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A digital game using collaborative storytelling to help children practice empathy

Master's thesis in Computer Science
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Master's thesis

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Abstract

Context: Research shows that greater social and emotional skills are correlated with being happier, more confident and better at preserving relationships. Storytelling is shown to be an effective way to practice one such social and emotional skill, namely empathy. Furthermore, game-based learning is linked with higher motivation and more effective learning, but has only recently been adapted to explore its potential for social and emotional learning. Existing storytelling games that aim to foster empathy often leave players with a passive role, lacking active engagement, which is a crucial component of effective social and emotional learning.

Objective: This thesis investigates the possibility of drawing on prior research to inform the design of a digital game that aims to help children practice empathy. This vision inspired the following research questions:

- **RQ1:** How can digital games facilitate empathy practice in children using storytelling?
    - **RQ2:** In which contexts could such a game be useful?

Method: Design and creation was used to develop a proof-of-concept game. A focus group was facilitated to collect feedback on the game, along with a questionnaire to assess its usability. Furthermore, the original research plan is presented, as well as a discussion on why and how it changed over time.

Results: The main contribution to knowledge is a digital game developed by combining existing research in a new way. Additionally, the presented literature review on related topics and material for obtaining ethics approval for studies in the U.S. can benefit others conducting similar research.

Limitations: The game has not been evaluated with the target audience, nor were they involved in the design process. Therefore, conclusions can not be drawn on their behalf.

Conclusion and future work: The game received positive feedback during the evaluation with domain experts, proving to be a usable and technically solid solution. Literature points to the game being useful both in a classroom setting and at home. In future work, the game should be evaluated with the target audience, and teachers and parents, among others, should be involved to specifically tailor the game to its real-world applications.

Sammendrag

Kontekst: Forskning viser at gode sosiale og emosjonelle ferdigheter er korrelert med større grad av lykke, høyere selvtillit, og en bedre evne til å opprettholde relasjoner. Historiefortelling er vist å være en effektiv måte å trene på en slik sosial og emosjonell ferdighet, nemlig empati. Videre er spillbasert læring koblet opp mot høyere grad av motivasjon og mer effektiv læring, men er først relativt nylig tatt i bruk for å utforske dets potensiale hva gjelder sosial og emosjonell læring. Eksisterende spill som benytter historiefortelling med formål om å trene opp empati tildeler ofte spillerne en passiv rolle. Dette fører til at de går glipp av en svært viktig komponent i effektiv sosial og emosjonell læring, nemlig aktiv deltagelse.

Målsetting: Denne oppgaven ser på muligheten for å bygge på tidligere forskning for å utvikle et spill med den hensikt å hjelpe barn å trene opp sine empatiske ferdigheter. Denne målsettingen la grunnlaget for følgende forskningsspørsmål:

- **RQ1:** Hvordan kan digitale spill legge til rette for trening av empati hos barn ved hjelp av historiefortelling?
    - **RQ2:** I hvilke kontekster kan et slikt spill være nyttig?

Metode: Design og utvikling ble brukt til å lage et digitalt spill. Videre ble en fokusgruppe arrangert for å få tilbakemeldinger på spillet, og et spørreskjema benyttet for å vurdere dets brukervennlighet. I tillegg presenteres den originale forskningsplanen, samt en diskusjon rundt hvorfor og hvordan denne endret seg over tid.

Resultater: Oppgavens hovedbidrag er et digitalt spill som kombinerer eksisterende forskning på en ny måte. I tillegg kan litteraturgjennomgangen og materialet produsert for godkjenning av forskning i USA være til nytte for andre som utøver liknende forskning i fremtiden.

Begrensninger: Spillet har ikke blitt evaluert sammen med målgruppen, og de var heller ikke involvert i designprosessen. Konklusjoner kan derfor ikke trekkes på deres vegne.

Konklusjon og videre arbeid: Spillet fikk i evalueringen positive tilbakemeldinger fra eksperter, og viste seg å være en brukervennlig og teknisk solid løsning. Litteratur peker på at spillet kan være nyttig både i en klasseromssituasjon og i hjemmet. I fremtidig arbeid bør spillet evalueres sammen med målgruppen, i dialog med blant andre lærere og foreldre, slik at det på best mulig måte kan tilpasses dets reelle bruksområder.

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List of acronyms

CASEL   Collaborative for Academic, Social and Emotional Learning

IPIT   International Partnerships for Excellent Education and Research in Information
Technology

IRB   Institutional Review Board

NTNU   Norwegian University of Science and Technology

SEL   Social and Emotional Learning

SUS   System Usability Scale

Chapter 1: Introduction

1.1 Motivation

Research shows that children with greater social and emotional skills are happier, more confident and are able to preserve relationships better than those who don't (Albright & Weissberg, 2010; Jennings & Greenberg, 2009). In addition to the positive effects on daily functioning and academic competence, a survey conducted by NBC news and Pearson Education found that U.S. parents deem their children's social and communication skills to be the most important skills to acquire in life (Princeton Survey Research Associates, 2015). Fortunately, social and emotional skills are dynamic and can be acquired, practiced, enhanced, improved and fostered in all children and adults alike (Bernard, 2006). Empathy as "the ability to feel or imagine another person's emotional experience" (McDonald & Messinger, 2011, p. 2) is one of the many social and emotional skills, but perhaps one of the more commonly known.

Research has demonstrated the potential of using games to teach academic skills, with game-based alternatives leading to higher motivation and greater learning outcomes (Tüzün, Yılmaz-Soylu, Karakuş, İnal, & Kızılkaya, 2009; Papastergiou, 2009; Rosas et al., 2003). However, using digital games to teach social and emotional skills is still an under-researched area (Slovák & Fitzpatrick, 2015). Such games are, however, on the rise, but many of the games focused on empathy tend to be aimed at children with special needs (Bratitsis, 2016; Bratitsis & Ziannas, 2015). Furthermore, storytelling is a popular way of promoting empathy practice in players, however, the majority of the games give the players a rather passive role of observing a story play out on screen and only interfering when it is time to make a decision in the game. This thesis presents a proof-of-concept digital game that seeks to help children without special needs to practice empathy through a collaborative and active storytelling approach.

1.2 Project description and context

The author got in touch with professor Letizia Jaccheri in May of 2018 after reading about her project on using digital games and storytelling to foster empathy, and the two decided to work together to realise the project's vision over the next year. The project started out as a continuation of the work of one of professor Jaccheri's previous master students, where a game was created aiming to exercise players' empathic abilities (Skaraas, 2018). During Skaraas' (2018) project, a workshop was set up to test the game, showing potential for the game concept, although revealing some issues with usability and technology that was suggested to be looked into for future work. A focus of this thesis was therefore to take inspiration from this past work and carry out a thorough preliminary study to make use of existing research in redesigning a game concept with a focus on usability and technical robustness.

This master's thesis builds on the work carried out by the author in the specialization project during the fall of 2018, presenting a literature review and proposing research questions and a methodology. An improved understanding of the literature throughout the spring semester, as well as arising challenges related to ethics approval and recruitment of subjects, resulted in a shift of focus from aiming to measure a change in empathy to revealing how the game is perceived and understanding how it can be used in a real-world setting.

This master project is part of the International Partnerships for Excellent Education and Research in Information Technology (IPIT) project at IDI, which is a cooperative initiative with Tsinghua University, Nanjing University, the University of Michigan and the Norwegian University of Science and Technology (NTNU) (Jin, Cico, & Jaccheri, 2018). The author is the first student to go to Ann Arbor, Michigan, to carry out her research for the master's thesis, receiving supervision from professor Gabriela Marcu at the University of Michigan. The exchange period was originally set to last from March 10th to June 10th, but the research period was later extended to July 22nd 2019.

1.3 Research questions and method

An extensive preliminary study, presented in chapter 2, on topics related to social and emotional learning, with a specific focus on empathy, informed the following set of research questions:

RQ1: How can digital games facilitate empathy practice in children using storytelling?

   RQ2: In which contexts could such a game be useful?

The author seeks to answer RQ1 by presenting a proof-of-concept game intervention to help children practice empathy, translating theory into practice by grounding the game mechanics and design decisions in research and drawing inspiration from related work. The intervention is designed and implemented using the design and creation strategy, as presented in section 4.3.1. The results from a focus group with experts in human-computer-interaction and educative technologies resulted in a set of adjustments to the game prototype, as presented in section 5.1, and a usability questionnaire helped assess the usability of the intervention, discussed in section 5.2.

Furthermore, RQ2 will be answered by findings from previous research that illustrates how the game presented in this thesis can be applied to different settings. However, to fully answer this research question, further work needs to be done by talking to potential stakeholders of the game. A plan was made to arrange focus groups and/or interviews with children, parents, teachers, psychologists and others who work with children on empathy, but due to restraints in time and resources, this was not carried out, as discussed in section 5.3.1.

1.4 Contribution to knowledge

The main contribution to knowledge for this master's thesis is the digital game prototype itself, along with its unique design, combining existing research and applying it in a new way. Furthermore, the preliminary study combining literature and research from the fields of

psychology, social and emotional learning and digital games, to mention some, is a valuable collection of literature that future work can build on. Additionally, material for the Institutional Review Board (IRB) to apply for ethics approval to do research with human subjects in the U.S., here specifically to help inform RQ2, is included in Appendix A-E and can serve future researchers doing similar studies.

Lastly, a conference paper to IDC 2019, as seen in Appendix F, was produced and submitted in the early stages of the master's thesis, based on the planning and design completed in the specialization project in the fall of 2018.

