perceive affects their gaming experience this will not be a problem in this case. Thematic analysis has the benefit of being as flexible as it is but this is also the methods biggest flaw.
6.5 Future Studies

Future research with longer tests and interviews to supplement the data collected in this study might show a deeper understanding in why and how adolescents perceived that the gaming experience increased or decreased over time.

Another future study can be made to investigate a larger sample of the target group to verify the result from this study and possibly find correlations that were missed due to outliers in this study with so few participants.

More studies to control the result from this study that indicates that adolescents with MID holds their engagement up by being challenged at the right difficulty level would be interesting to conduct.
Chapter 7

Conclusion

The purpose of this study was to examine the users’ experience of the game Planera Mera and what parts of the game that increases or decreases their gaming experience for adolescents with MID. This has been done by user testing the application at special needs upper secondary school. This section presents the conclusion of this study aiming at answering the research questions and ends with a suggestion of implementations that could be used when designing an application for people with MID.

7.1 Gaming experience over time

How the gaming experience affected over time with adolescents in the age of 16-20 years with mild intellectual disability?

There is no statistical significant correlation between the number of tasks the participants had executed and the average grade each task got from the participants. This implies that the perceived gaming experience of the application does not raise over time. This might, however, be due the participants high grade of their gaming experience already from the beginning which left little room for improvement of the score during the session. It might also depend on the short time the participants got to use the application and in the context they were using it.
7.2 Gaming experience and performance

How is the gaming experience affected by the performance of the tasks with adolescents in the age of 16-20 years with mild intellectual disability.

There is, however, a statistical significant correlation between the number of participants who completed the each task and the average grade each task got from the participants. There also is a statistical significant correlation between the mean number of trials it took the participants to complete each task and the average grade each task got from the participants.

7.3 Changes in gaming experience

What reasons does adolescents in the age of 16-20 years with mild intellectual disability give to explain their gaming experience?

The most common reason said to lay behind an increase of the gaming experience is when they clearly understand how to solve the tasks, when the tasks are correctly executed and when the tasks are easy to solve properly.

The most common reason said to lay behind a decrease in the gaming experience is when it is hard to understand the task, when the tasks given are to complex or when the tasks are not solved correctly.


7.4 Designing an application for people with mild intellectual disability

More complex activities can be taught over time by people with MID if they are divided into smaller tasks. As the user masters one component of the task, a new component might be added to the task. This might be applied by dividing harder tasks and revisiting easier tasks to make the user get familiar with the basics before more complexity is added to the tasks given. This is also supported by the results were tasks that were the participant understand what to do and correctly executed the task raised the participants perceived gaming experience. To complex tasks and wrongly executed tasks lowered the participants perceived gaming experience so focus need to lie on teaching one concept at a time.
Bibliography


Appendix
Appendix A

A.1 Manuscript

Förklaring vem jag är och vad vi ska göra under testet:

Fokus i detta projekt kommer inte att ligga på planering utan på användandet av applikationen i sig och hur upplevelsen av spelet ser ut för olika delar. Det jag behöver hjälp med i mitt projekt är att veta vad DU tycker är roligt och vad som är mindre roligt i spelet.


Efter varje uppgift kommer jag att fråga dig lite vad du tyckte om uppgiften och om det är något du undrar så är det bara att du fråga mig. Jag kommer att filma under tiden och spela in det du gör men det är bara för att jag ska slippa komma ihåg allt i huvudet och ingenting som någon annan än jag och mina handledare kommer att titta på.

Jag kommer under testet att be dig att svara på en skala från 1-10 där 10 är det roligaste du kan tänka dig och 1 är supertråkigt.

Vad är det roligaste du vet att göra?
Vad är det tråkigaste du kan tänka dig?

Vart någonstans är du just nu på skalan 1-10 om 1 är tråkigast och 10 är roligast?

Använd de exempel som de själva givit på roligast och tråkigast

Hur pigg är du just nu? Är du redo att börja spela?
Nu kommer du att få spela lite som du själv vill och få klicka överallt så att du får se lite hur spelet ser ut och sen kommer vi att göra lite speciella uppgifter.

Spela fritt i 10 minuter

Nu när du har fått spela lite så kan vi börja med några uppgifter, är du redo för det?
Uppgifterna:

Gå in i köket och gör uppgiften som Hensi ber dig göra
(426 get toaster)
Stanna i köket och gör uppgiften som Hensi ber dig göra
(428 something to drink with)
Gå in i hallen och gör uppgiften som Hensi ber dig göra
(313 get umbrella)
Gå in i badrummet och gör uppgiften som Hensi ber dig göra
(10 get towel)
Stanna i badrummet och gör uppgiften som Hensi ber dig göra
(12 get washing liquid)
Gå in i sovrummet och gör uppgiften som Hensi ber dig göra
(224 get belt)
Gå in i badrummet och gör uppgiften som Hensi ber dig göra
(1 wash clothes)
Gå in i sovrummet och gör uppgiften som Hensi ber dig göra
(232 put on t shirt and sweater)
Stanna i sovrummet och gör uppgiften som Hensi ber dig göra
(236 pack toy in backpack)
Gå in i hallen och gör uppgiften som Hensi dig göra
(326 pack bag for school)
Stanna i hallen och gör uppgiften som Hensi ber dig göra
(331 fill bucket with water)
Gå in i köket och gör uppgiften som Hensi ber dig göra
(437 lay the table for soup)
Stanna i köket och gör uppgiften som Hensi ber dig göra
(421 fry an egg)
Stanna i köket och gör uppgiften som Hensi ber dig göra
(406 toast with cheese)
Gå in i hallen och gör uppgiften som Hensi ber dig göra
(329 get dressed for rain outside)
Stanna i hallen och gör uppgiften som Hensi ber dig göra
(328 pack bag with warm clothes THEN fill bucket with water and soap)
Stanna i hallen och gör uppgiften som Hensi ber dig göra
(323 get mop)
Gå in i badrummet och gör uppgiften som Hensi ber dig göra
(3 shower)
Stanna i badrummet och gör uppgiften som Hensi ber dig göra
(31 use washing machine THEN use tumbler)
Stanna i badrummet och gör uppgiften som Hensi ber dig göra
(17 get shampoo)

Frågor mellan varje uppgift:

På en skala från 1-10 där 10 är det roligaste och 1 är det tråkigaste, vad tyckte du om den här uppgiften?

Om det är stor skillnad mellan detta och tidigare svar:
Kan du berätta varför det var roligare/tråkigare nu än förut?

Efter 15 minuter:
Hur pigg känner du att du är just nu?

Efter uppgifterna:
Nu är vi klara! Hur pigg känner du att du är just nu?

År det något du tyckte var extra roligt i spellet som du kommer ihåg nu efter att du har spelat?

År det något som var extra tråkigt som du kommer ihåg nu efter att du har spelat?

Tack för att du var med och hjälpte mig med det här.
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