

# Master Degree Project



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## **STRESSED OUT?**

Guidelines for making a game to aid with stress symptoms in young adults

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# Abstract

Stress is a rising problem in society today, stress brings with it side effects that are detrimental towards an individuals' physical and psychological health. One way to treat stress is through metacognitive therapy, which includes a change in how to perceive ones' emotions and behavior in stressful situations.

Using current technology, treatment for mental illnesses can be aided with digital programs such as digital games, which can be easier accessed than traditional therapy.

The aim of this thesis work is to make guidelines that can act as a guide to develop games that aims to help young adults with stress management.

**Keywords:** Stress, Metacognition, Serious Games,

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# 1 Introduction

Stress is a problem in society, and one that is growing larger and larger (Östberg, Almquist, Folkesson, Brolin Låftman, Modin, & Lindfors, 2015). There are many different factors that can make an individual feel stressed, these factors are also individual, but some of them are experienced by many people. One period of life that is known to have many stress factors is during the adolescence (Östberg et al., 2015; Moksnes, Espnes, & Haugan Gørill, 2014). Stress is also known to bring more negative side effects, both physical and psychological (Rapolienė, Razbadauskas, Šalyga, & Martinkėnas, 2016), this is something that should be dealt with and not ignored. However, research show that many young adults either drop out of or do not reach out for help when it comes to treatment programs for mental health. Some of the reasons for this have been shown to be a lack of motivation, the stigma around mental illnesses, and accessibility of the treatment programs (Schoneveld, Lichtwarck-Aschoff, & Granic, 2017).

To treat symptoms from stress there are different therapies that could be used. One of them is metacognitive therapy. In metacognitive therapy, the patient learns to change their mindset by focusing on the feelings and their reactions rather than the content of their thoughts. (Wells, 2013).

Games have been used with success within healthcare, both when it comes to physical therapy and psychological therapy (Horne-Moyer, Moyer, Messer & Messer, 2014; Hammedi, Leclerq, & Van Riel, 2017; Schoneveld, Lichtwarck-Aschoff, & Granic, 2017). Amongst the positive effects, increases in motivation and encouragement to continue their rehabilitation have been shown. (Horne-Moyer, et al., 2014; Hammedi, Leclerq, & Van Riel, 2017). As there are research showing that young people have a problem with keeping up the motivation to continue programs against mental health, digital games that have shown to be increasing the motivation of the patient may be a good solution. There is also the accessibility of technology, as computers and cell phones are spread around the world, sending a program to a computer or a cell phone greatly enhances the reach of a game compared to if the healthcare worker would have to meet the patients face to face (Reynolds, Hodge, & Simpson, 2017; Schoneveld, Lichtwarck-Aschoff, & Granic, 2017).

The aim of this thesis is to make guidelines that could aid developers when developing games in stress prevention.

## 2 Background

### 2.1 Stress

Stress is a part of life, for some it is an everyday occurrence and for others something they experience only occasionally. The “fight-or-flight” response is the most common, this response to stress is caused by the release of stress hormones. In short term stress, this response decreases and returns your body to normal after the stress has been dealt with. However, in the case of long-term stress, there is a problem. If the person keeps experiencing stress and the body does not get time to relax, the body does not have time to recover and the stress hormones build up in the blood, which can cause health issues later (McEwen, Sapolsky, 2006). Stress is known to be detrimental to an individual’s health in many ways, it has been linked to loss of productivity, fatigue, insomnia, cognitive impairment, migraines, immune system disturbances, depression and other mental illnesses as well as neurological disturbances (Rapoliene et al., 2016).

Stress is commonly defined as the imbalance between experienced demands or challenges and an individual’s possibility to deal with the demands or challenges.

(Östberg, et al.; 2014, p.2)

Stress can come from many kinds of factors, such as responsibilities, changes, high demands, lack of demands etc. (Engström, 2018; Östberg, et al., 2015; Espejo, Hammen, Connolly, Brennan, Najman, & Bor, 2007; Moksnes, Espnes, & Haugan Gørill, 2014). Where stress comes from is a highly personalized thing, for example, one person can feel a lot of stress and pressure from having to hold a presentation in front of other people, whereas another person thinks it’s easy and has no stress response from it. How a person reacts to situations involving stress depends on earlier experiences with the situation, genetics, education and the resources of that person (Östberg et al., 2015; Espejo, et al, 2007). Some people feel more stressed by demands from outside (other people, situations) others feel more stressed by the demands they put on themselves (Engström, 2018). According to Moksnes, Espnes, & Haugan Gørill (2014), the difference in how people handle stress, and how some people handle stress better than others, can be explained with a concept that they present as the ‘sense of coherence’ (SOC). With that concept they propose that people with a high SOC are more driven to overcome challenges and strive to find the best way to deal with the situation at hand. Continuing with stating that another factor in how people handle stress is their resources, both their own capacities as well as the resources they have in their environment, both material and non-material qualities as the important factor here is not which resources they have at hand, but rather how they use these resources.

Studies have shown that reports of stress have increased over time (Östberg et al., 2015). Östberg et al. suggests that this is because of factors such as social context and circumstantial matters but that an individual can usually point out the source of their stress.

#### 2.1.1 Stress in young adults

As stated in the previous segment, one factor to stress is changes. The adolescence is a time where individuals experience many changes in their lives. These changes ranges from psychological to physiological, to social (Östberg et al., 2015; Moksnes, Espnes, & Haugan

Gørill, 2014). All these changes make the individual adapt to a new kind of life. These changes and new situations bring with them many potential stress factors for the individuals (Moksnes, Espnes, & Haugan Gørill, 2014). As many studies of stress amongst a younger audience is based in self-evaluation in large-scale surveys, Östberg et al. (2015) did a study on the concept of stress amongst a group of students in eighth grade in two schools. Their findings in that study show that there need to be more awareness to the role of the perceived expectations in stressful situations and the coping mechanisms that the affected students experience.

An issue that has been noted with young adults and adolescence is that many of them do not search for help or they decide to drop out before finishing programs. The reasons behind that can be traced to the stigma around mental illnesses, a lack of motivation while doing the programs and the accessibilities of the programs themselves (Schoneveld, Lichtwarck-Aschoff, & Granic, 2017).

### **2.1.2 Different therapies for stress**

To alleviate the levels of stress in individuals, different types of therapies are available. Among these the ones that are most used are CBT or Mindfulness-based therapies.

CBT is generally used as treatment for anxiety and depression, but it's also common to use for rehabilitations to stress related issues (Sjöström, & Köpsén, 2020). In CBT, the aim is to aid the patient to overcome their own issues by identifying them, and then alter how they react to them. This includes to alter dysfunctional thinking and behaviours, as well as the emotional responses to situations and thoughts (Galsworthy-Francis, & Allan, 2014). This kind of intervention first helps the patient to identify their own mind and thoughts. Then to understand how to handle both physical and psychological responses. By then using the knowledge gained to identifying strategies that can be used to prevent or reduce stress in the participant. By doing this and finding strategies, the participant can practice these strategies to alter their behaviour when approaching a situation that have a high chance of making them stressed, or their reaction to a stressful event. After learning how to alter their behaviour, they also learn how to maintain the new behaviour (Strauss, Gu, Pitman, Chapman, Kuyken, & Whittington, 2018; Sjöström, & Köpsén, 2020).

Another therapy used to reduce stress is MBCT (Mindfulness-based cognitive therapy). Mindfulness in itself has roots in Buddhist traditions, which extend back over 2500 years, and in the last few decades there has been an interest to apply the mindfulness from Buddhist tradition into the context of western treatments (Sipe, & Eisendrath, 2012). The practice of mindfulness includes to practice one's own conscious attention and awareness of their current mental state, there is also an emphasis on seeing things as they are, and then accepting them (Horesh, & Gordon, 2018). In MBCT, the participants generally partake in an eight-week course. The course includes weekly counsellings as well as physical exercises such as body scan, yoga, and sitting and walking meditation. During the course, participants also learn about mindfulness, for example, they learn mental exercises such as observing their own thoughts, behaviour, and feelings. They would also learn how to focus their attention to the present moment, and not get stuck in the past or the future (Verweij, van Ravesteijn, van Hooff, Lagro-Janssen, & Speckens, 2017).

MBCT does also include some elements from cognitive therapy, as well as psychoeducation where the patient learns that trying to resist or avoid the unwanted and dysfunctional thoughts may make them worse. A key difference in MBCT and CBT is that while CBT focuses on the

altering behaviours and thoughts, MBCT rather focuses on the patient's own awareness to their own feelings and thoughts, by doing this the aim is to have the patients take a step back and observe the relation they have to their thoughts and feelings. The goal is to have the patient to distance themselves to a point where they can assess their thoughts and feelings in a calm way and see that what they feel and think doesn't necessarily reflect the truth (Sipe, & Eisendrath, 2012).

A third kind of therapy that can be used is metacognitive therapy. This is a kind of intervention based in metacognition, which will be presented in the following section.

## **2.2 Metacognition**

The approach in therapy explored in this thesis will be stress therapy based in metacognition.

Metacognition is a relatively new science, the first mentions of it only being in the 1990s. It is defined by Martinez (2006) as "The monitoring and control of thoughts." By this Martinez means to have awareness of ones' own thoughts and to be able to control them. Martinez presents three categories that one can use to easier grasp the breadth of metacognition. The first category is Metamemory and Metacomprehension, which he states is the understanding and comprehension of ones' own knowledge. While metamemory is the understanding part, that can be evaluated by simple yes and no questions. Meaning that, either you know the answer or you don't, for example: If a person were to get the question; 'Do you know where the which store that is the closest to your current location?', they either know this fact or they do not. Metacomprehension on the other hand is about the comprehension of ones' own reading and listening. How much a person knows that they understand from what they read or listen to, this is something that easily can be inaccurate, what metacomprehension deals with according to Martinez is whether the person realizes how their comprehension is. An example that Martinez brings up to explain this is that of a student reading a textbook and not understanding the contents, the student however might not realize that they do not understand the contents of the textbook. Metacomprehension is about knowing how much one understands about the things they take in by reading and listening. Metamemory and metacomprehension are two alike concepts that both deals with learning, which is why Martinez categorized them together instead of making them into two distinct categories, however, they are not indistinguishable from each other as they deal with two different aspects of learning. The second category that Martinez presents is Problem solving. Martinez defines problem solving as "The pursuit of a goal when the path to that goal is uncertain. In other words, it's what you do when you don't know what you're doing." (Martinez, M.E., 2006). By taking a step back and analysing ones' own thinking, then based on the analysis remaking the plan and figuring out the best approach to the problem at hand. This action needs to be made several times during the process of the problem solving. To constantly ask oneself whether the current path is the most promising or if the current strategy is working. The third category that Martinez presents is that of Critical thinking. Which is close to problem solving in that one takes a step back and evaluates and judges their ideas. Asking question such as is the idea logical? Is the idea clear to everyone involved or are there any confusion? Is the idea backed by anything such as evidence, research or experience?

### **2.2.1 Metacognitive therapy**

Metacognitive therapy is based around making the patient change their way of thinking and focus on the feelings and reactions rather than the thoughts themselves (Wells, 2013). After

this, the patient learns how to change their mindset with the help of techniques such as detached mindfulness, which creates a new way for the patient to deal with thoughts and worry. By the use of a Socratic dialogue, the therapist asks the patient questions about the way the patients thinks, for example 'How much time have you been sitting and thinking about this, would it help you to reduce that time?'. This question is not meant to make the patient suppress their negative thoughts, but rather to guide the patient to understand the difference in suppressing their thoughts, sustain processing and the most desirable strategy which is to reduce the attention to negative cognitions. The therapist also works on helping the patient with challenging the negative beliefs about uncontrollability, for example, most patients believe that they cannot control their worry. The therapist challenges this, as well as other things such as importance and danger of thoughts, then the therapist challenges the thoughts that the patient thinks of as positive and in the end helps the patient with relapse prevention (Wells, 2013).

Batmaz (2014), talks about the core principles of metacognitive therapy, in the article he brings up CAS (cognitive attentional syndrome) as a concept to explain they reasons why the maintenance of the psychological distress is needed. CAS is explained by Batmaz as the main factor that is underlying psychological disorders. In the article, CAS is presented as arising from metacognitive knowledge and beliefs, and that CAS then takes the form of worry, unhelpful coping behaviours, rumination and attentional focusing on threat. The CAS is what determinates how an individual copes with negative thoughts, beliefs, and emotions. The CAS also prevents the individual from feeling that these negative emotions or cognitions fade away. To explain it further they liken CAS into a cage, where the individual is stuck in a prolonged emotional experience instead of walls, but that from the individuals point of view, it feels as they are being stuck (Batmaz, 2014). The article then goes into the nine core principles of metacognitive therapy, which consists of; 1, That any negative reaction, such as anxiety and/or depression are to be considered as a signal that points out that there is discrepancy between self-regulation and of threats to the well-being of the individual. 2, That these negative emotions are usually self-limiting, as the individual would incorporate coping strategies to overcome them. 3, That if these emotional experiences become persistent for some reason, there may be a psychological disorder. 4, That the persistence of these emotions' experiences is mainly depending on the thinking styles and behavioural reactions of the individual. 5, that the non-adaptive style of thinking and reactions are what activates CAS and that this activation is evident through all psychological disorders. 6, The components of CAS are closely related with worry, threat monitoring, rumination, avoidance behaviour, and ineffective thought control strategies. 7, CAS is a result of erroneous metacognitive beliefs, which in turn are involved with control of and appraisal of emotions and cognitions. 8, CAS is responsible for both the prolonged and the intensified negative emotional experiences. 9, MTC is primarily targeting CAS and also, the relevant metacognitions (Batmaz, 2014). The article then lists some techniques used within metacognitive therapy, the first technique listed is that metacognitive therapy deals with metacognitive beliefs, both negative and positive, and the reality testing of them when appropriate. The second is the postponement of worry or rumination. The third one is attention training technique. The fourth one is detached mindfulness, and the fifth one is metacognitively delivered exposure.

### **2.3 Use of technology for therapy**

Incorporating technology in therapy gives therapists new opportunities to help their patients. By using means such as the internet, email and mobile devices, a treatment can progress at



the patients' own time. This lets the therapists be there as guides or help if needed, instead of leading the whole session. Examples for this include online forms, long distance means of communication, computer programs and mobile applications (Horne-Moyer, et al., 2014; Uwatoko., Luo, Sakata, Kobayashi, Sakagami, Takemoto, Collins, Watkins, Hollon, Wason, Noma, Horikoshi, Kawamura, Iwami, & Furukawa, 2018).

Digital applications can be used with mobile devices such as smartphones to directly deliver therapy such as CBT to the users. These kinds of therapies may be more attractive to a younger audience as they are easier to access and this might help to alleviate the barriers that stop them from seeking help (Uwatoko, et al., 2018).