1.5 Report outline

Chapter 1 presents the background to this master's thesis, including the motivation and context along with the chosen research questions and contribution to knowledge. Chapter 2 presents the preliminary study, including the author's approach to studying the existing literature as well as an extensive literature review including social and emotional learning, storytelling, the potential of digital games and a review of existing games that seek to foster empathy in its players. Chapter 3 presents the digital game, with a description, discussion of how it builds on existing literature, context of use, as well as requirements for the game and a presentation of the concept and design development from sketching to the final solution. Chapter 4 presents research methodology relevant to this project, including both the initial research plan and the methods that were executed in the end. Chapter 5 includes results from the focus group and questionnaire, as well as a discussion of the challenges faced and changes made throughout the semester. Furthermore, it presents an evaluation of the methodology and requirements, as well as limitations to the study. Finally, Chapter 6 concludes the project and states the contribution made to the research questions, before suggesting a path for future work.

Chapter 2: Preliminary study

2.1 Approach to studying literature

Conducting the literature review was a process of deciding on a set of relevant keywords. These keywords included *empathy, storytelling, development, teaching, children, digital game, technology, SEL, social and emotional learning, active engagement, active learning, collaboration, collaborative learning* and *cooperative learning*, and were used in different combinations and search fields in various databases. The databases were chosen based on their academic recognition, relevance to the topic at hand, as well as their admission process of papers, favouring those that were peer-reviewed. More specific searches were carried out first, to ensure that these papers were considered, before broadening the scope and reading tens, if not hundreds, of abstracts. If the titles and abstracts were deemed relevant, the introduction and conclusions were examined further. The year of publication was also considered, knowing the fast development in the field of computer science. Lastly, the relevant research papers were put into an excel document, summarising their findings and relevance to this project, along with basic information.

When coming across referenced articles that seemed highly relevant, these were located and read in their entirety, if available. By using NTNU's network, several databases allowed for download of full-version research papers, which was very convenient during this phase. After an extensive research period, the most relevant theories were combined to compose the literature review that makes up this chapter.

The databases used include ACM Digital Library, ScienceDirect, EBSCO ERIC, IEEE Xplore, APA PsycNET, PubMed and Google Scholar. Where the search results came out overwhelming in numbers, the publication year range was set from 2013 to 2019.

2.2 The importance of social and emotional skills

It seems only right to start by addressing what social and emotional skills are, and why this is worthwhile looking into. Social and emotional skills, also known as soft-skills, is concerned with regulating one's thoughts, emotions and behavior (OECD, n.d.). Research shows that children with greater social and emotional skills are happier, more confident and are able to preserve relationships better than those who don't (Albright & Weissberg, 2010; Jennings & Greenberg, 2009). In addition, a study done by Farrington et al. (2012) suggested a bidirectional relationship between academic skills and social and emotional skills. This supports the argument that social and emotional learning should be an important focus in schools, and rather than taking away from the time for academic teaching, it can actually help enhance it in the long run. In addition to the positive effects on daily functioning and academic competence, a survey conducted by NBC news and Pearson Education found that U.S. parents deem their children's social and communication skills to be the most important skills, even more so than getting good grades or understanding technology (Princeton Survey Research Associates, 2015). Not only does parents value these skills for their children, but 95% of parents in the survey also deemed social and emotional skills to be "very important" to parenting, in order for them to be the best possible caregiver (Princeton Survey Research Associates, 2015). Although the majority of US parents recognize social and emotional skills as a top priority for their children's success, few are able to articulate how they teach and promote these skills at home (Zero to Three, 2016).

2.3 Social and emotional learning

The concept of social and emotional learning (SEL) is not a new trend, as it has in fact been discussed in American public schools since the 1960s, historically in order to target issues such as bullying, drug abuse and school violence (Sugishita, 2019). The Collaborative for Academic, Social and Emotional Learning (CASEL) has defined five core competencies in SEL that are widely recognized in literature and often used by SEL programs as guidelines for what their

curriculum should cover. The learning aspect of social and emotional learning implies that these are dynamic skills that all children and adults can acquire, practice and improve (Bernard, 2006). The five core competencies of SEL are (CASEL, 2013):

- Self-awareness
- Self-management
- Social awareness
- Relationship skills
- Responsible decision-making

Figure 1: Core SEL competencies (CASEL, 2017)

Each of these five core SEL competencies shown in Figure 1 encompass more specific social and emotional skills, and empathy is one of the skills within social awareness. Allemand, Steiger, and Fend (2014) found that empathy can be manipulated through practice over a relatively short time

period, making it an interesting skill to target through a game-base intervention. The study by Allemand et al. (2014) also showed that not only the level of empathy, but the change in empathy throughout the adolescent years (12-16 years old), predicted self-reported social competence two decades later. This shows the importance of exposing children and adolescents to empathy practice in order to not only invest in their current social life, but also for their future adulthood.

2.4 Challenges of social and emotional learning programs

There are currently many SEL programs to choose from, all with a slightly different focus and/or approach (Jones et al., 2017). However, a SEL program that only targets children while they are at school is not reaching its full potential. It is important that schools, communities and families work together on shared practices when it comes to helping children practice social and emotional skills across different contexts (Garbacz, Swanger-Gagné, & Sheridan, 2015). For younger children, this is particularly important as the family is more often than not the most important source of defining one's values, goals and behaviors (Oberle, Domitrovich, Meyers, & Weissberg, 2016). This ties in with the common concern with a lack of continued learning beyond the classroom, where school staff often struggle to help children transfer and apply the specific social and emotional skills in real-life settings, such as on the playground, at the dining hall or at home (Jones et al., 2017). Slovák et al. (2016) also stresses the need for research to explore how technology can be used to strengthen home-school collaboration and encourage reinforcement of social and emotional skills at home.

However, a lack of home-school collaboration and continued learning is not the only challenge concerning implementation of SEL programs in practice. Even though many teachers express interest in incorporating SEL practices in their work with students, many feel that they need formal training and support to do so (Bridgeland, Bruce, & Hariharan, 2013; Buchanan, Gueldner, Tran, & Merrell, 2009). Furthermore, inadequate funding is often one of the main concerns when wanting to integrate SEL practices (Oberle et al., 2016). A study conducted by

Humphrey et al. (2015) also found that teachers often didn't find time in their busy schedule of academic teachings to make time for a particular SEL program, and only half of the recommended SEL lessons were actually given.

2.5 Empathy and its development

For the scope of this master's thesis, it was decided to target a specific part of social awareness within social and emotional learning, namely empathy. Empathy is a concept many of us have an understanding of to some degree or another. However, for the purpose of pursuing empathy as something an intervention can help practice, it is necessary to look into more literature on empathy, defining the concept and looking at how it is developed.

The human species would not have survived if every man only cared about himself (Hoffman, 2000). Making sacrifices and helping one another is a topic that has preoccupied philosophers since Aristotle, not oddly, since it is what makes social existence possible (Hoffman, 2000). Empathy has no one universally agreed definition. However, common understandings of empathy are "the ability to feel or imagine another person's emotional experience" (McDonald & Messinger, 2011) and that empathy is "the spark of human concern for others, the glue that makes social life possible" (Hoffman, 2000). McDonald and Messinger (2011) goes on to identify four main outcomes of empathy; internalization of rules, prosocial behaviour, social competence, and relationship quality. These are important qualities that we use every day in our interaction with others. It is therefore obvious that empathy is a skill that is worth putting effort into practicing.

It is broadly agreed by psychologists and educators that empathy has two different components; the emotional/affective, and the cognitive (Cotton, n.d.). Emotional empathy is the ability to vicariously experience the emotional state of another person, whereas cognitive empathy is being able to imagine what others are going through and see it from their perspective (McDonald & Messinger, 2011). Cognitive empathy is often related to the theory of mind, which looks at the

ability to comprehend the fact that others may have different emotional states and knowledge from oneself (McDonald & Messinger, 2011). False belief tasks are often used to test this ability, where a child will typically witness an item being moved without another person knowing it (Wellman, Cross, & Watson, 2001). The child is then asked where the other person thinks the item is. If the child has developed theory of mind, or perspective-taking, at this point, they will say that the person still thinks the item is in the original location. This ability is usually developed by the age of 4-5 years (Wellman et al., 2001). It is this cognitive empathy that allows for constructive measures of a situation, as the child is able to put themselves in the shoes of another and figure out what their needs are (McDonald & Messinger, 2011). The alternative would be to just feel sorry for another person, but not knowing what to do about it, as is the case when only emotional empathy is present.

Whereas early theorists Freud (1958) and Piaget (1965) argued that empathy was not yet developed in young children, later studies have shown otherwise. To measure empathy in children yet unable to verbally express themselves, newborn's responses to other infants crying were examined in three different studies (Martin & Clark, 1982; Sagi & Hoffman, 1976; Simner, 1971). The studies found that newborns demonstrated distress by reflexive crying when hearing other infants cry (Martin & Clark, 1982; Sagi & Hoffman, 1976; Simner, 1971). This points to emotional empathy being present from birth, and having a predisposed biological component (McDonald & Messinger, 2011). However, infants still struggle with regulating their emotions and have not yet developed the ability to differentiate themselves from others, and thus are unable to take the perspectives of others and inhabit cognitive empathy (McDonald & Messinger, 2011).

Perspective-taking can be defined as "the ability to look at and understand a situation or concept from an alternate point of view" ("Social Awareness (Social Emotional Learning) - Landmark Outreach," 2019, p. 1). Perspective-taking is related to cognitive empathy through the aspect of being able to imagine another person's perspective. According to Knafo, Zahn-Waxler, Van Hulle, Robinson, and Rhee (2008), perspective-taking and the awareness of others as different to

oneself, along with the concern for others, start to develop in the second year of life, manifested in facial expressions and hugs from toddlers. A study conducted by Zhao, Wang, and Apperly (2018) found that 10-year-olds generally make fewer egocentric errors than 8 year olds when it comes to perspective-taking. This points to a gradual improvement in children's perspective-taking ability. A longitudinal study of twins conducted by Zahn-Waxler, Robinson, and Emde (1992) signified that emotional empathy is inherited, whereas cognitive empathy to a larger extent is impacted by our social upbringing. These findings leave cognitive empathy as being a more approachable quality to target in children through the use of technology. As perspective-taking is essential for the ability of cognitive empathy, seeking to understand different situations from another's point of view seems like a promising mechanism for practicing empathy.

Human beings do however have a flawed empathy in the sense that it is vulnerable to biases. According to Hoffman (2000), there are two types of biases in the way that empathy works: familiarity bias, which favours victims who are personally close to us and/or similar to oneself, and here-and-now bias, which favours those who are present in the situation. Hoffman (2000) argues that these biases may pose problems in cases of social justice. In the book "Against Empathy: The case for rational compassion" from 2016, Paul Bloom argues that empathy serves as a poor moral guide because of these instinctive biases. Bloom (2016) distinguishes between empathy and compassion, and points to compassion for others as an important quality when making rational choices (such as who to give aid to). However, Bloom does not believe that empathy, in terms of being able to put oneself in another's shoes, is constructive in such situations. He does, however, acknowledge the importance of empathy in intimate relationships and parenting. Hoffman (2000) counters Bloom's argument by claiming that in the case that society's resources should be allocated, every man would inherently take on a self-serving perspective that favoured himself and his own. However, if empathy is aroused, other people's needs will also be considered and a fairer distribution of resources will take place after all (even if it's not optimal for everyone).

After having looked at two different forms of empathy and how they evolve, it is also interesting to look at some of the effects of empathy specifically, according to research. Eisenberg and Miller (1987) conducted a meta-analysis of previous studies and found that empathy is positively correlated with both prosocial behaviour and socially competent behaviour. A study done by Cramer (2003) found that empathy was one of the most important factors in determining the satisfaction of a romantic relationship among adults. In addition, higher dispositional empathy has been linked to better conflict management and problem solving, as well as less conflict engagement, among adolescents (De Wied, Branje, & Meeus, 2006). Altogether, empathy seems to have multiple positive effects on a person's daily functioning, with fostering social competence and in turn bettering relationships.

2.6 Storytelling

Storytelling is a natural part of our everyday lives through conversations, music, movies and books to name a few, and Manney (2008) argues that storytelling indeed has a large part in fostering empathy. Bratitsis (2016) points out that storytelling can be a way for children to confront challenging life situations through fictional stories and characters that they can relate to in their own lives. As such, storytelling makes an excellent tool for fostering empathy and emotional intelligence (Bratitsis, 2016). Some researchers have seen this potential and have developed digital games that use storytelling as a mechanism to foster empathy (Skaraas, 2018; Bachen, Hernández-Ramos, Raphael, & Waldron, 2016; Raminhos et al., 2015). A study conducted by Bratitsis and Ziannas (2015) looked at whether using interactive digital stories can foster and/or enhance empathy in young children, and the results indicated that this is indeed possible.

In the same way that empathy has always been an important human trait, storytelling has been a way for humans to connect, and pass on ideas, stories and knowledge for as long as language has been around. By listening to stories, be it real or fictional, the listener is presented with the opportunity to see the world through the eyes of the characters, and thus sparking empathy

towards them (Manney, 2008). Bal and Veltkamp (2013) conducted two experiments where they looked at how fictional narrative experiences effects empathy over time, and found that being highly emotionally involved in a fictional story led to higher empathy. By having the reader or listener put themselves in the shoes of others, both similar and unlike from oneself, they are likely to become more empathic beings (Smiley, 2006).

2.7 Active engagement

Durlak, Weissberg, Dymnicki, Taylor, and Schellinger (2011) conducted a meta-analysis of 213 SEL programs reaching more than 270 000 students globally from kindergarten through high school. They found that the most effective SEL programs incorporated the following four practices, serving as a suggested framework for future SEL programs with the acronym SAFE (Durlak et al., 2011, p. 6):

- Sequenced: including a connected and coordinated set of activities
- Active: including active forms of learning
- Focused: including at least one component devoted to developing personal or social skills
- Explicit: targeting specific social and emotional skills

Literature suggests that these four characteristics should all appear together in a SEL program for it to be as effective as possible. However, for a singular activity that seeks to complement, or be part of, a SEL program, should not be expected to incorporate all of the characteristics of an effective program as a whole. Furthermore, the *active* part has found support from other research.

Prince (2004, p. 1) defines active learning as "any instructional method that engages students in the learning process", with student activity and engagement being crucial parts of the learning process. Prince (2004) also points out that active learning can be seen as a contrast to traditional lectures where students passively take in information. There is extensive support for the

effectiveness of student engagement with active engagement strategies on learning outcomes (Redish, Saul, & Steinberg, 1997; Hake, 1998).

Similarly, the Center on Great Teachers and Leaders points out active engagement as one of the ten recommended SEL practices to follow for a balanced instruction (Yoder, 2014). Active engagement strategies help children stay attentive, involved and focused on an activity, and can be used in different settings and scales, such as with a class, a small group or individually (Sugishita, 2019). Active learning strategies can utilize activities such as games and role play to evoke spontaneity, humor, flexibility, creativity and playfulness in children (Elias et al., 1997).

2.8 Collaborative learning

Another form of learning that has proven to be effective is collaborative learning, defined as "any instructional method in which students work together in small groups toward a common goal" (Prince, 2004, p. 1). A meta-study conducted by Johnson, Johnson, and Smith (1998), where 90 years of research was examined, showed that cooperative learning, as opposed to individualistic, showed improved outcomes not only in academic achievement, but also in the quality of interpersonal interactions, self-esteem and perceptions of greater social support.

Crook (2000) argues that motivation is very important for successful collaborative learning, and suggests that such shared experiences help people bond. Issroff and del Soldato (1996) presents a list of features they believe to be important for motivation in collaborative learning settings, including:
- Social affinity
- Distribution of control
- Nature of the task
- Time

Social affinity is concerned with the respect and willingness of the parties to work together, which can largely affect the nature and effectiveness of the collaboration (Issroff & del Soldato, 1996). A study by Vass (2002) on collaborative writing showed that friends who were used to interact in an informal setting were able to translate this into a classroom-setting and use some of their usual ways of interacting, such as humour, successfully in the new context. Distribution of control can be used to ensure the participants all have a fair share of control within the collaboration, both in terms of their own learning and of the actual tool (Issroff & del Soldato, 1996). The nature of the task is concerned with whether tasks can be divided into smaller pieces and distributed between the participants, without having them lose ownership of certain parts and thus lose interest (Issroff & del Soldato, 1996). Time is an important aspect in the sense that interactions change over time and so can motivation, influenced by different factors, such as the aforementioned ones (Issroff & del Soldato, 1996).

2.9 The potential of digital games in social and emotional learning

A study conducted by Tüzün et al. (2009) sought to assess the effects of game-based learning to teach geography in a primary school, and found that in comparison to traditional classroom learning, using a game had positive effects on both motivation and learning, as well as receiving positive feedback from students and teachers alike. Papastergiou (2009) also found similar results by studying an educational computer game to teach high school students computer memory concepts, finding that a game-based approach was more effective than a non-gaming approach to foster motivation and learning, regardless of the students' gender. Furthermore, a study assessing the effects of an educational video game on 1274 first and second grade students' mathematical and reading skills showed increased motivation to learn as well as an improved classroom dynamic (Rosas et al., 2003). Judging from this selection of studies, digital educational games show great potential in fostering increased motivation and learning of a range of theoretical skills.

Simultaneously, understanding social and emotional learning through the use of technology is an emerging, yet under-researched area (Slovák & Fitzpatrick, 2015). Although SEL programs have been a part of school education for decades with tens of millions of pupils, there has not been much technology involved in the learning process (Slovák & Fitzpatrick, 2015). However, studies of existing games that seek to promote social and emotional skills indicate potential in doing so for children of all ages as well as adults (Bratitsis & Ziannas, 2015; Bachen et al., 2016; Neuenhaus & Aly, 2017). Although there is research being conducted in the area of social and emotional learning and digital games, most of it concerns people with disadvantages (with autism spectrum disorder being the most prevalent type), leaving out a large population for whom learning social and emotional skills are also essential (Slovák & Fitzpatrick, 2015).

2.10 Related work

During the preliminary study, existing games from the past five years with the intention of fostering empathy was looked into. Although there are interesting inventions like empathic robots that seek to improve the problem-solving skills of mothers of cancer patients (Marsella, Johnson, & LaBore, 2000) and empathic companions that support the player in a virtual job interview (Prendinger and Ishizuka, 2005), the focus was narrowed down to digital games that sought to foster or practice empathy in the player(s). With these restrictions at hand, eleven games, including Tappetina's Empathy by Skaraas (2018), was deemed relevant and looked into in order to gain an understanding of what already exists in this specific domain and what might be lacking and thus subject to further exploration. This preliminary study of existing solutions gave a useful overview of what has, and has not, been developed and tested in the area of games in relation to empathy. All of the reviewed games aimed at fostering empathy in one way or another, and more than half of them made use of storytelling as a means of doing so. However, the games varied in target group, number of players and platform for the game, and some also had additional goals, such as preventing bullying (Raminhos et al., 2015), supporting refugees (Neuenhaus & Aly, 2017) and raising awareness of sexism issues (Muller, Van Kessel &

Janssen, 2017). Table 1 gives an overview of these existing games along with some of their characteristics.