Technology such as digital games are used in therapy, both games specifically made for this purpose as well as games that one can buy off the shelf (Horne-Moyer, et al., 2014). These games can be both for psychological and for physiological therapy. For example games played on consoles such as the Nintendo Wii or Xbox Kinect where the player has to move their body to play have been used to help patients to improve their physique through exercise in a way that is engaging and motivating (Hammedi, Leclerq, and Van Riel, 2017). Games for psychological therapy are mostly games that have been designed to fit one or more therapeutic needs, which means that a game is created with the intent of helping the player with a specific problem or an area of need. Such games can aim to help with things such as depression and anxiety (Horne-Moyer, et al., 2014; Schoneveld, Lichtwarck-Aschoff, & Granic, 2017). However, games made for entertainment have also been used in psychological therapy, as they can provide a large variety of interfaces and experiences that can be used together with therapy. Fleming et al. gives the games *Bejeweled II* and *Tetris* for example. *Bejeweled II* were noted to improve the mood of the players after the game session, and *Tetris* were used to help players with PTSD (2017). These games can be used in both group and individual therapy, where they have been primarily used for behavioural therapy and talk therapy with children (Horne-Moyer, et al., 2014). Both games for physiological and psychological therapy can be used to increase knowledge, motivation, and engagement. Games can also provide therapeutic imagery and emotional expression, as well as give the player immediate feedback (Horne-Moyer, et al., 2014; Hammedi, Leclerq, & Van Riel, 2017).

### **2.3.1 Serious Games**

Serious games is a phrase used to describe games with the intent of not only entertaining the player. There are different ways a serious game can be used, in some cases the game is made with a different purpose than just entertainment, and the game is made to help with a specific situation. One way is to use an off-the-shelf game, a game that has been made for commercial use and then use it to do something else rather than just entertain. An example of this is the *Wii Fit Plus* being used by a hospital to help with patients' rehabilitation from medical problems such as stroke or MS (multiple sclerosis). Another way is to use the mechanics of a game in the real world, such as scoring systems or game rules, this is more commonly known as 'gamification'.

There are many advantages to using games as a medium for healthcare treatments. For example, the technology for games are very widespread, as a game can be played on different platforms, or even with a cell phone (Reynolds, Hodge, & Simpson, 2017; Schoneveld, Lichtwarck-Aschoff, & Granic, 2017). The usage of a game as a medium for teaching could heighten the reach and have a higher accessibility if the only thing needed to play that game would be to download it from a link in an email that the lecturer sends out. In that case the

lecturer can simultaneously have their lecture for virtually anyone, instead of just one group of students at a time.

### 3 Problem

Stress is a growing issue in society, it is an issue that causes further and/or more issues for the individual if not dealt with. Stress has many side effects that affects the patient both physically and mentally, like insomnia and depression (see section 2.1). Stress can be caused by many different reasons, and something that is a stress factor for one person may not be one for another. What someone experiences as stressful is highly individual, even though there are situations or experiences that many individuals think of as stressful (Östberg et al., 2015; Espejo, et al, 2007). Stress is also something that is known to be a part of adolescence as this period of time has many factors and experiences that are known to be stressful for many individuals (see section 2.1). This coupled with the fact that young adults are known to not search for help when it comes to mental health problems (Schoneveld, Lichtwarck-Aschoff, & Granic, 2017) shows that there is a part of the public where the current methods of stress management do not reach. By using technology such as games, it creates a larger accessibility as the game can be sent to multiple players at the same time instead of having one on one sessions (Reynolds, Hodge, & Simpson, 2017; Schoneveld, Lichtwarck-Aschoff, & Granic, 2017). As discussed in section 2.3, the use of games within healthcare is not a new concept and the cases where gamification have been implemented or games have been used has shown positive effects in the participants. There have been increases in factors such as motivation and engagement (Hammedi, Leclercq, & Van Riel, 2017; Schoneveld, Lichtwarck-Aschoff, & Granic, 2017; Horne-Moyer, et al., 2014), which are lacking in the young adults that drop out of treatment plans for mental health (Schoneveld, Lichtwarck-Aschoff, & Granic, 2017). Metacognitive therapy is based around having the patient learn how to analyse their own mind and thoughts and then be able to decide what to focus on, and by this be able to change their mindset (see section 2.2.1). Therapy for stress is generally done by CBT or MBCT, however the usage of metacognitive therapy could be an effective way to lessen the stress for an individual. As a part of metacognitive therapy revolves about the participant learning how to handle their own thoughts and to be able to distance themselves from their thoughts and analyse the process of their thoughts. By having the participant learning the techniques there is a high chance that they will continue on their own and manage their own stress after taking completing their program. This makes the approach of metacognitive therapy a feasible approach (Wells, 2013; Batmaz, 2014).

In summary, there is an interest in using games as a digital intervention to mental health issues. Especially when it comes to young adults as there is a stigma that may hinder them to search for professional help, by using a game the hinder may seem easier to overcome or to break through. When it comes to stress in games, most people will think about games that have a stress factor, sometimes in the shape of an timer or just a stressful gameplay, but there are also games that are designed for the opposite, games that are made to be relaxing for the player, these games are popular enough that platforms such as Steam and itch.io has 'relaxing' as a genre. Research of games that aid in stress management or lower the stress levels is something that has been done, but not a lot. When it comes to stress management therapy, one way to manage an individual's stress levels is through metacognitive therapy, in this kind of therapy the focus is on the patient to view their own thoughts and change their mindset and way of thinking by focusing on the reactions and feelings of the patient, rather than the content of the thoughts.

With this in mind, this thesis will study **what aspects game designers need to take into consideration when designing games to aid young adults' stress management**. To be more specific, the aim is to develop design guidelines that can be used when developing games that could help young adults in dealing with symptoms of stress.

To answer the research question, this study has three main objectives:

1. Obtain an overview for how metacognitive therapy is used for stress management
2. Obtain an overview of how games can be used in therapy
3. How the knowledge above could be used to create guidelines that can be used when developing a game for stress management

To solve the first objective, a literature review will be made, in this review one part will delve into the topics of metacognition and stress to see how metacognitive therapy can be used for stress management. This will also give an insight of how metacognitive therapy is currently used and perceived when it comes to stress. By looking at this aspect, a clearer understanding of metacognitive therapy as an intervention for stress management will be reached, this will help with reaching a conclusion for the research question.

To solve the second objective, another part of the literature review will delve into the topics of games and stress, this will give an insight in how games or digital interventions are used in therapy. By further understanding the uses of games in therapy, the aim is to find elements that can be used as a basis for making the guidelines.

To solve the third objective, this thesis will, in addition to the literature review, also review and analyse a few games. This is to see how the elements found in the literature review can be applied to games and how this knowledge could be used to make guidelines for developing games that are aimed towards stress management.

In order to reach a conclusion for the research question, the results from each objective will be used to make a set of guidelines that can be used when developing games that aids young adults in stress management.

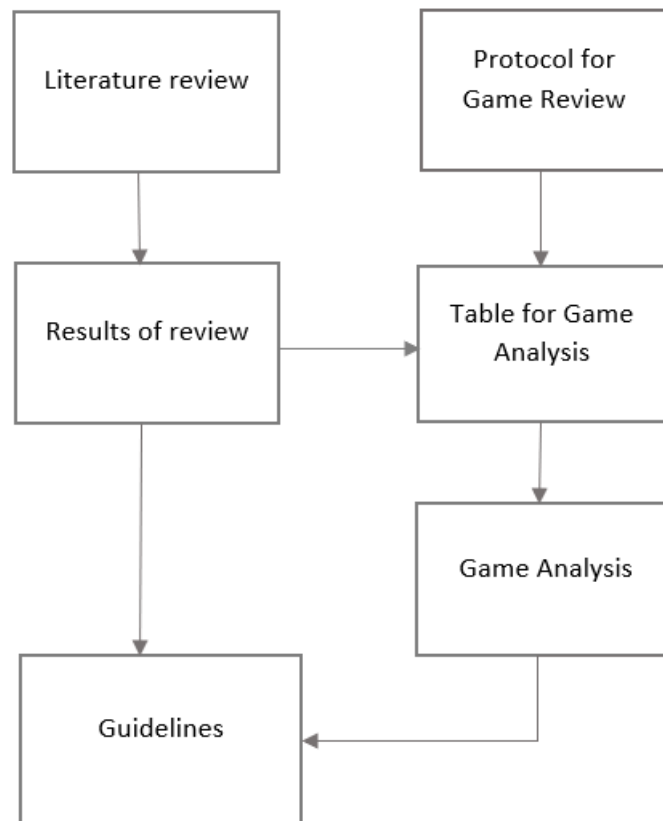
## 4 Method

In the following segments, the method for this thesis work will be presented. The aim of this thesis is to develop a set of guidelines that can be useful when developing a game that aim to help with stress management based in the metacognitive approach to stress management.

Different methods can be used when answering the research question. One such method would be to make a prototype of a game that is worked on in iterations. This would mean to develop the core mechanics and turn that into a playable prototype, then test it and evaluate it. After that, the prototype is worked on again to improve it (Eladhari, & Ollila, 2012). This kind of prototype could be made either in paper or digitally and would then be tested during playtests with participants. to do this kind of study, a sample of participants would be needed, preferably within the target audience, which in this case is stressed young adults. The evaluation could be done through observations and interviews and/or self-evaluative questionnaires which would be answered by the participants. However, to be sure that the prototype works as imagined, the testing would also have to be spaced out with multiple tests on each iteration to see whether or not the prototype helped with giving the user the tools they would need to manage their stress. To first do these studies and then have an iterative process while making a prototype would make the scope of the project too large to be possible to execute in the time allotted for this thesis.

In this study, there will be a theoretical approach to solving the problem. First there will be a literature analysis done, this is with focus on the first objective of the study. The literature review will be based on the methodology presented by Engström, Berg Marklund, Backlund, and Toftthedahl (2018) where the literature review is done in parts, first by making a search query that can be used on multiple databases, so that the results will be within the same topics on each database. The search query will be tested on two databases first to see if it works as intended. If it does, then it will be used on more databases, otherwise, it will be remade and then tested again until deemed to be functional. the results in the databases will go through a two-stage filtering system, first they will be filtered according to the titles, keywords, and abstracts. This is to make sure the articles that are used in the literature review are on the chosen topics. The second stage is to read through the article that passed stage one with a protocol. The protocol has two parts, one for general information of the article and the second part is to check the quality. By reading the articles with a protocol, articles that at first filtering seemed to fit but were about different topics or are unrelated to this thesis work can be excluded. The articles left will then be analysed. Through analysing the articles, elements from the literature will be extracted, these will then be used when analysing the games. After that the guidelines will be made using the knowledge gained from the earlier parts.

After the analysis, a review of games will be made. The games will be taken from two different platforms, they will then be played for 30 minutes together with a protocol that will be filled in before and after the play sessions. These games will then be evaluated using a table that has its basis in the elements that were found during the analysis of the literature review, for the analysis the games will be played again for 15 minutes with the new table. The reason for doing this is to see how the elements found to be important for the development of a game targeting stress management, could be applied to games that are on the current market.



**Figure 1** Flow chart of the work process showing how each part of the work will be used for the guidelines

Taking off from the results of both the literature review and the review of the games, guidelines that should be considered when making a game targeting the stress management of young adults will be constructed.

## 5 Literature Review

### 5.1 Pre-study

Before starting the literature review, a small-scale study was made to try out the search queries. This study can be compared to a pilot study in how it was executed. The method of this small-scale study is based on the method used in the article by Engström, et al. (2018). The article presents a way to analyze and a methodology to use when doing a literature review of papers that handle the subject of video games.

The first phase in the preparation was to find out which search query that would be used to gather the texts. A first search was to simply put all the topics together and see what kind of articles that would show up, so the search query used was 'stress metacognition game'. The first five hits were then looked at to see what topics these texts addressed.

- Article 1: This article addressed an insight on how digital games could be used as a tool for education (Morris, B. J. et al., 2013).
- Article 2: Is about the use of metacognition in therapy (Wells, A. 2013).
- Article 3: Dealt with how stress affects the metacognitive accuracy (Reyes, G., et al. (2015).
- Article 4: Is about the development of a competitive digital game made to train the metacognitive agility and intercultural intelligence. (Raybourn E.M. 2009)
- Article 5: Addressed two types of exercises and their impact on childrens' cognition. (Tomprowski, McCullick, Pendleton, & Pesce. 2015)

The articles addressed the three topics, but not together, instead each article addressed one or two of the three topics and widely different aspects of them. Going through the keywords in each of the five articles, gave more search words that could be used in the search query. To tune in the search query a mix of search words were tried out to see which ones that could be used as a search query. The search query was then used on the databases.

In the small-scale preparation study two databases were used to search through articles containing the topics that will be used when doing the literature review. The databases used in the pilot study were Scopus and ieee. In the small-scale study, two tests of search queries were made (the second was split into three parts).

The first search queries included all the topics and words associated with them the full phrase being 'Stress OR Stress management OR Stress therapy OR Psychological Stress OR Mental health AND Metacognition OR Metacognitive therapy AND Game OR Gamification OR Serious game OR Applied game '. This led to 962 articles found on ieee and 1 article on Scopus. Because of the sheer amount of hits on ieee, only the first 50 were looked at (the search included to sort by relevance to the search phrase). Out of these 51 articles, 2 were deemed to be of relevance enough to get through the first filtering, and later 1 remained after the quality control. As not many articles of relevance were found with this search phrase, it would need to be fixed and tested again.

The second search query was split up into three parts. Each including with two of the topics used in this thesis. The word 'Game' was taken away after the first search, as there were a

multitude of articles that dealt with aspects such as analogue games or games that were of no relevance to this thesis.

- The first of these dealt with Metacognition and Stress, the search query being “Stress OR Stress management OR Stress therapy OR Mental health OR Psychological stress AND Metacognition OR Metacognitive therapy”. This gave 115 found articles on Scopus and 4 articles on ieee. Out of these, the first fifty according to relevance on Scopus were put through the first filtering, as well as the 4 that were on ieee.
- The second of the search queries dealt with stress and Serious games, the search query here being “Stress OR Stress management OR Stress therapy OR Mental health OR Psychological stress AND Serious game OR Gamification OR Applied game OR Digital game”. This search gave 212 found articles on Scopus and 11,671 articles on ieee. Again, the ones put through filtering were the first 50 hits according to relevance on both databases.
- The third search query dealt with Metacognition and Serious games, the search query being “Metacognition OR Metacognitive therapy AND Serious game OR Gamification OR Applied game OR Digital game”. The third search gave 9 found articles on Scopus and 11,603 articles on ieee, as with the others, the first 50 articles according to relevance were passed through the first filtering as well as the 9 that were on Scopus.

The full number of articles put through the first filtering were 214 and the amount that passed the first filtering were 15. The first filtering was made by looking at the title, the keywords and the abstract of the article. This to see if the article was relevant to this thesis. This to make a first impression whether or not the article had any relevance for this thesis, for example, an article which has the keywords ‘stress’ and ‘game’ may be of the impact a stressful game has on its players which would not give have any relevance to this thesis.