Name of game	Gameplay	Aim	Target group	Number of players	Platform
Tappetina's Empathy (Skaraas, 2018)	The players are presented with different scenarios and characters for whom they are asked to tell the story of by using their character traits	Exercise players' empathic abilities	Children and teens	Multi-player	Mobile
StopBully (Raminhos et al., 2015)	The player is either a bystander or victim of bullying and has to make choices in the game, from which they receive a score	Prevent bullying and promote empathy in bystanders	10-12 year olds	Single-player	PC, tablet
Young Kostas goes to school (Bratitsis, 2016)	The player is given the choice of how to react to a character with autism, and is shown how this reaction is interpreted by the other	Foster empathy towards children with Autism Spectrum Disorders	4-5 year olds	Single-player	Unknown
ImagePal (Lyckvi & Torgersson, 2018)	Students from two different classes anonymously exchange images from their life through an app, monitored by the teachers	Evoke curiosity and empathy towards people of different socio-economic circumstances	11-12 year olds	Multi-player	Mobile game (iPhone)
The Magic Swan Geese (Muravevska ia, Tavassoli, & Gardner-Mc Cune, 2016)	The player will visit different places with a story and a challenge, where they are given different choices	Help children develop cultural awareness and empathy	5-7 year olds	Single-player	PC

Why did Baba Yaga take my brother? (Muravevskaia, 2017)	The player needs to interact with different emotion-based characters and experience their perspectives to complete their mission	Promote empathy development	5-8 year olds	Single-player	PC using VR
Inside Out (Kralicek, Shelar, Von Rabenau, & Blikstein, 2018)	Each student reflects on and logs their emotions into a virtual avatar, which is anonymously shared with the rest of the class	Facilitate social-emotional learning in middle school classrooms	Middle school students	Multi-player	Tablet (iPad)
Empathy-Up (Neuenhaus & Aly, 2017)	The players go through different scenarios addressing cultural differences and meets face-to-face at the end, using geo-location	Create support and increase empathy of German youths towards Syrian refugees	German youths and Syrian refugees	Multi-player	Mobile game
Through Pink and Blue Glasses (Muller et al., 2017)	The player chooses a male or female character and is presented different sexist scenarios, where the player needs to choose how to react	Stimulate the development of dispositional empathy and increase awareness about sexism	Adults	Single-player	PC using VR
The sad little chicken (Bratitsis & Ziannas, 2015)	The players are shown a story and asked to describe the emotions of different characters and propose a solution, which affects the story evolvement	Enhance social empathy of preschoolers through interactive digital storytelling	3-5 year olds with and without special needs	Multi-player	PC + physical game
Inside the Haiti earthquake (Bachen et al., 2016)	The player is either an American journalist or Haitian survivor dealing with the aftermath of the 2010 Haiti earthquake	Convey the historical events that took place and induce empathic concern in the players	Target group	Single-player	PC

	through a simulated narrative story where they are given choices and tasks				

Table 1: Overview of existing games for fostering empathy

Reviewing the existing games presented in Table 1, the author found that although most of the games utilize storytelling in some way, the vast majority do so in a passive way, where the player(s) are presented with a situation in the game and given a few options on how to react to the situation. Depending on what the player chooses to do, a story will play out on the screen for them to observe. One thing that this type of storytelling does not encourage to a great extent is an active engagement, as the players take on a passive observing role most of the time. According to active engagement theory discussed in section 2.7, it would be a good idea to engage the player's creativity to a greater extent. The author believes this can be done by giving the players a more active role as the storyteller of the game, where occasional prompts are given to drive the story rather than having the players only pitch in occasionally with their ideas.

Another observation made from Table 1 is that only half the games are made for multiple players, which is a prerequisite for collaborative learning happening within the game. As the theory presented in section 2.8 points out, collaborative learning has a clear advantage over individualistic learning, which makes the author question why the majority of these games aren't made for collaboration.

Another interesting aspect of the existing games is how they have been evaluated, if at all. The methods used to evaluate the games often include questionnaires, interviews and/or observations (Raminhos et al., 2015; Bratitsis, 2016; Neuenhaus & Aly, 2017; Muller et al., 2017). However, most seem to have used quantitative data analysis methods and present their results in numbers. As the concept of empathy can be hard to grasp and measure for its reliability, the author believes new valuable information can be retrieved from a qualitative approach using thematic analysis, as described in section 6.4 about future work.

Chapter 3: Design and development

As previously mentioned, this master's thesis project is inspired by that of professor Jaccheri's former student Sindre Skaraas. In Skaraas' (2018) game Tappetina's Empathy, he presented a proof-of-concept game that sought to exercise players' empathic abilities through storytelling, using characters, traits and what he called *story tags* (events in the story). During a workshop with twelve teenage participants, Skaraas observed the participants play his game and had them fill out a questionnaire about their enjoyment of the game while also self-assessing their empathic abilities. Although the validity and reliability of the data collected from the questionnaire is worthy of critique, the responses showed an interest in the game which made Skaraas decide to continue the project development.

However, Skaraas (2018) reported some challenges with his game that he suggested be looked into if the game was to be taken further. The first issue he met was regarding the usability of the game, suggesting future researchers to find a way to better match the user interface and game flow to players' mental models of how the game would work. On the technical side, Skaraas (2018) stressed that the game ideally should be able to automatically store game logs, including timestamps, as well as audio recordings of the players. These conclusions were taken into consideration when designing and developing the game for this master's thesis. The author decided to start afresh with a slightly different game concept based on the preliminary study, focusing on usability and technical stability. The user interface was redesigned from scratch, but inspiration was drawn from previous work by Skaraas (2018) and other similar games presented in section 2.10. Figure 2 presents a screenshot from the game by Skaraas (2018).

Figure 2: Story tag selection in Tappetina's Empathy (Skaraas, 2018)

3.1 Game description

Pathos was chosen as the name of the game presented in this thesis, inspired by it being the greek word for *feeling* and the origin of the word *empathy* ("Empathy | Origin and meaning of empathy by Online Etymology Dictionary", n.d.). Pathos is a digital game with the purpose of helping the players practice empathy through collaborative storytelling. This is done by having the players collectively choose a character to follow throughout the game and take turns in telling the story of how the character strives to reach their goal, using a set of traits given to the character at random. The idea is that the empathetic concern for the character will come from making the players metaphorically put themselves in the shoes of the character, not to decide what they would in their place, but to try and understand what the character would do in the given situation, based on their traits.

The gameplay includes having the players choose a character and giving him/her a name, before a handful of character traits are presented to the players to be used throughout the game. The game goes on to present a set of goals that the character can pursue in the game, and it is up to

the players to collectively decide on what they want their mission to be. When the goal is known, the players will take turns to tell the story of how the character pursues this goal, gets through an obstacle, identifies the character's feelings and states something to be learned from the story.

Pathos is designed to be played by three players on one tablet, where all players need to pay attention to how the others continue the story, as every person is asked to continue to build on the story. The target audience of the game are children around the ages of 8-14, however, the game's appeal to this age group should be tested through user studies, and the game, or target audience, should be adjusted thereafter.

Pathos is available online through the following link: https://storytelling-01.firebaseapp.com/.

3.2 Design and content

When designing a game with 8-14 year olds in mind, it was kept a focus to match the graphical user interface to this age group. The researcher chose a minimalistic approach, with consistent but lively use of colors (including a gradient background) as well as graphics that appealed to a younger audience, including diverse and inclusive characters that resembled the target audience. The graphics used in the game were all created and freely distributed by Freepik (https://www.freepik.com/). A heavy focus was also put on easy navigation of the game, including a consistent "continue button" at the bottom of the page and having only a few options to click on every page to avoid a cluttered look. Another consideration was that of using words that the target audience is familiar with. This was kept a priority throughout the whole game, and sentences were kept as short, concise and unambiguous as possible. Section 3.7.3 presents the final implemented solution, with extensive screenshots from the game.

Each singular task is designed to build on one or more of the previous tasks, making it crucial for the players to pay attention to the stories told and choices made by the other players. The game is also made for a tablet, rather than mobile phones, to ensure that the screen is big enough for all

players to focus on the same gadget for every new task, which is a more social and collaborative act than staring at their individual phones. As the game only acts as a facilitator, stating each new task, the players are more likely to look up from the screen and tell the stories to each other, that they would be in more traditional digital games. This works well in combination with the other players paying close attention, as their next move is dependent on what is currently being said. Furthermore, having all players in on choosing the character illustration and goal was a conscious decision to help the players establish ownership and affiliation to the character, so that the players would actually care about telling their story afterwards.

Knowing from Hoffman (2000) that humans are subject to the familiarity bias, tending to favor those who are similar to oneself when it comes to race, sex, status or even interests, the researcher wanted to counter this. If the players were given the choice to pick the traits of the characters themselves, chances are they would have often picked traits they could identify with themselves and that fit well together. However, the author wanted Pathos to present characters that could be vastly different and even conflicting to force the players to practice empathizing with a variety of different characters. In order to do this, and counter the familiarity bias, the four character traits are chosen at random from a predefined set, seen in Table 2, including two "positive", one "negative" and one "neutral" trait.

Another important consideration in the game was which traits, goals and feelings to include for the game to pick randomly from. The traits and feelings were carefully chosen to not only include words that the target audience would be familiar with, but to also represent a range of personalities and life situations, as well as both pleasant and unpleasant emotions (two of each are presented in the game). Last but not least, the goals were chosen from what the researcher imagined the target audience would relate to, as well as drawing inspiration from existing interviews with children about their wishes in life ("What do kids wish for?", 2010; "International Children's Day: What do kids wish for?", 2016). Ideally, the goals included in Pathos should have been derived from talking to children in the target audience, which is something that can be improved in future work. The researcher quickly saw the potential of

bringing up controversial topics such as sexuality and religion, as well as important global issues like sustainability and sexism, through the traits and goals presented in the game. However, the researcher is aware that such content needs to be adjusted to the context and culture that the game is played in, as children could quickly make inconsiderable comments, unknowingly offending or hurting another player. However, the current version of the game includes some of these potentially controversial terms, like "gay", "poor" and "become a vegetarian", as seen in Table 2 and 3. Which terms to include and avoid in different settings should be carefully considered in future work, before any evaluation takes place with the target audience.

Desired character traits	Undesired character traits	Neutral character traits/life situation
"Generous", "Reliable", "Loving", "Kind", "Sincere", "Persistent", "Adventurous", "Cooperative", "Tolerant", "Confident", "Funny", "Open-minded", "Intelligent", "Sporty", "Brave", "Charming", "Talented"	"Dishonest", "Mean", "Rude", "Disrespectful", "Impatient", "Selfish", "Sore loser", "Lazy", "Stubborn"	"Only child", "Divorced parents", "Has many friends", "Has no friends", "Rich", "Poor", "Is in love", "Gay", "Bisexual", "Transgender", "Has a famous relative", "Trouble concentrating", "Has diabetes", "Loves animals", "Allergic", "Loves to read", "Dyslectic", "Shy",

| | | "Competitive", |
| | | "Lonely" |

Table 2: Possible character traits presented in the game

Goals
"Make a new friend",
"Become the team captain",
"Get a good grade",
"Ask someone on a date",
"Get a pet",
"Buy a gift for someone",
"Be popular in school",
"Learn to play an instrument",
"Get a part-time job",
"Become famous",
"Have a first kiss",
"Get into a baseball team",
"Start dance lessons",
"Cook a meal for the whole family",
"Learn how to read",
"Save money for college",
"Have a fun birthday celebration",
"Learn a new language",
"Be more environmentally friendly",
"Save money for college",
"Go on a vacation",
"Visit family",
"Buy new clothes",

"Come out",

"Become a vegetarian",

"Move to a new house"

Table 3: Possible goals presented in the game

Pleasant/indifferent feelings	Unpleasant feelings
"Understanding", "Confident", "Free", "Content", "Relieved", "Lucky", "Grateful", "Important", "Optimistic", "Calm", "Comfortable", "Encouraged", "Relaxed", "Bored", "Nervous", "Passionate", "Loved", "Emotional"	"Frustrated", "Annoyed", "Upset", "Bitter", "Aggressive", "Resentful", "Disappointed", "Discouraged", "Ashamed", "Guilty", "Miserable", "Embarrassed", "Hesitant", "Lonely", "Sceptical", "Lost", "Vulnerable", "Rejected", "Offended", "Heartbroken", "Desperate"

Table 4: Possible feelings presented in the game

It is obvious from the amount of terms listed in Table 2, 3 and 4 that as these are chosen at random for every game, there are endless possibilities for different combinations and stories to be told.

3.3 Game mechanisms from research

As seen from the preliminary study in Chapter 2, perspective-taking, active engagement and collaborative learning are all important mechanisms that have shown potential in social and emotional learning. These have therefore deliberately been incorporated into Pathos through the use of storytelling. The next paragraphs will go into detail on each of these mechanisms to explain how they are each an integral part of the way the game is designed, through specific examples from the game.
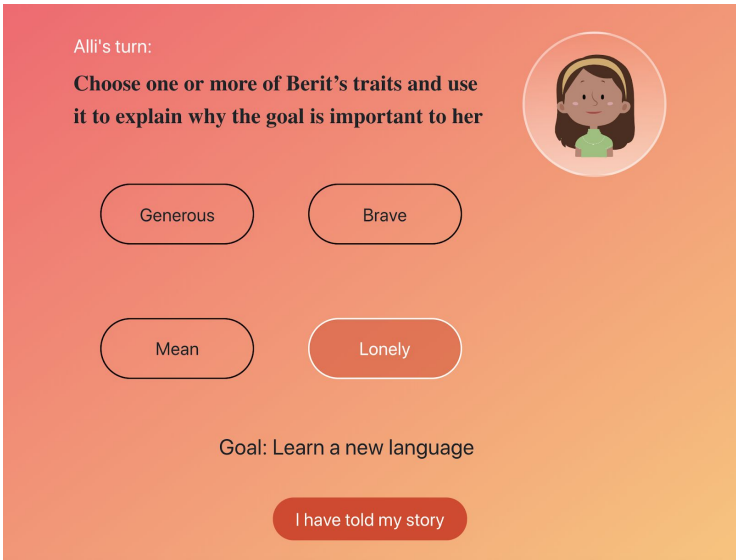
3.3.1 Perspective-taking

As seen from the preliminary study, perspective-taking is an essential part of cognitive empathy, and thus a promising mechanism to facilitate empathy practice through a game. Perspective-taking is integrated into Pathos through the use of storytelling. As previously mentioned in the preliminary study, telling stories is a natural way for humans to pass on knowledge, be it how lions are dangerous or how the first day of school can feel for a young child. The latter is more so what this game seeks to do - creating stories with real-to-life characters that sets out to reach a goal that the players can relate to, or at least reflect on. As the story progresses, the game prompts each player to use what they know about the character to answer a question and build on the story. Doing this requires the players to see the goal and challenges from the character's point of view, thus practicing perspective-taking.
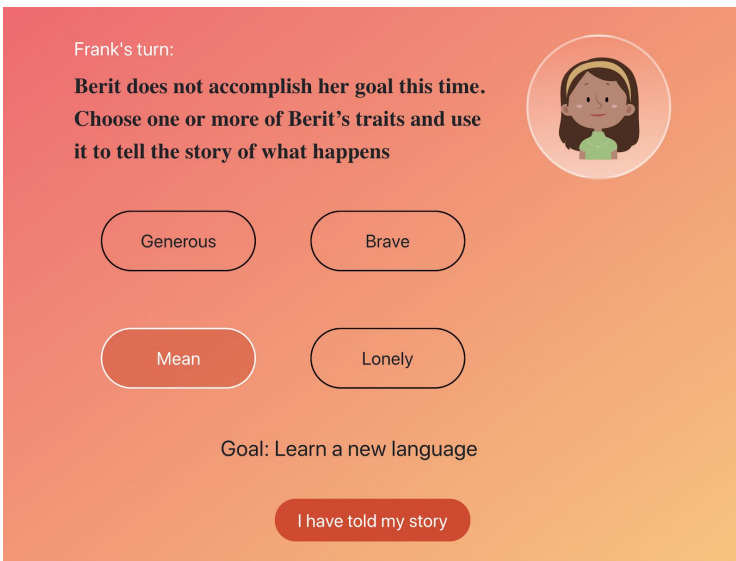
A few examples of how Pathos prompts perspective-taking can be seen in Table 5.

Screenshot with game prompt	How it encourages perspective-taking
Alli's turn: **Choose one or more of Berit's traits and use it to explain why the goal is important to her** Generous Brave Mean Lonely Goal: Learn a new language I have told my story	The player is asked to use one or more of the character's traits in order to justify the importance of the chosen goal. This means that the player needs to imagine what it is like having those four character traits and connect this to the goal in some way. In this particular example, the character may have just moved to a new country and feels lonely because she doesn't have any friends. In order to make friends, she needs to learn the local language.
Frank's turn: **Berit does not accomplish her goal this time. Choose one or more of Berit's traits and use it to tell the story of what happens** Generous Brave Mean Lonely Goal: Learn a new language I have told my story	The player is asked to use one or more of the character's traits to explain why they did not accomplish a goal. This is a way for the players to empathize with the character by explaining how something went wrong by using at least one of the given character traits, meaning that the player needs to think about how this could have affected the person's actions and in turn the outcome of the situation.

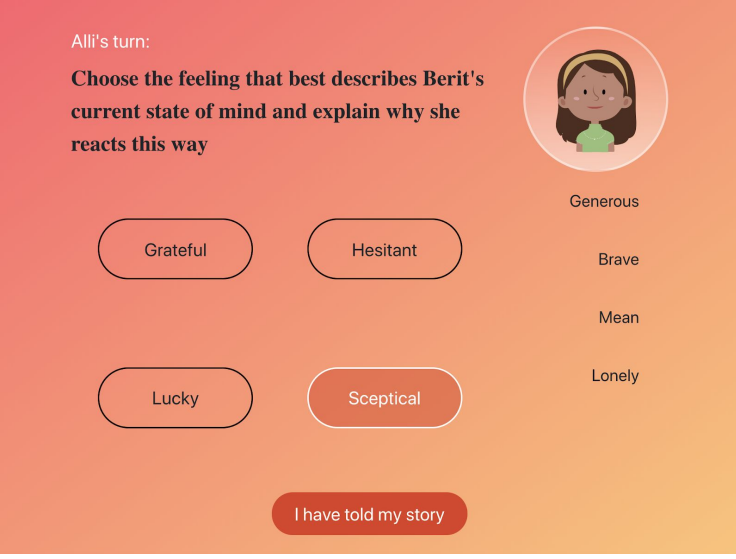|	
Alli's turn: **Choose the feeling that best describes Berit's current state of mind and explain why she reacts this way** Grateful Hesitant Lucky Sceptical I have told my story Generous Brave Mean Lonely	The player is asked to attribute one of four feelings to the character after they did not reach their goal, and explain why this is their emotional reaction. In order to do so, the player needs to put themselves in that position of not reaching a goal and think about how this might feel to the character, before articulating this to the other players.

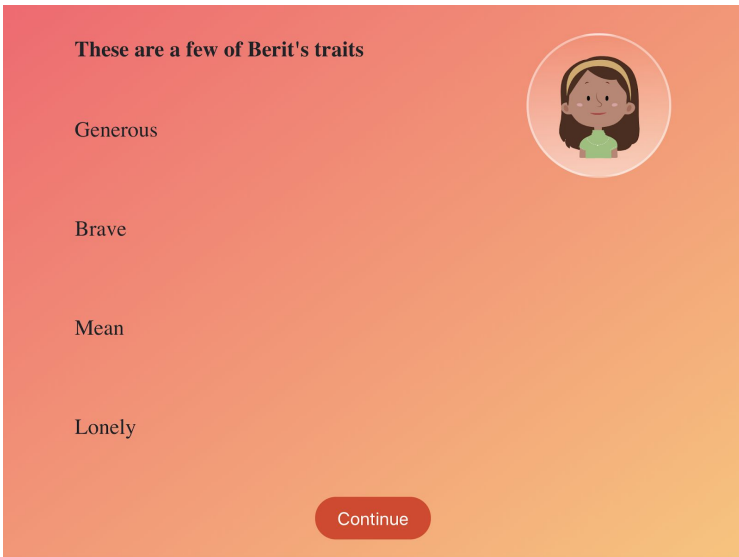Table 5: How the game encourages perspective-taking

3.3.2 Active engagement

As seen in a meta-study conducted by Durlak et al. (2011), incorporating active forms of learning seem to be one of the success factors in effective SEL programs. Active engagement strategies help children stay attentive, involved and focused on an activity while encouraging their spontaneity, humor, flexibility, creativity and playfulness (Sugishita, 2019; Elias et al., 1997). Elias et al. (1997) suggests games as a way to ensure this active engagement, and in being a game, this game can therefore be seen as an active engagement strategy. However, more thought is put into the design of the game in order to target the more specific skills of creativity and flexibility.