The second filtering were made by reading through the 17 articles with a protocol. The protocol is split up into two parts, one containing the general information and one containing the quality part of the filtering. After this, the number of articles left were 7. As this was a pre-study made mainly for testing out the search queries, this was deemed usable.



<b>General information</b>	
Article Name	
Link	
Keywords	
Topic	
Year	
Which part of searchphrase?	
Type of article	
Aim of article?	
Short summary	
Publisher	
Published in	
<b>Quality check</b>	
Is research question clearly presented?	
Research Question	
Is the method clear?	
What method is used?	
Results of study?	
Which region?	
Is this brought up in article?	
Useful for thesis?	

**Figure 2** The protocol used in the second filtering.

In the first part, the protocol contains general information about the article; the title of the article, a link to where the article can be read, which keywords that the article has, which of the three topics (Stress, Metacognition and Serious Games) that the article deals with, which year the article was published, which of the search queries that the article was found through (at the time of the pilot test search queries were referred to as search phrases), what type of article it was (review, conference paper etc.), the aim of the article, a short summary of the article, which publisher the article has and where it was published.

In the second part of the protocol, the quality of the article was assessed. This was done by looking for specific aspects of the article and how well they are presented in the articles. These aspects were; if the research question of the article was clearly stated to the reader, what the research question(s) are, if the method that is used is clearly stated to the reader, which method is used, what the results in the study are, which region the study is from, if the authors of the article mention anything about how the region of where the study was made can affect the results and lastly if the article has any relevance to the thesis.

To summarize; the small-scale study was made to test out the search queries and protocol that would be used for the literature review. There were two test searches (the second being split into three search queries). The articles that were found with these search queries were put through a first filtering where they were filtered by their title, keywords and abstract (in the case where a multitude of articles were found, the first 50 according to the databases relevance were put through the first filtering). After the first filtering 17 articles were read through with a protocol. After that 7 articles were deemed to be of relevance to the thesis.

## 5.2 Main study

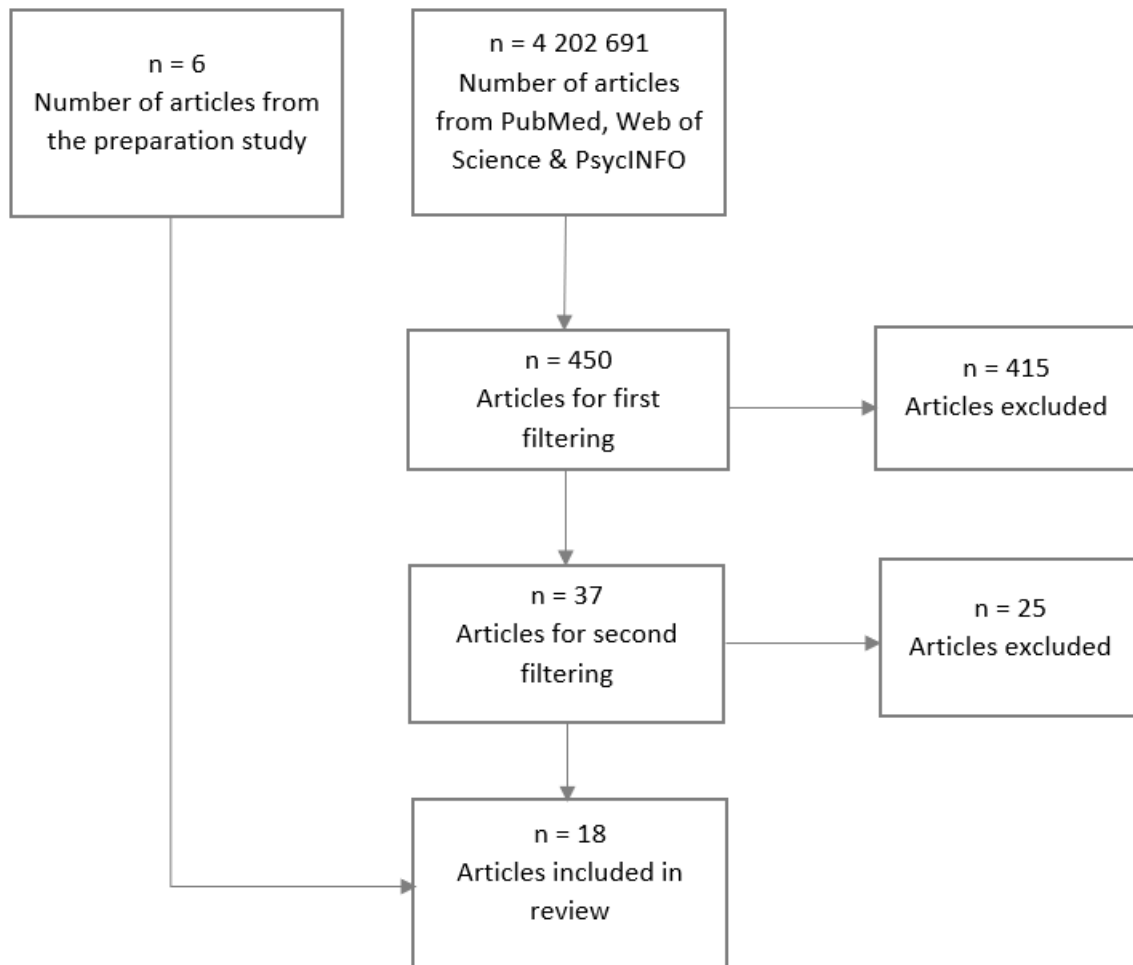
By taking in the results of the preparations, and the small-scale study made there, The only changes that needed to be done to the protocol was to rewrite one of the questions so that it became easier to understand from an outside view. However, as the method in finding articles worked, this would be the method used in the literature review.

To do the literature review, databases were selected out of their focus areas. The databases used in the literature review are PubMed, Web of Science and PsycINFO.

By following the same methods as the small-scale study, the idea is to look through the first fifty article according to relevance on all databases. Each database will have three searches, one with each query. The articles that pass through the first filtering, where they are filtered based on the title, the keywords and the abstract, will be read through with a protocol. The three queries are:

- Stress OR Stress management OR Stress therapy OR Psychological Stress OR Mental health AND Metacognition OR Metacognitive therapy
- Stress OR Stress management OR Stress therapy OR Psychological Stress OR Mental health AND Gamification OR Serious game OR Applied game
- Metacognition OR Metacognitive therapy AND Gamification OR Serious game OR Applied game

The filtering followed the same sequence as the previous one had. In each of the three searches, the first 50 articles according to relevance were first filtered by the titles, keywords and abstract. After this step, 37 articles remained, 16 from the query of metacognition and stress, 13 from the query about stress and serious games and 7 from the query of metacognition and serious games. These articles were read through with the protocol and 23 articles were excluded after this filtering. Of the 12 articles remaining, 4 are of the query stress and metacognition, 6 from the query of stress and serious games and 2 are from the metacognition and serious game query. The articles from this filtering were put together with the articles that had passed through the two filtering stages in the preparation study.



**Figure 3** A visual representation of the sampling process of the articles

### 5.2.1 Stress and Metacognition

In this part, six articles were deemed usable, of these two detailed the usage of metacognition in relation to mental health in general, both articles dealing with mental health issues such as anxiety and depression. One article brought up a view on stress and how it affects individuals, as well as different ways to manage it (one of these ways being with the help of metacognitive skills). Two articles present studies detailing the relation of metacognitive beliefs to stress. The last article details a study where metacognitive therapy was used to alleviate stress symptoms for the participants.

Research on metacognitive therapy in relation to mental health is not a new thing, mostly focusing on metacognition as an intervention to aid in anxiety. In an article by Rochat, Manolov, & Billieux (2017) they do a review of studies where metacognitive therapy have been used as an intervention to different mental issues. What they find there is that using metacognitive therapy as an intervention have a great effect on mental health issues like depression and anxiety. This were also found by Philipp et al. (2018) in a review where they state that in treating patients with mental health issues such as anxiety disorders and depression, amongst others, metacognitive therapy is just as effective, if not better, as other psychological interventions.

Stress has a negative influence on a persons' health. According to Arpaia, and Andersen (2019), stress is known to contribute to mental issues such as anxiety, depression, but also

conditions such as chronic pain and diabetes. The effects of stress can be seen negatively affecting both individuals and families, but also in the long run organizations and communities. To manage stress, different methods can be used, one of these methods used as interventions is metacognitive therapy.

However, metacognition as an intervention to stress is harder to find studies of, as there have not been much research into this area. One that mention the impact of metacognitive therapy on stress related mental health issues is an article detailing the effect of positive metacognitive beliefs in on patients dealing with stress and anxiety. In this article Ruiz, and, Odriozola-González, (2017) tests both positive and negative metacognitive beliefs. In their article they compare metacognitive therapy with acceptance and commitment therapy models they state in the discussion part that signs of the relationship between dysfunctional metacognitive beliefs and stress and anxiety symptoms emerged, and that these signs would be clearer in long term studies. Another study that deals with the topic of metacognitive beliefs in relation to stress is presented in an article by Sariqam, (2015). In this article he presents a case study where he researched the role metacognitive beliefs have in relation to stress, and how a person perceives their stress. In this article the author categorized metacognition as five different sub-divisions, the first sub-division were positive beliefs about worry, the second were negative beliefs about worry, the third were lack of cognitive confidence, the fourth were beliefs about need to control thought and the fifth were cognitive self-consciousness. In the study, one of the hypotheses that were tested proceeded from the belief that these sub-divisions will be positively associated with participants perceived stress, this was also part in another hypothesis in the article, that the existence of metacognition in a participant will increase the stress of the participant and that this relation between metacognition and stress will negatively affect the participants happiness. The conclusion reached in this study supported the hypotheses and the participants with a lower metacognition were more likely to have a lower level of stress and the participants with a higher level of metacognition were more likely to experience higher levels of stress.

In an article by Maddahi, Nikpajouh, Khalatbari, Zakerini, and Hashemi (2017), the focus is on metacognitive therapy and mindfulness-based therapy and the effect these have on the participants level of perceived stress, perceived social support and improvement of emotion regulation. The participants in this study suffered from CHD (coronary heart disease) and through the study the participants were split into three groups, one going through metacognitive therapy, one through therapy based in mindfulness and one control group. The results found during the study showed that the participants in the group that had gone through the sessions of metacognitive therapy had had positive effects on the level of perceived stress, the perceives social support and improved their emotional regulation. The results supported the used of metacognitive therapy as an intervention for patients with different mental and physical conditions.

In conclusion, stress is known to aid to several other conditions that negatively impacts an individuals' life (Arpaia & Andersen, 2019). The perceived stress of an individual has been shown to be linked to their metacognitive skills (Sariqam, 2015, Ruiz, & Odriozola-González, 2017). To alleviate the stress levels of an individual, metacognitive therapy can be used as an intervention (Philipp, et al., 2018, Rochat, Manolov, & Billeux, 2017). The use of metacognitive therapy as an intervention to has been shown to be positively affecting participants with different mental diseases, among these, metacognitive therapy have been shown to have a

positive result when being used to treat individuals suffering with stress symptoms (Maddahi, et al., 2017).

### **5.2.2 Stress and Serious game**

In this part that involves stress and serious games, there were ten articles that after the second filtering was deemed usable. Out of these articles, two were focused on serious games as an intervention to mental health issues, one were detailing the role of gamification in a mental health intervention, one article focused on how an audience respond to different ways of promoting a serious game for mental health, one about the engagement with behaviour change interventions, two about developing digital interventions for mental health (one dealing with children specifically), one case study about a making a game to help with anxiety, and lastly two about designing games to aid with stress.

The use of and development for serious games in health care, especially for mental health conditions is an area that is growing (Lau, Smit, Fleming, & Riper, 2017.). A few of the reasons for this is the method of using games is cost-effective, that they are scalable, and have a high accessibility and reach (Shoneveld, Lichtwarck-Aschoff, & Granic, 2017).

A systematic review by Lau, Smit, Fleming, and Riper, (2017), suggests that, in this case focused on issues with disorder-related symptoms such as depression, cognitive functioning and PTSD, interventions that use serious games as a medium may be effective as a means to reduce the symptoms for the participants. In their article they reviewed different studies on the treatment of mental health issues, that used serious games as a part of the treatment. The definition they use for serious games are: “Games that do not have entertainment, enjoyment or fun as their primary purpose.” (Lau, Smit, Fleming, & Riper, 2017). After conducting their review, they categorize serious games in three types depending on their design processes, the first which is designed games, the games that from the beginning are designed with the intent of being serious games. The second category is purpose-shifted serious games, these are the games that were not designed to be serious games, but can be used with a serious purpose, with this they mean a game that were made for entertainment but that is used for a different purpose. The third category they present is the modified serious games. Modified games are games that were made for entertainment, like the purpose-shifted, but that later have been modified to suit another purpose. In this categorization, they do shift a bit from their initial statement of what a serious game is, but instead of discarding the purpose-shifted and modified games, they included these when searching for studies to review (they do state that they did not find any studies that contained a modified game). The conclusion that they reached was that the use of serious games as a medium has potential to aid the treatment of mental diseases in various age groups.

In a study by Schoneveld, Lichtwarck-Aschoff, and Granic, (2017), they examined if an applied game, could be as effective to use as a prevention effort as a CBT (cognitive behavioural therapy) based program is. In this study they split the participants and their parents into groups, which were later randomly assigned either the CBT based therapy or the serious game. The participants did questionnaires one week prior to the start of the study, at the two-week mark, and then follow up questionnaires at three months and six months after the study. The participants that had been assigned to use a serious game did this for six one-hour sessions. The results they found after the study showed that the serious game was as effective as the CBT based therapy when it came to prevent anxiety.

Gamification is the use of game-mechanics for purposes outside of a game. The use of gamification in healthcare is usually applied to interventions for physical fitness or to motivate individuals with chronic illnesses to manage and maintain health behaviours. To apply gamification to interventions for mental health have happened but they are less common (Cheng, Davenport, Johnson, Vella, & Hickie, 2019). A point that Cheng et al. brings up in their article here is that the usage of gaming elements such as points, achievements, rewards, competition and social comparison may be inappropriate to individuals in distress, as these points may be able to affect the individual negatively if the gamified intervention ends up having a higher threshold to clear than the individual is capable of, as the enjoyment of playing video games are linked with the satisfaction of managing these elements. In their article they analyse and discuss the usage of gamifications in mental health apps. In their review they found two main themes in the justification of using gamification in mental health apps, the first being to promote engagement with the intervention and the second being to enhance the intended effects of the intervention. In their review they also analysed what kind of gamification that are used in the apps, in which mechanics such as progress feedback, points or a scoring system, a narrative and customization were the most used, whereas mechanics such as social cooperation, artificial assistance, and open-world or exploration were the least used. In the articles that they reviewed, only 59% stated a reason to why a gamified intervention was used, this is something that they noted as something that should be taken into consideration when deciding to bring in gamification to the intervention tool. They also note that there may be rewarding to take a step back from just focusing on the engagement aspect of a serious game, and rather focus more broadly on how gamification could enhance other parts of an intervention targeted towards a mental health.