With storytelling at the core of the game, creativity is essential in telling the story to move the game forward. When being asked to come up with an explanation of what happens, or a justification of why a choice is made or a feeling felt, oftentimes creativity is needed. This is especially true because the traits given to the character is chosen at random and may not necessarily fit together or with the chosen goal. The players therefore need to use their creativity to find new ways of possibly making sense of the unsensible. Furthermore, flexibility also ties

into this same argument of needing to work with what you are given in the game, both in terms of traits and feelings, but also when being asked to build on the story of the other players. The story may have taken an unexpected turn and the players may need to be flexible and bend their minds in order to finish the game. Additionally, humor and playfulness are also ingredients to be expected in such a storytelling game. However, this may vary from game to game and depend on the themes brought up and the direction in which the players choose to take the game.

Table 6 shows how active engagement is incorporated into the game.

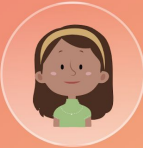| Screenshot with game prompt	How it encourages active engagement
These are a few of Berit's traits Generous Brave Mean Lonely Continue	The players are given four traits for the character at random. Further in the game, the players are asked to use these traits to explain some of the choices made and why the story progresses the way that it does. Working with a set of pre-defined traits requires flexibility and creativity, such as possibly combining the traits generous and mean in this example.

Katie's turn: **Choose one or more of Berit's traits and use it to tell the story of how she pursues her goal** Generous Brave Mean Lonely Goal: Learn a new language I have told my story	The player is asked to use one or more of the character's traits in justifying why the chosen goal is important to the character. Depending on whether the players chose the goal thinking about the traits or not, this justification might come easy to them or require them to be creative.
Alli's turn: **Choose the feeling that best describes Berit's current state of mind and explain why she reacts this way** Grateful Hesitant Lucky Sceptical Generous Brave Mean Lonely I have told my story	The player is asked to link the failure that the character just faced in pursuing their goal with one of four random feelings. This can be hard at times, and part of the challenge and take-away from this task may be to justify another person's feeling, even if it seems irrational at first. This ties back to perspective-taking and thus practicing empathy.

Table 6: How the game encourages active engagement

3.3.3 Collaboration

Collaborative learning, meaning "any instructional method in which students work together in small groups toward a common goal" (Prince, 2004, p. 1), has proven to be an effective form of learning. Another study showed that cooperative learning improved interpersonal interactions, self-esteem and greater social support (Johnson, Johnson, & Smith, 1998). Even though this game does not seek to teach traditional academic skills, it is worth pursuing the idea of trying out

the concept of collaborative learning also in the context of practicing social and emotional skills. Seeing that collaborative learning is shown to positively affect other areas in the realm of social and emotional learning, it is not unlikely that it will have a positive effect in the context of empathy too. Regardless, this is an interesting idea to explore further with the game.
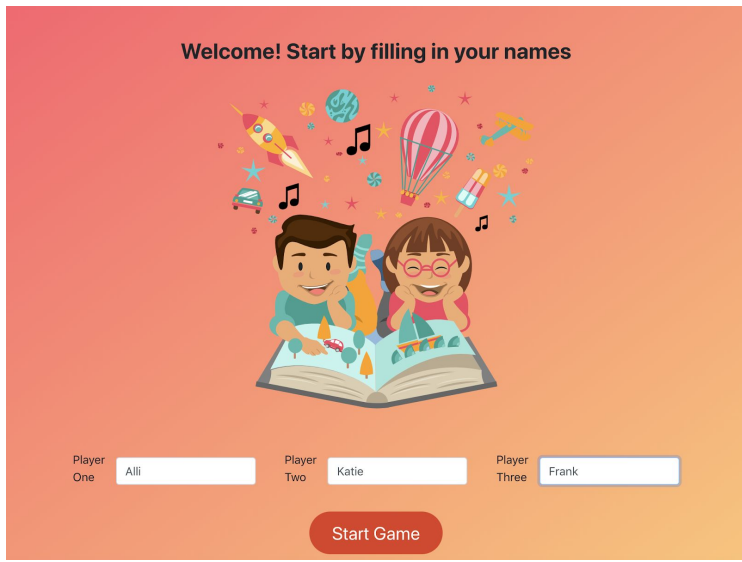
Collaborative learning, or at least practice through collaboration, is promoted in this game by having three players be part of the game from the very beginning and having them type in their names in order to start playing. Furthermore, the first few screens ask the players to make choices together (picking and naming the character as well as choosing their goal). The rest of the game is set up for individual turns, however, they are all asked to build on the story of the previous player. Active listening skills and turn-taking are therefore important skills that are also indirectly being practiced through storytelling in the game.

Furthermore, the multiplayer game is designed to be played by three players on one screen (preferably a tablet), encouraging meeting up in person to play the game. The decision of co-locating the players and having them pay attention to the same screen was based on wanting the players to feel present with the others and not having them look down at their own screens, but rather be attentive to the player who is telling the story at each given time.

Table 7 shows how collaborative learning is incorporated into the game.

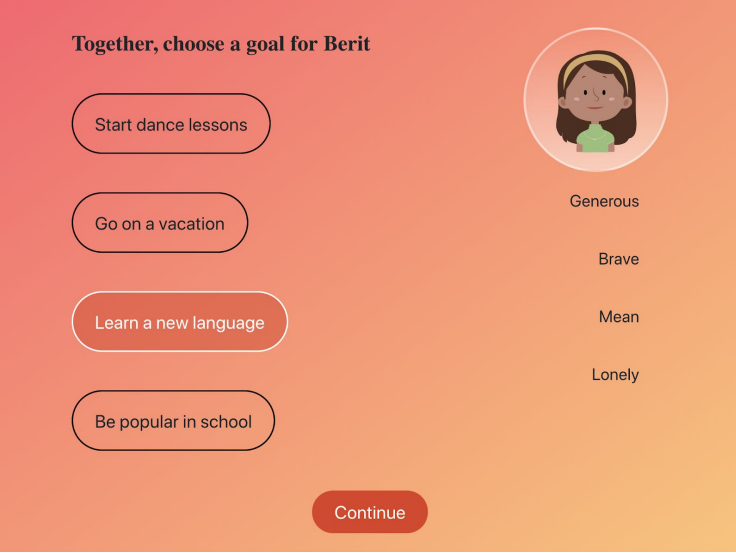| Screenshot with game prompt	How it encourages collaborative learning
	The game starts by inviting three players to play the game together. The "Start Game button" will only be enabled when three player names are typed in. The names are used further on in the game to tell the players whose turn it is, and for it to be more personal than calling them by a player number.
	The second screen asks the players to collaboratively choose a character and type in the character's name on the screen. Whether the players choose to pick a character that they do or do not identify with is completely up to them, but since the character will represent all three players in the game, it is likely that not all players see themselves in the character, especially after being given a set of traits.

| | The players are asked to agree on one of four randomly proposed goals that the character will work to pursue in the game. Some goals will relate more to certain people, but the game intentionally makes the players empathize with people that are different from themselves in terms of looks, personality, background and/or goals. |

Table 7: How the game encourages collaborative learning

3.4 Context of use

Social and emotional learning can be incorporated into the school's existing curriculum in classes that naturally relates to emotions, behaviors and relationships, such as social sciences (S. M. Jones, Brown, & Aber, 2011; Yoder, 2014). Even if the school already has a SEL program in place, Pathos could work as an addition to this, perhaps as the only game-based learning alternative in the classroom. The fact that a game round is relatively short, usually no more than five minutes, is also likely to make it easier for the teacher to fit this activity into a busy schedule, as reported in section 2.4 to be a common struggle for teachers. Even though the different groups playing the game will have tackled different situations, a joint discussion can be facilitated with the whole class afterwards, where groups can present their story from the game and the teacher can facilitate a discussion around that specific topic. The fact that Pathos presents goals and traits at random brings up new topics and situations for discussion naturally, which means that the teacher can focus on facilitating the discussion, rather than come up with relatable topics. If the game is well designed and usable, as the usability questionnaire data presented in section 5.2 implies, using Pathos in class would likely not require training of the teachers, as stated in section 2.4 to be a challenge with many SEL programs.

Slovák and Fitzpatrick (2015) highlights the lack of support for continued learning of social and emotional skills outside of school, including the difficulty of involving parents in the learning process, as one of the main challenges with SEL programs today. Even though Pathos is designed for and targeted towards children, the author believes involving parents or older siblings can be a good idea. In a home setting, parents and children can play the game together, as a quick break from academic homework, while making dinner together or as a night-time activity before the children go to bed. This will give the parents an opportunity to gain insight into their children's thought processes by hearing how they make choices and reflect on them. When the parent is involved in the game, they are able to pause and have meaningful discussions about the topics that the game brings to the surface. Some parents and children may find it hard to talk about feelings and issues in or outside of school, and a game that presents situations for a character might work as a gateway to engage in those important conversations - whether they choose to talk about it from the character's point of view or bring up personal experiences.

Making use of Pathos both at school and at home could potentially help bridge the gap between home and school when it comes to social and emotional learning, in the sense that it provides a consistent framework for discussion. Having the parents, teachers and fellow classmates all be familiar with the game could motivate the child bring up a character they played or a lesson they learned to discuss more easily.

Another important aspect of this game is that it is freely distributed online, available to anyone with a web browser (preferably on a tablet) and an internet connection. This also means that children not attending schools where funding is given to the implementation of a SEL program will also have free access to a tool that enables empathy practice - be it in a classroom, facilitated by a teacher, or outside of school.