An article that on the other hand does promote engagement is by Perski, Blandford, West, and Michie, (2016). In their article they present a review of articles that dealt with engagement of digital games, technology and digital behaviour change interventions (DBCI). They then proposed a conceptual framework in how the engagement with a DBCI is affected with the DBCI itself, with the context and the behaviour that is targeted by the DBCI. In their review they define engagement in two groups, one details engagement as a subjective experience, and the other engagement as behaviour. To measure the engagement, they analysed them in three different categories, the first being User-reported, which included, self-reports from the users, interviews and think aloud-studies. The second being the automated recording, which logged things such as page-views and logins to the DBCIs, and the third was recordings of the physical and psychological correlations of the interactions with the DBCIs. Through their conceptual framework they deemed that engagement of DBCI is either directly or indirectly influenced by the context of use, that the target behaviour may influence the DBCI directly while the action mechanisms may indirectly influence the DBCI. They conclude this by stating that this suggests that there is a positive feedback loop.

In a study by Poppelaars, Wols, Lichtwarck-Aschoff, and Granic (2018) they examine the participants reactions to different alternatives of promoting a serious game for mental healthcare, to do this, they had two different trailers for the same game. Wherein one trailer promoted the game to be a mental health game and the other trailer used a more stealthy approach and did not mention the mental health aspect of the game, it focused on promoting the entertainment value of the game. In their study they found that it was almost four times more likely for a young adult with mental health symptoms (ranging from mild to severe) to choose a game that was promoted as a mental health help than the game that was promoted for being entertaining. As there is a stigma in seeking help for young adults to seek help for

mental health symptoms, many do not. As there is a problem with many youths not seeking out help, serious games aimed at this group may create a bridge for the youths with symptoms and encourage them to seek professional health. This is a point that Poppelaars et al. (2018) brings up, and stating that while the primary target audience for serious games is for young adults that already are in therapy, they do make the suggestion to aim serious games towards an audience with young adults that are not in therapy. They continue this by specify it to a target audience in two points; first, that the youth that have mild enough mental health symptoms that that they don't need to be treated in a clinical setting and that second being that research within prevention have proved multiple times that prevention that are targeted towards a risk group are more effective than universal prevention.

While making a serious game for mental health, certain guidelines have been made by Shah, Kraemer, Won, Black, and Hasenbein, (2018). These guidelines were based on a literature review they made where they collected articles dealing with a serious game and mental health disorder. By analysing the articles after what could work and what did not, as well as comparing them against each other; Shah et al. presents a list of twenty two guidelines that they believe would be of use when making a serious game for mental health intervention. Alongside the list they also present a few points that they deem extra important for the development. These points being Engagement, Accessibility, Consistency with treatment, Generalizability, Effective skill building, Time and cost, Potential limitations. When it comes to the management of stress, they do bring this up together with managing anxiety. In their review, they talk about how individuals suffering from stress and anxiety symptoms can use games for recovery, to relax, to disengage from work, and to gain a feeling of control.

In the study made by Dheda, and Heymann, (2019), the aim was to make a game for anxiety management. They strived to make the game accessible, and cost-effective, while also placing the user in control of their own anxiety management. In their study, they aim towards a game that will not be a stand-alone treatment for anxiety, but rather a complement that can be implemented in the treatment program. The game has four levels, and each level will tell the user to press a stress ball, starting with full strength at the first level for 25 seconds, and then lighter and shorter for each level. The user has a physical device that they can press on with their hand (like a stress ball) that they use to play the game. In their game, they have the hardest level first, instead of starting easier and gradually building up the complexity. This they explain by the reasoning that they have structured the game to emulate the stages of a minor anxiety attack. The game aims to make the user more relaxed at the end of the game. From their testing, the game had a positive effect on the user for managing stress.

Human-Centered Design (HCD) is defined by Lyon, Dopp, Brewer, Kientz, Munson, (2020) as a process where a set of methods are used to develop technology, products and other artifacts that are meant for direct human use. They characterize it by the fact that it requires a human perspective from the start of the design process, and that the users or the individuals that are affected by the product in the end have involvement in the process of development. It is an iterative process and barriers, or new problems can show at any stage in the process, which prompts the developers to go back to previous stages. In their article, Lyon et al. talks about the use for HCD within the development and design of mental health services for children and youth. Within their article they bring up topics such as Accessibility (as the HCD methods have a large potential to improve accessibility, with an iterative process that is aimed to fit-to-purpose), Effectiveness (the effectiveness can be maximized during the iterative process, if tested, and since user engagement and usability is already one of the aims in the

HCD process, there is a high chance of the end product being designed with this in mind), and Equity (by improving the cultural responsiveness and contextual appropriateness of the health service, HCD can aid towards supporting equity goals). Going off this, they state that “human-centered redesign of HSRPs (health services research products) provides an innovative and timely pathway for improving the public health impact of our best innovations by restructuring—and sometimes reimagining—them to enhance their feasibility and practicality for use in public sector youth service contexts.” (Lyon et al. 2020).

When it comes to serious games targeting stress specifically there are not many to find. An article by Yahyaoui, and Menelas, (2017) presents a way to develop a serious game that aims to help the users manage psychological stress factors in their workplace. What they aim at for this serious game is that the user will be able to identify stressors that may happen in their workplace and how to manage the situations that these stressors can lead to. They bring up examples on psychological stressors that they have identified, these are, The feeling of not getting recognition of your work, Being overwhelmed by work, The feeling of being isolated at work, and Being bullied at work. To counter these key stressors, they present plans for a serious game that allows the user to play through two modes, the first is having the user participate in meetings where different scenarios are described, the user will then discern whether or not the described scenario includes a stressor. If the player believes that the scenario does include a stressor, the user will then get to judge of how stressful the scenario is and be able to point out areas that can be improved. In the second mode, the user is given again a scenario, this time together with the assistance of either an AI or other players. As with the first mode, the scenarios presented to the user may or may not include a stressor. Whenever a stressor does show up in a scenario, the user will have to identify the stressor and how to correct it. Together with the scenarios, the article lists a few points that the serious game need to teach the user, these points include, prioritization, finding alternate solutions, recognize one’s own limitations, to promote communication to the user, to discuss career goals and expectations, to assess their workload, how to handle situations where the user is the victim workplace harassment, and to handle unfair treatment of employees (what to do in these kinds of situations). The article concludes with stating that the presented serious game has not been made, but that the idea they present is the first step towards this kind of serious game.

The use of having games as a medium for reducing stress levels is a topic that de Aquino Lopes, Junior, Cardoso, & Lopes, (2014) brings up in their article. They first bring up stress recovery, a concept they have split into four parts which all deal with the individual’s recovery from stress, these parts are Relaxation, Psychological Detachment, Mastery Experiences and Control During Leisure Time. They talk about coping and define it as a process wherein the individual manages to deal with the demands that the individual finds stressful and dealing with the emotions that are generated by them. According to de Aquino Lopes et al., coping has five key functions; helps the individual with adapting to negative situation, to let the individual maintain a positive image of themselves, to maintain their emotional balance, to maintain their interpersonal relationships, and to reduce environmental conditions that are perceived as threatening. They also divide coping into two categories, emotion-focused coping, and problem-focused coping. According to de Aquino Lopes et al. (2014), a key concept to have in mind while making a serious game for aiding stress is the users’ experience of ‘flow’. The model they present is a model with eight main categories: Challenge, Skills, Strength, Control, Feedback, Clear Rules, Immersion, and Social Interaction. The description they give of ‘flow’ is the same experience that users have when they are immersed into games, with the feeling



of losing track of time as well as external pressure. To keep the 'flow' for the user, the activities in the game must be balanced in a way that the challenge of the game does not get too high, if the activities and challenge gets too high, the 'flow' disappears and the activity becomes too overwhelming and produces anxiety. If the challenge is too low however, the game fails to engage the user and the user will lose interest and will presumably leave the game. Therefore, the balancing of the game is important, if a user's abilities exceeds the challenge that the game will give them, the user becomes bored, but if the challenge of the game exceeds the users' ability, the user will become overwhelmed and the game will generate anxiety.

In conclusion of this part, games as an intervention for mental health issues can be just as effective as therapy (Lau, Smit, Fleming, & Riper, 2017; Shoneveld, Lichtwarck-Aschoff, & Granic, 2017). A gamified intervention generates engagement for the participants (Cheng, Davenport, Johnson, Vella, & Hickie, 2019; Perski, Blandford, West, Michie, 2017). A game for mental health improvement is more likely to be picked up by the audience if it is explicitly promoted as that (Poppelaars, Wols, Lichtwarck-Aschoff, Granic, 2018). To make a serious game targeting mental health, there are a few key points to consider; Engagement, Accessibility, Consistency with treatment, Generalizability, Effective skill building, Time and cost, Potential limitations (Shah, Kraemer, Won, Black, & Hasenbein, 2018). A serious game can be used to complement a treatment, to make the treatment more effective or designed to be used in certain circumstances, as the serious game made to emulate an and help the user deal with an anxiety attack (Dheda, & Heymann, 2019). HCD (human catered design) could be used to further improve the design of a serious games in the aspects of accessibility, effectiveness, and equity (Lyon et al. 2020). To target specific situations, a serious game can be created in a way that lets the user identify the situation and then apply the techniques the game informs them of, by then training through multiple situations, the user can identify these scenarios when they appear in their life, and at that point be equipped with the knowledge of how to manage them (Yahyaoui, & Menelas, 2017). In order to make the user recover from their stress, the challenge from a game cannot be too high or too low, if the difficulty of the game is too high, it often leads to the user being frustrated and that they stop playing, on the other hand, if the games difficulty is too low, the user can easily get bored and quit playing (Aquino Lopes et al., 2014).

### **5.2.3 Metacognition and Games**

For this part of the review, only two articles were deemed to be on topic, or as close to the topic as possible. Of the two articles that passed the second filtering one is about the impact of metacognition and goal orientation when it comes to problem-solving in a serious game and the other addresses gamification in the when in the context of cognitive assessment and cognitive training.

The first article is by Liu, and Liu, (2020), where they study the impact of learner metacognition, as well as goal oriented problem-solving. This was done in a serious game environment. The results they reached was that participants having a high level of metacognition also had a high level of multiple goal orientations, the other two findings consisted of medium metacognition-low multiple goal orientation and low metacognition-medium multiple goal orientation. They also reached results that suggested that metacognition and goal orientation can predict an individual's problem-solving performance. They do bring up metacognition in relation to learning in serious games, with a suggestion that there is a connection between the two, however, they could not state this as there is a need for more research in the area.

The second article is a review by Lumsden, Edwards, Lawrence, Coyle, & Munafò. (2016), in their review they looked at why researchers use gamification as a tool in their research. In their findings they find different reasons, these reasons were later categorized into seven categories; the first being to increase the participants motivation, the second is to increase the usability/intuitiveness for the target group, the third is to increase the long-term engagement, the fourth is to stimulate the brain of the users, the fifth is to increase ecological validity, the sixth is to increase the suitability for the targeted disorder, and the seventh is to investigate the effect of gamification in their study. Lumsden et al. reached the conclusion that cognitive tasks, when gamified may result in the quality of the data collected being higher, merely since the engagement of the users are heightened. However, no matter if the gamified intervention can improve data there are still reasons for why gamification may play a great role in cognitive research in the future. Since the cognitive tasks that are gamified, are more engaging than the traditional tasks, which makes the participant having their experience in the study feel less effortful, which can lead to reduced dropouts in longer studies. The gamified tasks may also have the participant feel less anxious and allow other cognitive interfaces to be tested, which may be hard to test on certain populations.

There is not much research done on what happens when metacognitive methods are incorporated in a game and how it affects the users. In the articles that were found during this literature review that touched on both subjects, one was about the impact of metacognition in a learning environment, but that the environment was created via serious games (Liu, Liu, 2020). This is not fully the topics needed, as the metacognitive part of the study was not metacognition in the game, but rather the amount of metacognition that the users possessed and how that affected how they played the serious game and how they solved problems. The second article brought up how and why researchers use gamification as a tool, in this they bring up cognition and the use of gamification as a method for increasing the quality of the data that's being collected (Lumsden, et al., 2016). This article does however not go into the topics of metacognition and serious games together, or the uses of metacognition in serious games or gamifications.

### 5.3 Analysis

To analyse the results of the literature review, a table was used. By comparing the articles with the help of the table, similarities and differences were found. These things were both taken in consideration for the conclusions. In this analysis, the first and second objective are in focus, as the analysis of the review will provide

Article	Metacognition	The view of metacognition	Stress	How they view stress	Games	What kind of game is used	What kind of article	Mental health	How they mix topics	Do they mention therapy, if so, how?	Conclusion of article

**Table 1** The table used in the analysis

The table used was split into different categories. The first being if the article contained metacognition, with the second category being a follow up and detailing how the article views metacognition. The third category asks if the article contained stress, and the fourth is another follow up, this time about how the article views stress. The fifth category asks if the article

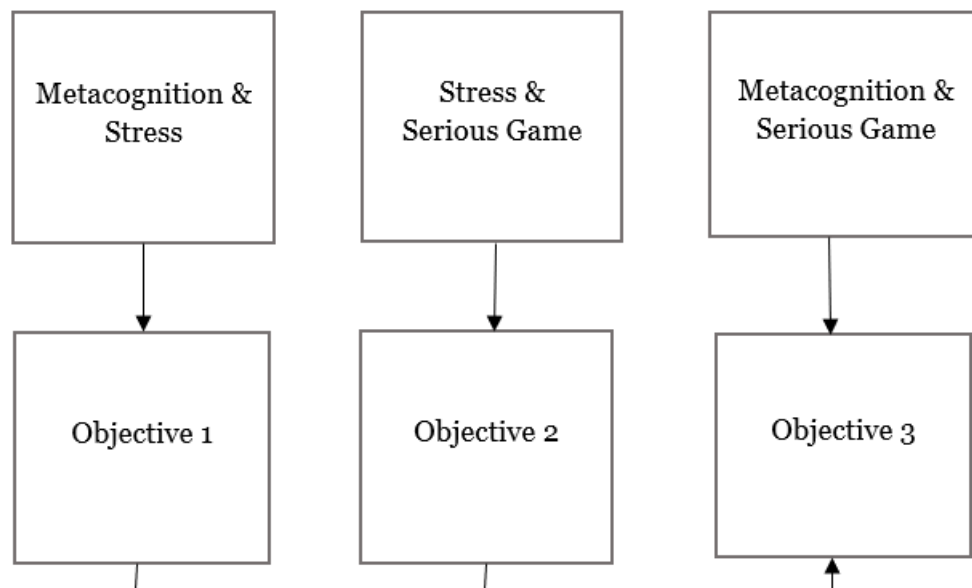
contains games, and the sixth is another follow up category and asks what kind of game and which form of game the article contains. The seventh category asks what kind of article it is, if it is a case study or review or so on. The eighth category asks whether or not the article mentions anything about mental health, such as mental issues. The ninth category is used for articles that contain more than one of the topics (metacognition, games, and stress) and how they mix these topics in the article. The tenth category asks if the article includes any form of therapy and if so, what kind and how it worked. The last category inquires over the conclusion of the article. In this analysis the first two objectives are in focus, by reviewing and analysing articles, more knowledge can be gained in both the relation of metacognition and stress, as well as the use of games in therapy.