3.5 Technology and development

3.5.1 Development and technological considerations

The development process was driven by the requirements presented in section 3.6, implementing the most critical components first. The design prototype was used as a guide for the development in terms of the flow and design of the application. However, design details like spacing and colors were experimented with during the development. A backlog was used to keep track of which tasks were done, underway and yet to be started. For development, the integrated development environment Atom (https://ide.atom.io/) was used, along with Github (https://github.com/) to ensure an online backup of the code.

When choosing the technology for this project, emphasis was put on familiarity and online documentation in case support was needed, a focus on user interfaces and reusability of code. C# and the game engine Unity (https://unity.com/) was considered as the former project by Skaraas (2018) that built a similar application applied this technology, but because of Skaraas' technical challenges and his evaluation of the technology for the purpose, it was chosen to steer away from this approach. The supervisors at NTNU strongly wanted the game to be easily accessible for people independent of what platform they were using, and the idea of a web application was therefore brought up, as it can be accessed in any online browser. Additionally, this approach would not require the users to download anything, and the developer would be in control of which version of the game was available to the users at any point in time. As the author had some prior experience with HTML5, CSS3 and JavaScript, it was chosen to use web technologies for the development of a single-page application for the digital game. After doing some research online on compatible web technologies, the author also settled on using React (https://reactjs.org/), a JavaScript library with extensive online documentation and support forums.

React is a declarative JavaScript library built for creating interactive user interfaces. The library uses states which effortlessly updates the view (what is shown to the user) when the data changes. Using components makes it possible to keep the state separate from the DOM, and passing data through the application is easy, with a render method that ensures the correct view is displayed to the user, considering the data taken as input. Additionally, React encourages reuse of code through its components, which was a good fit for the game as much of the user interface is repeated throughout. The extensive online support, integral focus on user interfaces and reusability of code therefore made React an obvious choice.

The web application was built with a focus on having the game display in the best way possible for a tablet, whereas second attention was given to the game being usable on a computer. Focus was not given to fit a mobile screen, as the focus for this thesis was to develop a game for tablet use. However, professor Jaccheri hired another student to adapt Pathos to a mobile version by reusing much of the codebase form this project. A mobile version of the game is therefore also currently in development.

3.5.2 Website hosting and data storage

As the initial plan for data collection for this thesis, as further discussed in section 4.4, included recording audio of the players while playing the game, one of the requirements when developing the game was that audio needed to be recorded and stored for future analysis. Additionally, the input the players made by typing in their names or selecting different buttons should also be stored, as the author and her supervisors agreed that this could bring about interesting findings, even if these were not foreseen from the start. Attention was therefore also given to finding a way to store these in-game choices, so that either in the scope of this thesis, or for future research, this player data could be used to look for patterns. Additionally, the task of hosting the webpage online was an important one that needed to be looked into.

Most of the free npm packages that were available online to ensure audio recording from the browser required the webpage to be hosted on a secure HTTPS connection. Using Amazon Web Services (https://aws.amazon.com/) to host the webpage was a valid option, as it is a popular platform with extensive support. However, depending on the traffic to the website, the author might have needed to pay for the service, and managing to host the site with a HTTPS connection showed to be difficult. Google's competing service Firebase (https://firebase.google.com/) was a good alternative, offering secure HTTPS hosting of websites, cloud storage and a realtime database. With its easy set-up, thorough documentation and appealing user interface, Firebase became the preferred choice that offered every functionality necessary.

Firebase's npm packages was then used to connect the application to the author's Firebase account, enabling easy deployment from the terminal. The HTTPS connection establishes an encrypted link between the server and the client when data is transmitted. The game data (logging of in-game choices and player names) is stored in the Firestore database, whereas the audio recordings are stored in Firebase Storage, both part of the Firebase platform. As this data, especially the audio recordings of children, can be sensitive, it has been highly prioritized to ensure the user's privacy is taken seriously and secure the data properly. Therefore, the database (textual information) and storage (audio) will only be open for write access, and never read access, which will prevent anyone not logged into the author's Firebase account from retrieving the stored files. In order to secure the Firebase account, two-factor authentication has been enabled. In case of actual user testing, the document that maps the participant's ID with the player data will be stored separately with a different password.

3.6 Functional and non-functional requirements

Table 8 and 9, respectively, presents functional and non-functional requirements for the game with their corresponding priority. High priority represents functionality that is essential for the game to work as intended. Medium priority includes features that should be in place before

testing the game. Lastly, low priority features are those that would be nice to have, and is seen as a plus if included, but are not necessary for the game experience to be satisfactory in this project. These priorities are used in the development process to make sure the highest prioritized items are taken care of first.

#	Description of functional requirements	Priority
FR1	The game should be played by three players on one device	High
FR2	The players should be able to choose one character from a diverse set of characters	High
FR3	The players should be able to give their character a name	Medium
FR4	The players should be presented with four character traits	High
FR5	The players should be able to choose a goal for the character	High
FR6	A player should be able to choose a feeling for the character	Medium
FR7	Each player should be presented with two individual tasks	Medium
FR8	The game should prompt all players to participate in telling the story	High
FR9	The players should be able to choose one or more of the character's traits to tell the story	Medium
FR10	The game should have a start-screen explaining the game's purpose and how it is played	Low
FR11	The game should have a continue-button that brings the gameplay forward	High
FR12	The game should have an end-screen that summarizes the game	Low
FR13	The game should have form validation to ensure that a valid name is written for the character and players	Medium
FR14	The game should adapt to using the right pronoun for the chosen character	Low

FR15	The game should record the players' voices when playing, and ask for permission to do so	Medium
FR16	The game should record the players' in-game choices of traits, goal and feeling, and store it safely	Medium

Table 8: Functional requirements with priorities

#	**Description of non-functional requirements**	**Priority**
NFR1	The game should have a design that adapts to different screen sizes	Low
NFR2	The game should be usable, with >90% of the users being able to navigate the game after one playthrough	High
NFR3	The game should work smoothly with a stable internet connection (>99% of cases)	High

Table 9: Non-functional requirements with priorities

3.7 Prototyping

3.7.1 Sketching

Initially, a variety of different ideas related to a collaborative storytelling was considered, experimenting with different numbers of players as well as user interface and tasks presented in the game. A few initial sketches are shown in Figure 3 and 4.
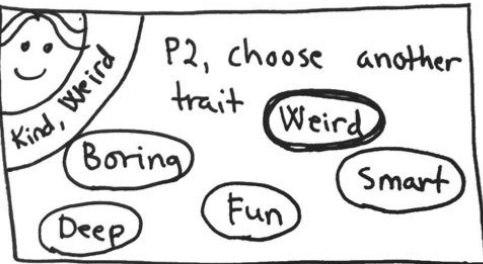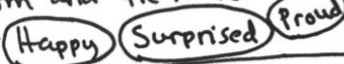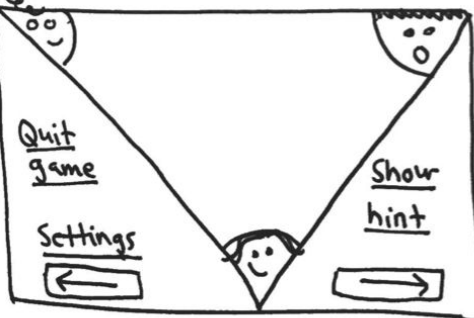
1) Welcome to the game
   How to play/goal:
   ～～～
   ～～

2) Agree on a character for your story

3) P1, choose one trait for your character
   (Kind) (Lonely) (Poor)
   (Funny) (Irritable)

4) Kind, Weird
   P2, choose another trait
   (Boring) (Weird) (Smart)
   (Deep) (Fun)

5) Same for Player 3.

6) Tom is made the captain of the football team. P1, pick a feeling for Tom and tie it to a trait. (Happy) (Surprised) (Proud)

7) P2, tell the group one thing his classmates doesn't know about. How does this affect Tom?.

8) Tom meets a new person that perceives Tom as shy. P3, knowing Tom, why do you think he was seen in this way?.

9) Quit game   Show hint
   Settings
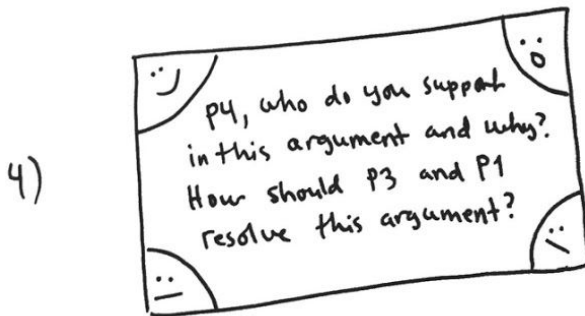   ←   →