In the articles for this analysis seven includes metacognition or metacognitive therapy, the view of metacognition is in these articles a rather unified one, where in metacognition is viewed, in short, as knowledge about one's own cognition (Philipp et al., 2019; Arpaia, & Andersen, 2019; Sariqam, 2015, Rochat, Manolov, R., & Billeux, 2017). This is both when it comes to metacognitive therapy which is regarded as a form of therapy where the participant is analysing the process of their thoughts rather than the content of their thoughts. In one of the articles, the one outlier they refer to metacognition as a characteristic of learning but do note that metacognition includes to think about thinking (Liu, & Liu, 2020). In the cases where metacognitive therapy has been used on mental health issues, the results have shown positive results (Philipp, et al., 2018; Rochat, Manolov, & Billeux, 2017), giving a high probability that the use of metacognitive therapy could be useful when it comes to helping users manage their stress. Some of the articles, the ones that included stress as one of the mental health problems also showed that metacognitive therapy can have a positive effect on an individual's stress levels (Maddahi, et al., 2017).

When it comes to stress, the way it is defined in the articles that includes this topic is either by define how it is caused or what it causes, in the former, it is generally regarded as a term to describe an individual's response to demands, either physical or psychological, that are perceived as or are exceeding the individuals capabilities (Maddahi, et al., 2017; Arpaia, & Andersen, 2019; de Aquino Lopes, Junior, Cardoso, & Lopes, 2014). In the second way, it is generally defined as being bad for the health of an individual, with symptoms that affect both the mental and physical health. It is grouped together with other mental issues such as anxiety (Ruiz, & Odriozola-González, 2017; Poppelaars, Wols, Lichtwarck-Aschoff, Granic, 2018; Shah, Kraemer, Won, Black, & Hasenbein, 2018; Yahyaoui, & Menelas, 2017).

The third topic is games, this means games that have been used as part of an intervention for mental health issues, have been developed to aid with mental health issues or in some relation to metacognition. This means that the usage of games in the article have been quite different from article to article. Most of the articles in this literature review are reviews of studies where games have been used as an intervention for mental health (Lau, Smit, Fleming, & Riper, 2017; Shah, Kraemer, Won, Black, & Hasenbein, 2018), some are studies where a game is used as an intervention to mental health (Schoneveld, Lichtwarck-Aschoff, & Granic, 2017), in some articles the subject is gamification of interventions or processes for mental health (de Aquino Lopes, Junior, Cardoso, & Lopes, 2014; Lyon, Dopp, Brewer, Kientz, Munson, 2020; Cheng, Davenport, Johnson, Vella, Hickie, 2019, ), in some articles the focus is on developing games or gamified interventions (Yahyaoui, & Menelas, 2017: Dheda, & Heymann, 2019; Perski, Bl&ford, West, Michie, 2017), and in one article the focus is on the marketing of a mental health game (Poppelaars, Wols, Lichtwarck-Aschoff, Granic, 2018,). As the articles have

different points of focus, the things to take from each article have been differing. The first thing done was however to look at the similarities that the articles gave. In the articles, attitudes towards the use of gamified interventions, or digital games as interventions for mental health issues are positive.



**Figure 4** Visual description of the topics and how they will be used in relation to the objectives

As the searching for articles in this literature review were split into three parts, each dealing with two of the topics each, most of the articles have a mix of two topics. This being either metacognition and stress, stress and games or metacognition and games. The first category, where stress and metacognition, the articles gathered are have two different focus points. The first being the use of metacognitive therapy on mental health issues, and the second being metacognition/metacognitive therapy in relation to stress/perceived stress. In the first focus point, wherein the metacognitive therapy on mental health issues, metacognitive therapy is either tested and compared to other therapeutic interventions, or about the effects that metacognitive therapy can have on mental health issues (Philipp, et al., 2018; Rochat, Manolov, & Billeux, 2017). In this part the mental health issues that are included in the articles are not stress, but other mental health issues such as anxiety or depression etc. In the second part, the articles discuss metacognition in relation to or as an intervention to stress or perceived stress (Sariqam, 2015,). The articles that research the relation of stress and metacognition have shown evidence that there is a relation between the two, that they can affect each other (Ruiz, & Odriozola-González, 2017). The results of using metacognition as an intervention to mental health issues or even stress have given a positive look on the matter (Maddahi, et al., 2017), in the article the usage have in cases given results that are on par with a conventional therapeutic intervention such as CBT. Which shows great promise for the use of metacognitive therapy and metacognition as an intervention when it comes to stress management.

The second part was stress and games, the articles in this part was split into four different focus points. The first being games as tools for therapy, the second being technology in relation to mental health, the third being developing a game for mental health, and the fourth being

serious games developed for stress specifically. In the first part articles that dealt with games as a part of therapy were sorted, these articles brings up different aspects of the usage for serious games in therapy as one directly compares an applied game to CBT (cognitive behavioural therapy) (Schoneveld, Lichtwarck-Aschoff, & Granic, 2017), and the other is a review of game based interventions for therapy (Lau, Smit, Fleming, & Riper, 2017). Both of these articles conclude that the usage of games as a tool in therapy for mental health is feasible. The second part that includes articles that deals with technology in relation to mental health. These articles brought forward how technology can aid in when it comes to individuals dealing with mental health issues. These articles still differ from each other, with two reviewing different types off gamified apps for mental health (Cheng, Davenport, Johnson, Vella, Hickie, 2019; de Aquino Lopes, Junior, Cardoso, & Lopes, 2014), one presenting a framework of influences of engagement in games that are made as interventions for behaviour change (Perski, Blandford, West, Michie, 2017), and one that analysed different types of marketing for mental health games (Poppelaars, Wols, Lichtwarck-Aschoff, & Granic, 2018). The different aspects of the articles make them a bit hard to compare to each other, but there are some similarities to find. The articles that review different types of digital interventions, both reach the conclusion that gamified interventions is an option that can be made, and has been made into option for individuals with mental health issues, this is however with a notion that more research should be made to further develop the potential of the medium. In the study of marketing they do point out the aspect that as the game that were explicitly marketed as a mental health game were the one most picked by the participants, this is something that can be related to findings in the background where Schoneveld et al. (2017) talks about the stigma and difficulty for young people to search for and finish mental health programs, as there is an interest in a game that clearly states it's for mental health, this can act as the bridge that helps young adults to seek out help. In the case of the article that presents a framework, it talks about the players engagement when using the intervention and different influences that may arise. The engagement of the user is another thing that have been brought up in the background by (Hammedi, Leclerq, & Van Riel, 2017), these two articles bring up points that can be put in the context of the reviews of digital interventions, the engagement of a user is an important part of an intervention, as this keeps the user from dropping out of the program. In the aspect of the article dealing with marketing, this is in general an important part of a game as the bigger reach a game can have the higher are the chances of gaining a large audience for the game, if this is put into a perspective of a game for mental health, the reach here would be to find young adults that might not seek out help otherwise. The third part has articles that are more aimed towards the development of a game for mental health. In this part the articles give two different aspects of developing a game for mental health, one dealing with the development of a game and a console that mimics a minor anxiety attack to help the user with their anxiety management (Dheda, & Heymann, 2019), and the other discusses digital health services for children (Lyon, Dopp, Brewer, Kientz, & Munson, 2020). One of these articles is more practical as the other is discussing the topics theoretically. Both articles talk about aspects of therapy, with one taking the aspect of developing a game as a supplement for existing therapy and the other taking the aspect of how to improve mental health interventions. The fourth category of this part is articles that include games that are specifically developed for stress, out of these articles one focuses on developing a game targeting the stressors in the workplace, and how to react and manage the situations (Yahyaoui, & Menelas, 2017). The second article takes up the aspect of recovery and coping from stress (de Aquino Lopes, Junior, Cardoso, & Lopes, 2014). Both articles' present way for a game targeting stress to be developed. The strategies they present varies a bit with one focusing on how an individual can recover from

their stress and pushing aspects such as the relaxation effect that games can bring and the psychological detachment that can focus the individuals attention to the game. The other article focuses rather on solutions to the stressful situations that can train the individual on how to deal with these situations, thus making them less stressful. Both articles do bring up the point of mastery and control, that this can be an element that helps an individual to manage their stress. The focus of mastery and control are focused on different things in the articles, with one having the aspect of controlling certain situations that might prove stressful and the other about the control a player would have in a game and the mastery of the skills needed to proceed in the game. The articles containing the use of games or digital interventions for either stress or other mental health issues have shown positive results, in some cases the efficiency have been shown to be as good as CBT, however some articles do note that more research is needed. There are results showing for an audience that can be reached through marketing. More than one article present guidelines or ways for how a game or a digital intervention can be developed, other gives ideas for how they can be improved. Things that showed up through different articles on the matter of making just games were the matter of engaging the players, the feeling of control the players have while playing (or over the situation they are in), the mastery of skills (this can be applied to both skills outside of the game, as well as in the game), a feeling of progression, and immersion in the game environment.

The third part was metacognition and games, this was by far the area that had been researched the least, and articles containing both of the topics were hard to find. The two articles found focused on different things as one was about the learning characteristic of metacognition (Liu, Liu, 2020) and the other dealt with gamification of cognitive research (Lumsden, et al., 2016). Neither had the aspect of the effect metacognition can have as a part of a game. As this area of research seem to have not been breached yet, there is no information to gather from here for this thesis.

### **5.3.1 Conclusions**

In this literature review, all the objectives have been involved. In the case of the first objective, that deals with metacognition in relation to stress, and the second objective, that deals with games and therapy, both of these have been answered through the literature review and the answers to the objectives will be presented in the Results chapter. In the case of the third objective, the one dealing with how the knowledge gained in the two previous and how it can be used for developing games. For the third objective, this literature review has provided a basis that can be evaluated with the game analysis in the next chapter.

To conclude, the view on metacognition is generally defined as knowing about knowing. This also defines metacognitive therapy, where the focus is to have the participant to analyses the processes of their own thoughts instead of the contents of the thoughts, and then how to manage them. The usage of metacognitive therapy for mental health issues have given positive response, both for mental health issues in general, and when it comes to the management of stress and stress symptoms. In several instances the use of a serious game as a tool for mental health, in this case stress interventions have been met with positive results. These interventions have at points shown as much efficiency as CBT (Schoneveld, Lichtwarck-Aschoff, and Granic, 2017), however, it is noted that there is more research needed in the area to make a final statement. The usage of games in therapy can also be split into the usage of games as an intervention, and the use of gamified interventions. In the first, this means a game was used as a tool in the therapeutic intervention, in the other the intervention was developed

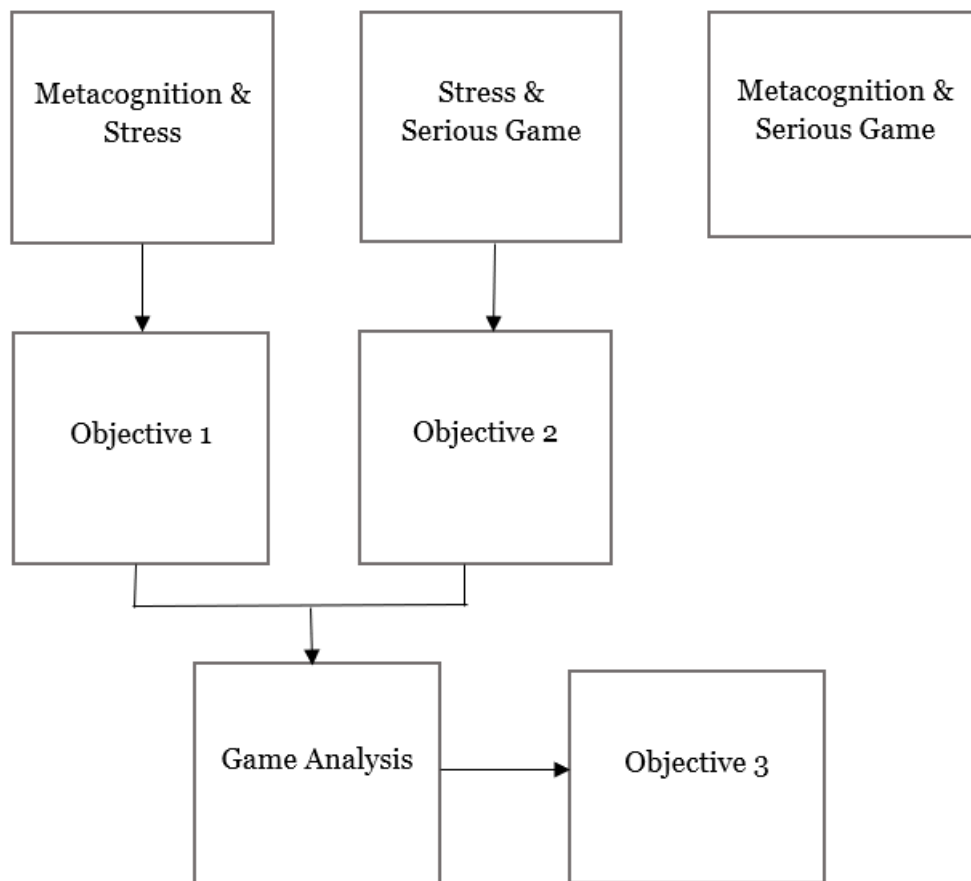
with gamified aspects, such as a scoring system. Both of these methods are used in therapy and have been used with positive results (Dhedda, and Heymann, 2019; Schoneveld, Lichtwarck-Aschoff, and Granic, 2017).

When it comes to the development for a game especially for stress symptoms, a few elements showed up that were deemed important. These elements are; The Engagement of users (to have users engaged and minimize the risk of a user quitting the game), the Feeling of Control the users have (that the user has a level of control over the game and makes choices that affect the game, this can also be related to control over situations outside of the game), the Mastery of Skills (both skills the user can use in game as well as skills the user can bring into the real world), a Feeling of Progression (that the users' actions are used to progress the game), the Feedback (that the game gives the player informative and immediate feedback on their actions in the game), and Immersion in the game environment (that the user feels immersed in the game and puts majority of their mind into the game and is not distracted by things going on outside of game). Some of these elements will be used in the analysis of the games, as they can be applied to the games to see how the games in the sample adhere to them.

As the area of metacognition in relation to games in research is very specific, the articles that were found that contained both of the areas were not focused on the direction that this thesis is. The articles showed other aspects of these two topics. This meant that the information in the articles were not applicable on the aspects of metacognition and games that this thesis explores.

## 6 Study of Games

As the information from the third part cannot be used to answer the third objective. Which dealt with how the knowledge gained in the first and second objectives could be used in developing a game, more focus will be laid on the game analysis to answer the third objective.



**Figure 5** An updated version of Figure 4, showing how objective 3 will be solved

Before an analysis can be made, first a review of the games will be made, this to find games that are aimed to relaxing the user. To find games the two platforms Steam and Itch.io were browsed. Both platforms have their games in a system where they are sorted by categories, as well as systems that makes the players able to rate the games according to how they liked them. By using the categories, the finding games that are aimed at the same thing becomes easier. As the categories on these two platforms are mainly aimed at the genre of the game, there are tags that tell the player more about how the experience of the game is, such as relaxing, storytelling, walking simulator etc. As stress management and stress reducing games are not a category on either of those platforms the closest category found was the category with relaxing games. the rating system allows players to leave both reviews and rate what they thought about the game, by looking at the rating of the game it is possible to see how the audience reacted to the game. By looking at the reviews, descriptions, and popularity of the games three games were chosen on each platform. The games used in the study are the games that are free, as the goal was to find games that were accessible to virtually anyone.



During this part, focus was on different parts of the games. By looking at aspects of the games such as color schemes, narrative, sound design and mechanics to see if there are any patterns that these kinds of games tend to follow. Are there anything that these games have in common, and why? If there are any patterns or aspects that the games have in common, these will be looked at and be compared to what the result of the literature review points at. This is to see if there are any theories in literature that correspond to what is used in current games. The chosen games were played for thirty minutes (after reading the instructions/rules of the games). Before and after playing a game, a protocol was filled in to help with comparing the games with each other, as well as ensure that the same information was collected for each game.

<b>General info</b>	
Name of Game	
Found at	
Website of game (if it exists)	
Creators of game/Studio	
Location	
Date of release	
Version	
Rating on site	
Do the description/creators mention stress, if so, how?	
<b>Gameplay</b>	
What Genre	
Mechanics	
Gameplay (?)	
Goal of the game	
<b>Aesthetics</b>	
Is there a narrative	
If so, what	
Art style	
Colour scheme	
Sound	
Music	
<b>Summary of playtime</b>	

**Figure 6** The protocol used when reviewing the games

The protocol for this part is split up into four parts, one with general information about the game (that could be written in before playing), such as the name of the game, which platform it was found at, a link to the games website (if possible), who created the game, where it was created, when the game was released, which version of the game was being played (if possible), which rating the game has on the platform, whether or not the creators mention stress in the description or anywhere on the games store page.

The second and third part of the protocol deal with the content of the games. In these two sections the gameplay and aesthetics of the games. This part of the protocol is built around the MDA framework (Hunicke, LeBlanc, & Zubek, 2004). The MDA framework splits a game into three parts, Mechanics, Dynamics, and Aesthetics where the mechanic of the game is providing such things as the rules and framework for the game, what the user can do with the game. Dynamics refer to the interactions that the user has with the game, such as gameplay. The aesthetic refers to the emotional experience the user gains from the game, why they would

play the game on an entertaining level, such as narrative or discovery. As there is only one question in the protocol about the mechanics of the games, this category was put together with the dynamic part of the protocol, which here has the title of gameplay. The protocol is based on the MDA framework; however, this is with some adjustment of how they define Mechanic, Dynamic and Aesthetic.

The first statement of the second part is about the genre of the game. As the games chosen were based on their score on the respective platform, and the tag of 'relaxing', this means that the genre of the game could be anything. The reason why this is a part of the protocol is to see if games with the tag 'relaxing' tend to lean towards a certain genre.

For the mechanic part of the protocol, it refers to how the user physically plays the game. This is more on the MDA framework (Hunicke, LeBlanc, & Zubek, 2004) where mechanics includes what the user can do. In this situation it means which buttons they press or if they use the mouse to advance in the game.

For the Gameplay it is what the user does in the game. How the user advances in the game and how they play the game. Example, the user walks around in an area trying to find a treasure.

The Goal of the game refers to the endgame of the game, what should the user strive towards. This can mean different things in different games. Example, reaching the end of a narrative, or collect as much points as possible.

In the third part of the protocol, focus is on aesthetics, which is the emotional experience for the player (Hunicke, LeBlanc, & Zubek, 2004) such as narrative and in this protocol also how the game is visually.

The third question is with regards to visuals. What the visuals in the game looks like, if they are in 2d or 3d, if the art style is more realistic or stylistic and so on.

The fourth question ties into the third one but deals with the colors rather than the style of the art in the game.

The last two questions also tie into each other. The fifth detailing the sounds from the game, such as footsteps or talking, whereas the sixth question regards the music of the game, if there is any music in the background or music that appears throughout the game.

The last part of the protocol is a summary of the playtime, what happened during the play and if something that might be good to remember but does not fit under any of the other parts happens.

## **6.1 Sampling of Games**

The games used here were chosen from two platforms, one being Steam, the other being itch.io. From there the games were selected from the 'relaxing' tag. The selection was based on the rating, reviews and popularity. This to see how the audience reacted to the games and if they were played much. The aim was to find relaxing games available to anyone. For the review, the games were played for 30 minutes. The games chosen will be presented with a short description.

### **Tanuki Sunset (2019)**

*Tanuki Sunset* were a game where the player takes control over a raccoon riding a skateboard down a road. The goal of the game is to earn points by doing tricks and jumps. The gameplay is quite fast as part of it is to keep the raccoon on the road, as well as dodging various obstacles such as cars or rocks.

The creators do not mention anything about stress or stress relief in their description of the game. The graphics of the game are based in synth-wave aesthetic using colours such as pink, blue, and purple. The player uses a control or their keyboard to play the game.

### Ruya (2017)

*Ruya* is a puzzle game with a narrative. the game starts with a narrative sequence where the player gets to see the backstory of the character Ruya, how she found her loved one, adopted a family and later lost her loved one. when she loses her loved person, Ruya falls into a deep depression, and this prompts antlers to grow from her head. Feeling like she is only a burden for her family, she goes into a meditate state. This is where the game starts and by completing the levels in the games, the player pushes the narrative forward, at the end of some levels

The creators of *Ruya* do not state anything about stress specifically, however they do state on their store page that aspects of the game are made to put the player into a state of relaxation. Through the game sounds like the wind can be heard, as well as atmospheric music.

### Lieve Oma (2016)

The game *Lieve Oma* follows a dual timeline, the main one is one where the player controls a child out looking for mushrooms with their grandmother in the autumn. In the second timeline the player controls an older version of the child, walking the same path in the winter. The player is given the objective to find mushrooms in the main timeline, and then bring them back to the grandmother. The gameplay is pacing itself to the player, the camera follows the grandmother, allowing the child to run around and search the area for the mushrooms, and the grandmother will stop and let the child catch up when the child is too far behind, or call out to the child to slow down when they are too far ahead. During the game, a narrative is being presented in snippets in the conversations between the grandmother and the child.

The creators do not state anything about stress relief or stress management on the store page for the game. The colour-scheme in the game changes in the dual timeline, but in the main timeline the game has pink, brown and orange and in the other timeline in winter the games colour-scheme is in blues and whites. The soundscape of the game is that of a forest with rustling leaves, bird sounds and footsteps on different terrains. The music in the game is an atmospheric piano in the background.

### What never was (2019)

*What never was* is a game where the player takes control of Sarah, whose grandfather recently has died. Sarah is tasked with cleaning up on her grandfathers 'attic, the player explores the attic through Sarah and solves puzzles to find notes and trinkets that leads her to discover new things about her grandfather and the world around her. The player uses the WASD keys on the keyboard to move and the mouse to inspect or interact with things in the attic.

The creators do not mention stress in the description of the game. The games graphics are realistic 3D, and the game as it takes place in an attic with only one window uses rather dark colors. The soundscape uses sounds such as footsteps, creaking sounds and whenever the player comes across something mystical, has a sound showing that it is something mystical, such as looking through the stone in her necklace that lets her see things that are not visible to the normal eye. The music in the game exists in the menu, as well as a melodic short when the player clears certain checkpoints in the game (such as finding the other part of the characters necklace).

## Floating Point (2014)

*Floating Point* is a game with minimalistic art style where the player controls a dot and a grapple. By clicking with the left mouse button, the player can attach the grapple to one of the squares on the playing field, by holding in the button the player reels in the dot. By using the grapple the player can swing around the playing field and by hitting pillars the player raises their score, when three or less pillars are still in the playing field, the player can advance to the next area. The pillars grow or shrink according to the players momentum, if the player keeps their momentum and flow in the game, the pillars grow and are easy to hit, but if the player loses their momentum or stops, the pillars start shrinking.

The art style for this game is minimalistic, the player controls a red dot (with a trail following when the player moves it), the grapple is a red line, the bars are red, and the blocks are gray. The music in the background is peppy and electronic, and there is a sound when the player collects the bars. There is no narrative in the game.

## Coloring Pixels (2018)

Like the name suggests, *Coloring Pixels* is a game where the players choose one of the motifs of pixel art and then colours it. The colouring is done by clicking down and holding in the left mouse button. The colouring is done with the help of numbers, every colour has a number assigned to it, which will show and be selectable on the lower part of the screen. The pixels will all have a corresponding number and by colouring the pixel with the right colours will reveal the full picture to the player. After the player is done with a motif, the game will show how the player processed in the game with a speed paint of the motif, following how the player did it.

The creators of this game do not specifically mention stress in the description of the game; however, they state that the game is relaxing to play. The colour-scheme differs with each motif as they use different colours, but most of the ones played were using strong visible colours. Some motifs use many different hues and nuances to the pictures, others are simpler with only three or four different colours. The player can freely choose between the motifs, they do not need to be played in any kind of specific order.

## 6.2 Analysis of Games

The analysis of the games was done in a way similar to the analysis of the literature review. In this case, the games were played, and data was put into the protocols. After that, the games were compared against one another with the help of a table. The table for this analysis was made by part of the findings in the literature review analysis and from the protocol used when reviewing the games. From the elements that were found in the literature review, five were

made into categories for this analysis. This is to see how these elements are used in the games, and how they could be used in development of other games.

The two other categories are taken from the protocol when reviewing the games, these two categories are there to see if there are any aspects within the visual style or the audio that are used across the games that can be analysed. To do the analysis, the games were played again, this time for fifteen minutes each, with the help of the table shown below.

Game	Sound	Visuals	Control	Mastery	Feedback	Progression	Immersion
Tanuki Sunset							
Ruya							
Lieve Oma							
What never was							
Floating Point							
Coloring Pixels							

**Table 2** The table used for the game analysis

**Sound** – This category refers to the soundscape in the game and includes both sound and music. By comparing the soundscape, the goal is to see if there is any preferred way to handle the music in the games that are amongst the sample. The basis for this category lies with the sound and music category in the protocol made when reviewing the games.

**Visuals** – This category refers to the visuals of the game, like the sound category, the goal of this category is to compare the visual parts of the games against each other. This is to see if there are any similarities or differences that can be seen. This category was made based on the art style and colour scheme categories in the protocol.

**Control** – This category refers to the level of control the user has, if there is anything that would make the user feel out of control or if the player or if the user has the feeling of being in control during playtime. This category is taken from the results of the literature review, with the point being the control in game and control over situations in real life.

**Mastery** – The mastery category refers to the mastery of skills that the user can learn in the game. This is a category that is taken from the results of the literature review analysis, in which the mastery of skills can be both of use in game as well as outside of the game.

**Feedback** – This refers to what kind of feedback the game gives to the user. This is according to the literature review analysis, that the feedback to the player should be given immediately and be informative of what the user affects.

**Progression** – This refers to the user’s progression in the game, is the user responsible for the progression and the end state of the game. This is taken from the literature review analysis, that the users’ actions should affect the progression of the game.

**Immersion** – This category refers the state of immersion that the user has when playing the game. This is taken from the result of the literature review, that a game should have a rich immersive environment and occupy a large part of the users’ mind.

In this analysis, the element of engagement will not be tested as this refers to the engagement the user has with the game, if they would continue to play and if they would seek out to play the game. In this study, the games were looked for with a set of restrictions and rules, rather than what was just appealing. This is also since the games all were played the same amount of time before being quit, this would go against the engagement of the game keeping the user from quitting. This is a problem area for mental health programs for young adults, as the stigma of mental health issues such as stress is something that keeps young adults from seeking out or completing their mental health programs. Engagement have been shown to be necessary in both to have users not quitting a game, as well as to make individuals not drop out of their intervention programs, as there are quite a few articles that supports this, it can be said as a statement.

This analysis has two goals; the first is to see how the elements found in the literature review can be applied in games and game development, in this study, it is more to see how these elements have been incorporated into the different games. The second is too see if there are similarities between these games and how that could be used when developing games in the future. The first of these goals ties in with the third objective that was derived from the research question. In order to see how the knowledge from the first two objectives can be used when developing games, this analysis will firstly see if the elements extracted in the literary review can be applied to games, and secondly, if that is the case, how these elements are used in the games and thus, how they can be used as guidelines. The second part deals with the similarities of the games, if there are any. Since these games are picked from the relaxing category but are mainly made for entertainment, they may be very different from each other. By looking at similarities and differences, the goal is to see if there are elements that show up in all or in the majority of the games. This might be something that later can be made into a guideline.

First category was about the soundscape of the game, out of the games used, most games emulated the visuals, as in, they would give the user the sound of footsteps or wind that would fit into the environment. There would also be sounds that reacted to the user’s actions, such as picking up a paper or hitting a pillar. Most of the games used a calm music in the background, this was mostly a melodic piece. In two of the games, *Tanuki Sunset* and *Floating Point*, the music was more upbeat, and had a faster rhythm.

The second category dealt with the visuals of the games, in most of the games, the visuals were simple, both in 3D and in 2D, the characters did not have much details and neither did the environment, in one game, *Floating Point*, the visuals were squares, rectangles and a dot with a trail that followed it. Another game, *Lieve Oma* had more detail on the environment than on the characters. The outlier in this category is, *What never was*, that had a realistic and very detailed environment that the character walked around in.

In the third category, the players control over or in the game was evaluated. This was one of the elements found in the literature review. In the games analysed here, the player was given varying amounts of control, some games, *What never was*, and *Lieve Oma*, let the user move as they wanted in the game area, at their own pace and explore, with *Lieve Oma* taking a bit of control over the users character when it came to some of the narrative parts. In other games, *Coloring Pixels*, *Tanuki Sunset*, and *Ruya*, the user can move as they want, but within the rules of the game, otherwise the games let the user have consequences, such as crashing in *Tanuki Sunset*, The numbers not disappearing in *Coloring Pixels*, and the game only allowing the shape they ask for in *Ruya*. In *Floating Point*, the game lets the user move as they want within the game area by using the wire, but the player must be aware of their surroundings to continue on moving.

In the fourth category, the aspect evaluated was the Mastery of skills. This was another of the elements found in the literature review. This was also an aspect of the games that varied from game to game, some games like *Tanuki Sunset* and *Floating Point*, had the user be more focused on mastering how to play then to progress in the game, by playing the games the user becomes better and thus they could reach further into the game easier. In *Ruya* and *What never was*, the mastery or training of a skill is not fully necessary, however, as both games include problem solving to move on in the game. In *Lieve Oma* and *Coloring Pixels*, no skill needed to be learned or trained to progress in the game.

The fifth category, the evaluated aspect was the Feedback element from the literature review. The games all give feedback of the users input, but in different ways. The feedback given to the user differed in the games, in some, *Lieve Oma* and *What never was*, the feedback would come from the characters in the game, in the case of *Lieve Oma*, from the Grandma character and in the case of *What never was*, the feedback came from the player character, both of these comes in dialogue or monologue respective. In the cases of *Tanuki Sunset*, *Floating Point* and *Ruya*, the feedback comes from the game play. In *Tanuki Sunset*, the feedback from the actions that the user does, this includes the user falling off the course or crashing into a car because of their actions, another way the game gives feedback is through a score system that makes it clear when the user does something that is considered a good move versus a bad move. In *Floating point*, the feedback comes from the pillars and from the velocity of the game. Then the user manages to move to dot fluidly around the game area, the pillars grow and the experience becomes smooth, but if the user makes a mistake in where they put the wire or so, the gameplay reflects this by stopping the dot and having the pillars shrink, the pillars start growing when the player has the dot move more fluidly and faster. In *Ruya*, the feedback from the game comes both as positive feedback, when the user clears a level or manages to clear away some of the “pawns” on the game area. There is also negative feedback when the user tries to clear away the wrong shape or has reached a standstill in the level. This feedback comes in both sounds and visuals from the game. When it comes to *Coloring Pixels*, the game gives feedback in visuals, when the user colours the wrong square, the number on the square will still be visible, or it will become visible again if it was already coloured.

The sixth category details the Progression element from the literature review, the evaluation is about the users input on the progression of the game. In all of the games that were in the sample, the user needs to interact with the game in order for the game to progress, this is done in different ways, but ultimately the games rely on the user to do actions for the game to continue. The user progresses the games differently however, in *What never was* and *Lieve Oma*, the games progresses when the user reaches narrative events, such as unlocking a

drawer in *What never was* or reaching a talking event in *Lieve Oma*. In *Ruya and Coloring Pixels*, the user progresses in the game by clearing levels, and moving on to the next. In the cases of *Floating Point* and *Tanuki Sunset*, the users' input is much needed for the game to proceed, if the user stops their input the games will stop. If the user stops their actions in *Tanuki Sunset*, the character will either fall off the course or crash into an obstacle. If the user stops their actions in *Floating Point*, the dot will stop moving and the pillars will shrink until they are not visible anymore.

The seventh and last category dealt with the aspect of immersion. In this category the level of immersion into the games varied from game to game but were still noticeable in each game. In some games, *Ruya*, *What never was*, *Lieve Oma*, the level of immersion could be quite high, using aspects such as sound to heighten the immersion for the user. In other games such as *Tanuki Sunset* and *Floating Point*, the immersion could be connected to the progress of the user, as the game over screen in *Tanuki Sunset* could break the immersion for the user, however, this game also does use sounds to immerse the user. In *Floating Point* its immersion is also connected into the gameplay as if the user reaches the point where gameplay feels smooth it could be easy to get immersed into the game, however when the gameplay stutters, the immersion can become lower. In the *Coloring Pixels* game, immersion could be likened to that of painting, where immersion may be of a high level.

From what can be shown when going through the sampled games with the table, both similarities and differences can be seen between the games, for example the games *Ruya* and *Tanuki Sunset* have differences when it comes to how the learning of skills are done and how much focus is on mastery, however, they share similarities when it comes to how the feedback is relayed to the user as both games relay their feedback through the gameplay and visuals. The elements found in the literature review were able to be applied to the games, these elements were part of the games in different level of focus. Some of the games leaned more towards the immersive element, letting the user move freely and immerse themselves into the game, other games were more leaning towards the mastery element, having the player train to master a skill to proceed. All of the games game the user feedback on their actions, and all the games had the user being the driving force in the progression of the game, these were done with different tactics depending on which game, but all games had these two elements as a staple. When it comes to the element of control, the games let the user have various degrees of control, but in most cases, it was a high level. Most of the games had the user set the pace with exploring, solving puzzles or drawing, however, the two games that had a higher pace, *Tanuki Sunset* and *Floating Point*, were both games that leaned more into the mastery category and valued the skill of the user.

Aside from the categories that stemmed from the literature review, two categories were based of the protocol used when reviewing the game, these categories were the Visual category and the Sound category. The first category, sound, dealt with both sounds from the game such as footsteps or audio feedback from scoring points, and with music that could be heard throughout the games. In the games, a few had sounds that fit into the environment, and thus heightened the immersion of the user. When it comes to the music in the games, three of the games had a calm melodic kind of background music, one did not have background music (only used realistic sounds of the environment), one game had a electronic soundtrack and the last game had a poppy soundtrack. From this, the music in the games seemed to reflect the gameplay, as the games where the music were calmer had a slower pace of gameplay, and the two games that had a soundtrack with a faster pace also had a faster pace of the gameplay.



The other category taken from the protocol was the Visuals one, in this category, both art style and colour scheme were considered. Out of the games analysed all but one, *What never was*, the art style, both in 2D and 3D were quite simple, containing enough visual to show an environment and in some games characters. One game, *Floating Point*, had a minimalistic graphics, only containing blocks, a red dot, and the trail after the dot. A thing to note in this analysis is that the games in this sample all were free to download and free to play, which may be a reason to why most of the games contain a simplistic art style.

### **6.2.1 Conclusions**

In this analysis, there were two goals, the first was to see how the elements that were found in the literature review could be applied to games and game development. The second is to see if there were any patterns in the games and how this can be used when developing other games. These goals tie into the third objective for the research question. This is to see how the knowledge from the first and second can be used when it comes to developing a game to help young adults with stress management. By taking the elements found in the literature review and apply them onto the games in the analysis, first the aim is to see if the elements can be applicable on games, and the second aim is to, in the case of the elements being applicable, how they can be applicable to the games.

When it comes to the elements that were found in the literature review, the ones that were evaluated in the analysis could all be applied on the games. They were portrayed in different ways in each game, as well as in different amount, for example, some of the games had more focus on having the user master a skill and some games leaned more towards having the user immerse themselves in the game. All the games however had the user as the man source of progression, if the user did not input anything, the game would not progress. The same applied to the feedback category, all the games gave feedback to the player, however this could be in different medium such as visual aspects or through sound. In the control category, most of the games all let the users have a high level of control, the two that had the level of control a bit lower both leaned more towards the mastery category and valued the training of a skill (in this case the gameplay). In conclusion, the elements that were found in the literature review and evaluated with the games were all found to be applicable on games.

In the second objectives, the sound and visuals of the games were evaluated. In the games evaluated it was noted that the music was tied into the game play in the games, if the gameplay had a higher pace, so did the music. The sounds in games was used to make the environment more immersive to the player, by adding sounds of footsteps or wind blowing. When it came to visuals, most of the games in this sample had simple visuals, foregoing details in both characters and environment, that might however be since the games in the sample all were free to play, so graphics may not have been the first priority, rather narrative or gameplay.

## 7 Results

In this section, there will first be a compilation of the findings that could be taken from both the literature analysis and from the game analysis. Then the results from this thesis will be presented.

### 7.1 Compilation of findings

In this thesis the research question was: **“What aspects game designers need to take into consideration when designing games to aid young adults’ stress management”** with the overall aim to create and present guidelines for developing a game that targets the stress levels of young adults.

To reach a conclusion for the research question, it was first divided into three objectives, the first being to **Obtain an overview for how metacognitive therapy is used for stress management**, the second being **Obtain an overview of how games can be used in therapy** and the third being **How the knowledge above could be used to create guidelines that can be used when developing a game for stress management**. The results from these objectives would then be used to create the guidelines.

#### **Objective 1: Obtain an overview for how metacognitive therapy is used for stress management**

To obtain an overview for how metacognitive therapy is used in stress therapy, articles containing the topics of metacognition and stress were included in the literary review. The articles were first used to define both of the topics, to do this the articles were looked through and the definitions (if there were any in the articles) were compared to see how metacognition was defined in literature, this was then taken as the definition for this thesis work. First was metacognition, the definition of metacognition was ‘to have knowledge about ones’ own cognition’, which then leads into metacognitive therapy, which could be defined as a kind of therapy where the participant focuses on the process of their thinking rather than the contents of their thoughts. When it comes to stress, the definition found was that of ‘the term used to describe an individual’s response to when demands, both physical and psychological, exceeds or are perceived as exceeding the individual’s capabilities.

By reviewing and analysing the articles, a greater understanding for this could be made. The articles that were reviewed presented different aspects of how metacognition could be related to and used in therapy to reduce stress. By analysing the articles and comparing them against each other different findings were made. One being the usage of metacognitive therapy as an intervention to mental health issues overall, another being the use of metacognitive therapy as an intervention to specifically stress, perceived stress or stress symptoms. Thus gaining an overview in how metacognition is defined, how stress is defined, the relationship between them and the current use of metacognitive therapy as an intervention for stress related symptoms. The usage of metacognitive therapy as an intervention for stress has been shown to generate positive results. Going by the results in the articles metacognitive therapy looks promising as an intervention to stress and stress related issues.

To sum it up: The use of metacognition and metacognitive therapy when it comes to stress management has been done. The results from this kind of therapy have shown to have a positive effect when it comes to individuals stress levels. From the articles in the review, it has

been shown that metacognitive therapy has positive effect on multiple mental health issues, among them also stress symptoms, which gives the method of using metacognitive therapy as a tool for stress management a high chance of being successful.

### **Objective 2: Obtain an overview of how games can be used in therapy**

To obtain an overview for how games are and could be used as interventions for therapy, the topic stress was again included in the query, but this time together with games. The articles were reviewed and analysed in the same way as the ones with metacognition and stress. In order to gain knowledge that could help answer this objective, the articles used had a wide variety of focus, as some focused on the current use of games in therapy in general, some about digital interventions for mental health, some about the development for games targeting stress and in one case the marketing of mental health games. These articles presented different ways to use games as an intervention or as a supplement to therapy.

The usage of serious games in relation to mental health issues have on multiple occasions showed to give positive results in the treatments where they have been incorporated. Some things to take out specifically would be the raise of motivation of the participants, the engagement, the ability to target specific situations, to manage and specify the difficulty to work for different individuals and to let the user recover when playing. Specifically, the motivation and engagement part have shown up multiple times during articles in this work. The engagement of the participant has shown to be a problem area when it comes to mental health programs for young adults and youths. By using a game as the medium, it could potentially break the stigma around mental health issues, something that has stopped youth from seeking help.

The usage of a game as an intervention for mental health issues such as stress can be made with specific situations in mind, which can be utilised in making different games for different aspects, such as managing stress, preventing stress symptoms, or dealing with stress symptoms. It can also targeting specific situations in the way that it can help the user identify these situations, these may be situations that cause stress for the user, and by helping the user identify and then also train the user in how to handle these kinds of situations, thus making the user more prepared when facing them in their real life.

To sum this up; Serious games have been used in different ways when it comes to mental health intervention. They can be used as complement to a mental health program, or as the digital intervention itself. The usage of a serious game as an intervention to mental health issues have shown, multiple times, to be positive. By using games as a medium, the stigma, which is a problem area when it comes to mental health treatment programs, may be lessened, which could encourage them to finish treatment. A game could also help the user identify and prepare towards specific situations that can help them manage their stress.

### **Objective 3: How the knowledge above could be used to create guidelines that can be used when developing a game for stress management**

In order to answer this objective, the topics of metacognition and games were used in a query (the third one), however, the articles that were found in the third search query did not give any knowledge that could be used for this objective. Instead, to answer this objective, two parts of the thesis were used, first the two first parts of literature review, and then the game analysis. In the literature analysis, knowledge from both the usage of metacognitive therapy as an

intervention for stress and other mental health issues, and the usage of games as an intervention for stress and other mental health issues were gathered. By using this knowledge as a basis, elements that were deemed important for developers to have in mind were presents. These elements where then used in the game analysis to evaluate them and see if they could be applicable onto games and, if they were, how they were used in the games that were analysed.

In the literature review, especially the articles that contained the development of games were used when it came to this objective. In these articles (as well as a few others in the review), some elements were noted to show up more than others and used while developing or in relation to the games. These elements were extracted and investigated. To then see if these elements were applicable to games and could be used in game development, five of the six elements were a part of the game analysis (the last one, that dealt with engagement was deemed valid to use as a guideline as it has been shown to be an important aspect of both mental health interventions and games in multiple articles, as well as it would not be possible to evaluate with the game analysis as the games only were played by one person and had been chosen after a set of variables). In the game analysis, the elements were evaluated in the sense of how they could be applied onto games, this was made by playing through the games for another fifteen minutes each, and seeing what elements were used and how they were used in the games. By doing this, the elements were shown to be applicable onto games, and a greater understanding for how they could be used was gathered. This knowledge was then used to make the elements into fitting guidelines for the development of a game targeted to help young adults manage their stress.

To summarize: To make use of the knowledge that was found in the literature review, five of the six elements that were found were evaluated in the game analysis to see how they could be applied to games.

## 7.2 Results

From the three objectives, the research question **“How games, with a basis in metacognitive therapy, can be used in aiding young adults’ stress management”** could be answered. In the previous section, the three objectives were answered, which through a literature review answered the first and second objective and for the third objective, both the literature review and an analysis of games were used. The first objective focused on gaining knowledge of the use of metacognitive therapy for stress management. By reviewing and analysing articles, the conclusion reached for that was that metacognitive therapy is an intervention that have a positive effect on individuals dealing with stress related issues. The second objective dealt with the usage of serious games in therapy, and to gain a better understanding of it. This understanding was gained by reviewing and analysing articles in the literature review. From this, the general understanding is that games are used in therapy, and that they generate positive results with the participants. The effect of using games in therapy can heighten the participants engagement and motivation, as well as help them identify and manage situations beforehand. In the third objective, the knowledge from the two other objectives were used to create a base for guidelines. These guidelines were then evaluated by incorporating them into the game analysis, to see how these elements (which were the base for the guidelines) were used in the games.

### **Mastery of skills – the user should be able to learn/train skills that can be useful in their lives**

The mastery of a skill in a game can help the user to progress in said game. The skills a user needs differs from game to game, but the existence of a skill that is needed means that the user will have to learn that skill to progress in the game. By mastering the skill, the user should have an easier time to proceed in the game, it also gives the player a feeling of mastery and competence which can aid the motivation to continue playing. Out of the games in the analysis, two of them were more focused on this element, *Tanuki Sunset* and *Flow*, as they both had faster gameplay that the user needed to learn before they could properly play the games. While the other games have no need for the user to quickly learn the gameplay, these two do. By learning the gameplay, the user can progress easier and thus their sense of stress they may have had in the start of the game would lower, to the point where the games are more relaxing to play.

By training and mastering a skill within the game, it could affect the user outside of the game. If the skill trained within the game involves metacognitive exercises, such as attention training techniques or detached mindfulness, the knowledge that the user gains from their playtime could be transferred to their real life (see section 5.3). If the user has trained on how to deal with stressful situations using metacognitive exercises, this can help them be more prepared and thus have an easier time managing their stress when encountering this in real life. A key part in metacognitive therapy is the learning of different techniques that will help the user to manage their stress or mental issue (see section 2.2.1). By having the user learn techniques used in metacognitive therapy, they can then use these techniques in their real life to manage their stress.

### **Engagement – the game should engage the user**

The aspect of engagement has been touched on throughout this thesis work. It was early on shown to be a problem area when it comes to young adults and youths dealing with mental health issues (see section 2.1.1 & section 5.2.2). As when the engagement of the user is low, they will drop out of the treatment program, or in this case, stop playing the game. This is something that seems like it can be targeted by using just games as the medium for the mental health intervention. One of the aspects that have been shown to be heightened when using digital games in therapy is just the engagement and motivation of the participants (see section 5.2.2). By focusing on the aspect of engagement while developing a game, it could minimize the amount of users that drop out of the treatment or quit playing the game, thus have a larger chance of aiding the users and help them with managing their stress. Rather than tie into the metacognitive aspect of this work, this guideline ties more into the research in stress and games (see section 5.2.2). As there is a problem with young adults not reaching out for or not finishing programs for mental health issues due to lack of engagement. By using games, that have shown to heighten engagement and also marketing, the reach for a game as a digital intervention have a high chance of being greater than clinical therapy.

### **Immersion – the user should be able to get immersed in the game during the play session**

By creating a high level of immersion, the user's cognition will be, in large part, occupied by the game. This will then give them a chance to relax and detach from their everyday stressors, which will help the user to recover from the stressors in their lives. If the user has time and

means to recover from their stress, there is a higher chance of reducing their stress levels (see section 5.2.2). By getting immersed in a game and not getting distracted by things around them, an immersive game can allow the players to relax in an environment that they can affect in a different way than in real life. By using aspects such as audio, narrative, graphics and gameplay, the level of immersion that the user experiences can be heightened. A thing to be noted in this is however the concept of flow. If the challenge of the game is too high, the user may feel anxious or stressed instead (see section 5.2.2). This can be shown by putting some of the games in the analysis against each other, in the game *What Never Was*, the user is faced with finding objects and solving puzzles. The game allows the user to be immersed in the mystery and by clearing the puzzles get to see the story unfurl. However, the user can easily be thrown out of the immersion if the puzzles become too challenging or if the user cannot find one of the objects. In the game *Tanuki Sunset* the user gets immersed in the fast gameplay where they control a raccoon on a skateboard. However, the immersion is broken when the user falls off the road and loses the game. Both of these games allow the user to both get immersed, but also have states where the user's immersion can be broken, these states are reached in completely different ways, however.

This guideline also ties in with the postponement of worry, which is a part of metacognitive therapy (see section 2.2.1). By having the user being occupied by the game, they can postpone their worries to a later time. To tie this into the previous guideline, by learning how to the user may then express their worry in a controlled manner and lessen their stress by using techniques from metacognitive therapy.

### **Control – the game should generate feelings of control for the user**

Giving the user control in a game can be done in different ways, in some games, this means letting the user move the main character, in others to move a whole group of characters and in some it means to choose what quest or what narrative to experience in a play session. By letting the user have control over the game, it provides them with a feeling of autonomy, as well as let the user have a feeling of being in control that they may not have in their everyday life (5.2.2). As the loss of control or having something happen that affects an individual that is outside of their control easily creates stress in an individual, the feeling of having control can aid to reduce the level of stress for the user. This guideline does bleed in a bit into the Mastery guideline, as the feeling of control could come from learning or mastering the different aspects of gameplay. In a fast paced game like *Tanuki Sunset*, the user may at first be stressed because of the fast pace and having to learn the controls, but after learning this and playing for a while, the feeling of control that the user have will grow bigger and the perceived stress would lower. This was one of the guidelines that were based on the literature review only, and in focus on the stress management and game part (see section 5.2.2).

### **Feedback – the game should provide the user with feedback that makes them analyse their actions**

Giving the user immediate and clear feedback on their actions in the game gives them clear notion of how well the game is going and even hints on how to proceed, this feedback can be given in different ways, such as changes in gameplay or voice lines. By giving the user a clear feedback, both good or bad or just as a reaction to what the user just did in the game can help the user do their next choice in the game and maybe rethink their strategy, thus analysing their own thoughts. As this is a metacognitive exercise, the feedback of the game could be used to have the user train their skills in metacognition, as the action of analysing one's own thinking

and thought process is a metacognitive exercise (see section 2.2). By analysing their own process, the user may be able to train their ability to step back and analyse their own thinking process.

In the analysis the games that mainly uses the feedback system to make the player think were *What Never Was* and *Ruya*, in both of these games the feedback had the user think about what they just did and what their next move would be. This could be likened to the process of analysing ones own mind that is a part of metacognitive therapy, the games feedback deals more with the user analysing their process in the games and the steps they took to get where they are in the games, as well as figuring out what to do next. However, by having the user analysing their own moves, they could become familiar with this kind of thinking and utilize it in other aspects.

### **Progression – the users’ actions should progress the game**

The last of the guideline is about the users input in the progress of the game. By having the player be the driving force behind the progression, the user is allowed to set the pace of the game themselves, and not having to have pressure that they need to do something, but rather to have the option to reach the end at their own pace (de Aquino Lopes et al., 2014). This can be especially important when it comes to mental health issues, as the effects of mental health issues such as stress effects individuals differently, each player should not have the play the game the same way.

All the games in the analysis relied on the user to progress, however, not all allowed the user to do it in their own pace. In the game *Tanuki Sunset*, the user progressed by keeping the raccoon on the trail, this was the game where the user had the least input in progressing as they could either follow the road that the game set up for them or crash the raccoon and end the game. In the game *Flow*, the progression in the game relies on the user, as is the pace, but for the game to be easier, the pace should not be slow, as one of the aspects of the game is to move fluidly through the field. In the other games, *Lieve Oma*, *Ruya*, *What Never Was*, and *Coloring Pixels*, the user has full control over the pace and can choose to play as fast or slow as they want. This was another of the guidelines that were only based on the literature review, Progression and Control do however bleed into each other quite a bit. Both guidelines focus on the control and pace of the user, which are important for the users’ chance of relaxing and recovering from their stress (see section 5.2.2 & section 5.3).

## **8 Discussion & Conclusions**

### **8.1 Summary**

This thesis work presents guidelines that could be used in the development of a serious game that could aid young adults with stress management. To do this, there have first been a literary review where knowledge of metacognition in relation to and as an intervention for stress were gathered and analysed. In the literature review, knowledge of the usage of serious games and digital interventions for stress were also gathered and analysed.

This thesis work aimed to create guidelines that can be used when developing a game aiming to aid young adults with stress management. The research question was turned into three objectives that were to be answered, these answers could then be used together to answer the research question and create the guidelines. To answer the first two objectives, a literature review was made, firstly the focus was on gaining knowledge of metacognition in relation to stress. Secondly the focus was on gaining knowledge of how games can be used in therapy. Continuing from the knowledge gained while focusing on the first two objectives, the third objective, which was how the knowledge gained can aid when developing a game, elements were taken from the literature review and evaluated in a game analysis to see if and how they could be applicable on games, thus showing if they could be made into guidelines.

The results of this thesis work present a set of guidelines that should be kept in mind when developing a game that is aimed at aiding young adults with their stress management. The guidelines were made by taking the knowledge obtained from the literature review, the background, and the game analysis.

### **8.2 Discussion**

In this thesis work the result presents a list of guidelines that can be used in developing a serious game, with the aim to aid young adults in stress management. To make these guidelines, first a literature review was made to gain knowledge from a theoretical standpoint. From the review, the guidelines were made. To see how the guidelines were applicable to games, they were evaluated with games in an analysis.

The games sample that were used in the game analysis were all free to play games. The reason behind this was that the games in the sample should be games that are available for anyone to play, so that the reach of the games would not be obstructed by a paywall. The games were instead chosen after reviews and tags. Which gave the three most popular games in the tags on each platform. By using games that are free to play, the positive sides are that they are games on the market available for all, and thus a good choice for testing the guidelines on. A downside is that the games were not specifically made for reducing stress, but rather as relaxing entertainment games. The ideal would have been to find games specifically made for reducing stress, that are on the market and available for all. But as that was not found, the games that were a part of the sample were the ones found under the relaxing tag on both platforms. By using games that were paid for and/or specifically made for reducing stress, the results might have been slightly different as aspects that the sample games covered might not have been covered on those games or vice versa.



In the results this thesis presents guidelines that can be used when making a game that aims to aid with stress management. Some of these guidelines do bleed into each other a bit, such as when the user is the driving force behind the progression of the game, this can be seen as a sort of control as the user controls the pace of which the game progresses. Another example could be that when the user receives feedback it could tie into the feeling of mastery that the user gets when they train a skill in the game or the progression of the game, in this case, the feedback that the user receives could give the user information both on their training of the certain skill, as well how the user progresses through the game. The guidelines are however made to have all in mind when developing the games, so the fact that some can be used in development together is currently seen as a positive thing as this may let the developer bend them a bit, but still have the effects work as they should.

When it comes to the other way around there is the issue of balancing. The guidelines may not work to full efficiency if they all have the same level of focus, instead it might be better to focus more on some of the guidelines and reduce from others, for example when making an adventure game, more focus could be put on the immersion-guideline and maybe a bit less on the control-guideline. Depending on what kind of game and what exact experience the developers want to give the user, as well as the effect the developers want, different ways of utilising the guidelines may emerge.

Poppelaars et al. (2018) brings up a point in their article about the aim of individuals with mild enough symptoms that they do not need clinical therapy, and aiming towards a risk group has shown to be more effective than universal prevention. This is something that could be useful knowledge when developing a game that aims to help young adults with stress management. By incorporating methods, in this case based in metacognition, of stress management into a game and market it as this, there is a promising chance that it will be picked up by the audience it was reaching out towards. By aiming towards individuals that are not yet in or not in need of clinical help can first of all help them deal with their stress symptoms and stress management on their own from their own home, and secondly, reduce the number of individuals that later would need clinical help. By aiming towards this kind of audience, there may be a chance to reduce the number of individuals that are in the risk-zone of falling deeper and deeper into stress symptoms until they would need clinical help. In the study by Schoneveld, Lichtwarck-Aschoff, and Granic, (2017), they bring up the point of prevention intervention, and from their study they state that a serious game can be as effective as CBT in the aspect of preventing mental health issues. This is another aspect that supports the use of a game as an intervention when it comes to reducing and preventing mental health issues. By aiming at preventing stress and reducing stress levels before they are high enough to need clinical help may be the way to go when it comes to helping young adults with stress management.

As this work did not use any participants, except the author, there was not any need to think about research ethics. Instead, this work has been viewed through the lens of social ethics.

Stress can be a common part of an individual's life, which can lead to a decline in health (see section 2.1 & 5.2.1). This is something that should be paid more attention to, as this is something that individuals could easily ignore until they need clinical help. As stress is something that is both general, in the way that there are situations that many feel stressed in or personal, perhaps caused by something that has happened in the individuals life before, there are no strict rules or guidelines that can fit for everyone to follow. As taking the step towards clinical help may be a very big one, there are many young adults who do not reach out

for help (see section 2.1.1). There is also the crowd that have light enough symptoms that they do not need clinical help, but still need some kind of aid to easier go on in their lives. By developing a game that could aim at either of these crowds, one could catch and help individuals that would have slipped past getting aid otherwise. As these individuals otherwise would go untreated, or have their health decline so far that clinical help is needed, the contribution this could give to society would be to be able to pick that crowd up and support them, reducing pressure for the healthcare and allowing these individuals to learn and help themselves.

If a game were to be made out of these guidelines, the process should be iterative with a lot of testing. This is to make sure that the end-product actually works as it is supposed to. One thing that would be important to keep in mind would be the balance of the guidelines, as depending on what kind of game the developer wants to make, the balance between the guidelines may differ. If the developer wants to focus on for example the Mastery guideline, they may need to lower the focus on another guideline such as the Control one, as has been done for the games *Flow* and *Tanuki Sunset* in the analysis, both these games rely on the user learning the mechanics and may even generate stress before the user has learned and can relax while playing. This however poses the issue of balancing, if a developer focus too much on one of the guidelines, there is a chance that the game would end up generating stress for the individual rather than relieving them of it. this can be solved with a lot of iterative testing with a lot of different individuals, or if the game could be made so that parts can be modified in some aspects such as challenge and thus be able to give different support to different individuals. If a game were to be released and ending up generating stress rather than aiding the user in reducing their stress, the responsibility for that game would fall back to the designer and developer.

### 8.3 Methodology

The methodology for this work has first been a literature review (with a smaller pre-study), and then a game review and analysis. The pre-study for the literature review was made to test and develop the search queries for the literature review. The articles found in the pre-study were also used in the analysis of the main literature review. This methodology based on the methodology presented by Engström et al. (2018) was something that in this case worked well. By using two different kinds of filtering, the article that ended up in this work mostly had information that could be used. The exception to that is the two articles under the Metacognition and Games category, where neither of the articles contained things that could be used, this however may be of the reason that the area of metacognition and games is a research area that is relatively new and that there aren't any research that has been done there yet.

In the game review and analysis, the games were chosen from rating, reviews, and popularity. They were then reviewed and analysed, with different protocols, the first one based on the MDA framework (Hunicke, LeBlanc, & Zubek, 2004), and the other based on findings from the literature review. After analysing the games, the results were used together with findings in the literature review and background to make the guidelines. The guidelines were then presented together with the conclusions of the research question.

By searching for games especially made for relieving stress and doing the analysis on these kinds of games, the results might have been different. There was also a thought about adding

apps for stress management in the game analysis, this could also have changed the outcome to the analysis, however, this was later taken out since the focus was on games.

This work used the MDA framework (Hunicke, LeBlanc, & Zubek, 2004) as a base for the review of the games, however, this was with some changes to the definitions to some parts of the framework. After the game review and analysis were done it was brought to my attention that the definitions I had used was more aligned to that of Schell (2015). After looking up his definitions on aesthetic I do agree on that part, so a thing I would change if this work would be remade would be to more thoroughly look through different frameworks and maybe use more than one as the basis for the game review.

Another change would be to plan the work more in detail from the beginning and establish each part of the thesis in the beginning. This would be so that all components for the thesis would be a part of the planning.

## **8.4 Future Work**

One way to further this line of research and proceed into future works is to take the proposed guidelines in mind and to use them as a basis for creating a game that could aid young adults with stress management. This could be done by making multiple prototypes in an iterative process and have multiple playtests throughout the development of the game. In this way, an ideal way of mixing the guidelines can be found, this to heighten the effectiveness of the game when it comes to aiding young adults with stress management.

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## **Appendix A - If needed**