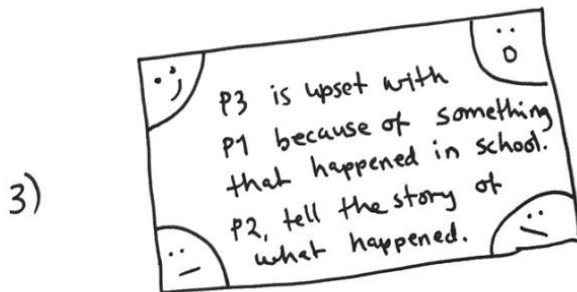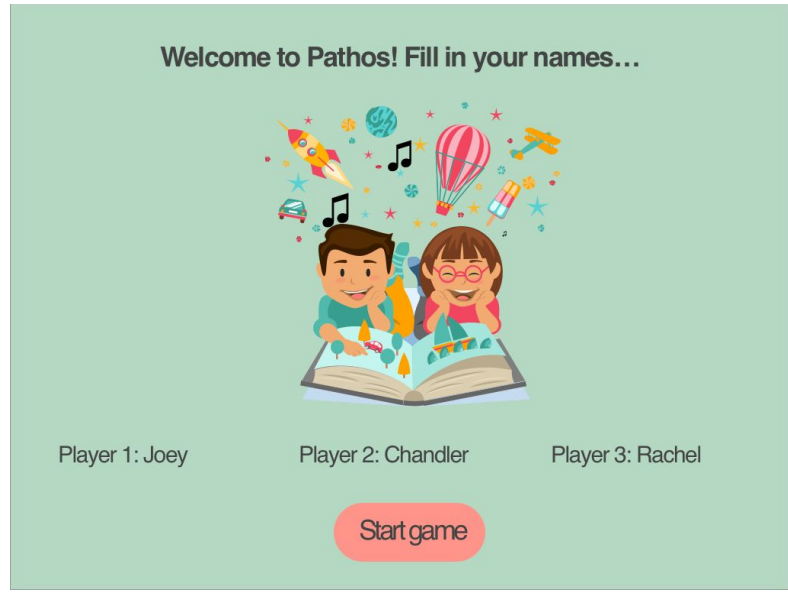Figure 3: Initial game concept sketch 1
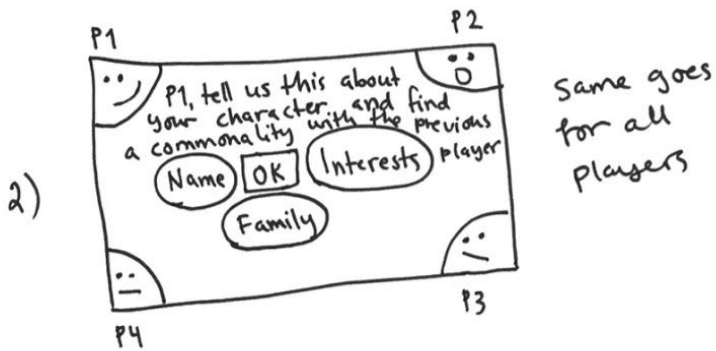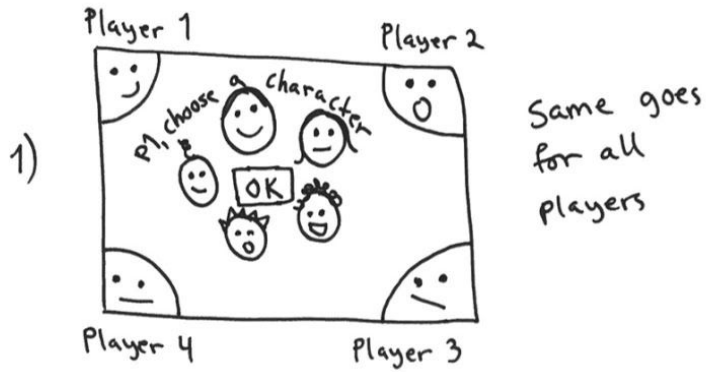
Figure 4: Initial game concept sketch 2

3.7.2 Design prototype

After having sketched out a few different ideas on paper and decided on some main features of the game, the vector graphics editor Sketch (https://www.sketch.com/) was used to refine the ideas further and eventually make a high-fidelity prototype. This included designing the different screens and deciding on the game flow (how to get from one screen to another). This digital prototype allowed for rapid experimentation with different placements, images, shapes and sizes. Sketch is a popular application to make design prototypes, and the author's previous experience with this application made it an easy choice. Table 10 gives an overview of the different screens that was made in Sketch, presented in chronological game-play order, along with an explanation of each screen.

In-game task	Game screen
1) Players are welcomed to the game and asked to fill in their names in order to proceed.	Welcome to Pathos! Fill in your names… Player 1: _____ Player 2: _____ Player 3: _____ Start game

1.1) Welcome screen with names filled in.	**Welcome to Pathos! Fill in your names…** Player 1: Joey Player 2: Chandler Player 3: Rachel Start game
2) The players are asked to choose a character together and type in the character's name.	**Together, choose your character and give their name** Name: _____ Continue

2.2) A character is chosen and name filled in.	**Together, choose your character and give their name** Name: Calvin Continue
3) The players are presented with four of the character's traits.	**These are a few of Calvin's traits:** Intelligent Sore loser Sporty Only child Continue

4) The players are asked to choose a goal for the character throughout the game from a list of four options.	**Together, choose a goal for Calvin** Get a new friend Have a sibling Become the team captain Get better grades Continue Intelligent Sore loser Sporty Only child
4.1) A goal is chosen for the character.	**Together, choose a goal for Calvin** Get a new friend Have a sibling Become the team captain Get better grades Continue Intelligent Sore loser Sporty Only child

5) The first player (here named Joey), is asked to tell the other players why the chosen goal is an important one for the character, by using one or more of their traits.	*Joey:* **Explain why this goal is so important to Calvin, using one or more of his traits** Intelligent Sore loser Sporty Only child Goal: Get a new friend Continue
6) The second player (here named Chandler) is asked to come up with a story of how the character pursues their goal.	*Chandler:* **Tell the story of how Calvin pursues his goal, using one or more of his traits** Intelligent Sore loser Sporty Only child Goal: Get a new friend Continue

7) The third player (here named Rachel) is asked to tell the other players a story of how the character didn't accomplish their goal and why.	*Rachel:* **Calvin does not accomplish his goal this time. Tell the story of what happens and why, using one or more of his traits** Intelligent Sore loser Sporty Only child Goal: Get a new friend Continue
8) The first character (here named Joey) is asked to choose between one of four feelings presented and explain why the character feel this way at this point in the story.	*Joey:* **Choose the feeling that best describe Calvin's current state of mind and explain why he reacts this way** Confused Proud Intelligent Sore loser Sporty Only child Lonely Embarrassed Continue

8.1) A feeling is chosen.	**Joey:** **Choose the feeling that best describe Calvin's current state of mind and explain why he reacts this way** Confused Proud Lonely Embarrassed Intelligent Sore loser Sporty Only child Continue
9) The second character (here named Chandler) is asked to tell the success story of how the character pursues their goal once again, now with a new strategy.	**Chandler:** **Come up with a new strategy for Calvin to pursue his goal, and tell the story of how he succeeds this time** Intelligent Sore loser Sporty Only child Goal: Get a new friend Continue

10) The third player (here named Rachel) is asked to state one or more lessons that the character learned from their experiences, before the game is completed.	

Table 10: In-game tasks and corresponding game screens

These ten steps conclude the game round and the game is over. The finish-button will take the players back to the welcome screen, where they can start over and tell a whole new story.

3.7.3 Final implemented solution

After having experimented with the design prototype made in Sketch and received feedback from supervisors, the author set out to build the application using web technologies. The Sketch prototype largely inspired the development, although a few changes were made along the way, such as adding a new radiant color scheme using a gradient. The implemented interactive game was then presented to experts and given feedback on, as described in section 5.1. From this, the changes presented in Table 13, section 5.1, were made. Another decision that caused the user interface to change for a number of the game screens was a discussion with the supervisor, where it was decided that being able to save and track the different traits players use in the story was important because it could potentially lead to interesting findings in the analysis of the data. Instead of just asking the players to use one or more of the traits presented on the right hand-side of the screen, the game screen now prompts the players to actually click on one or more of these traits before being able to move on in the game. This change can be seen in Table 11.

Table 11 presents the design prototype and interactive prototype side by side, showcasing evolvement of the game.

Design prototype (Sketch)	Interactive prototype (implemented)

Together, choose your character and give their name

Name: _____

Continue

Together, choose your character and give them a name

Name

Continue

Together, choose your character and give their name

Name: Calvin

Continue

Together, choose your character and give them a name

Name Calvin

Continue

These are a few of Calvin's traits:

Intelligent

Sore loser

Sporty

Only child

Continue

These are a few of Calvin's traits

Intelligent

Generous

Disrespectful

Rich

Continue

Panel 1

Together, choose a goal for Calvin

Get a new friend

Have a sibling

Become the team captain

Get better grades

Continue

Intelligent
Sore loser
Sporty
Only child

Panel 2

Together, choose a goal for Calvin

Ask someone on a date

Be more environmentally friendly

Buy new clothes

Save money for college

Continue

Intelligent

Generous

Disrespectful

Rich

Panel 3

Together, choose a goal for Calvin

Get a new friend

Have a sibling

Become the team captain

Get better grades

Continue

Intelligent
Sore loser
Sporty
Only child

Panel 4

Together, choose a goal for Calvin

Ask someone on a date

Be more environmentally friendly

Buy new clothes

Save money for college

Continue

Intelligent

Generous

Disrespectful

Rich

Panel 5

Joey:

Explain why this goal is so important to Calvin, using one or more of his traits

Intelligent
Sore loser
Sporty
Only child

Goal: Get a new friend

Continue

Panel 6

Joey's turn:

Choose one or more of Calvin's traits and use it to explain why the goal is important to him

Intelligent

Generous

Disrespectful

Rich

Goal: Be more environmentally friendly

I have told my story

Chandler:

Tell the story of how Calvin pursues his goal, using one or more of his traits

Intelligent
Sore loser
Sporty
Only child

Goal: Get a new friend

Continue

Chandler's turn:

Choose one or more of Calvin's traits and use it to tell the story of how he pursues his goal

Intelligent   Generous

Disrespectful   Rich

Goal: Be more environmentally friendly

I have told my story

Rachel:

Calvin does not accomplish his goal this time. Tell the story of what happens and why, using one or more of his traits

Intelligent
Sore loser
Sporty
Only child

Goal: Get a new friend

Continue

Rachel's turn:

Calvin does not accomplish his goal this time. Choose one or more of Calvin's traits and use it to tell the story of what happens

Intelligent   Generous

Disrespectful   Rich

Goal: Be more environmentally friendly

I have told my story

Joey:

Choose the feeling that best describe Calvin's current state of mind and explain why he reacts this way

Confused   Proud

Lonely   Embarrassed

Intelligent
Sore loser
Sporty
Only child

Continue

Joey's turn:

Choose the feeling that best describes Calvin's current state of mind and explain why he reacts this way

Optimistic   Hesitant

Courageous   Discouraged

Intelligent

Generous

Disrespectful

Rich

I have told my story

Table 11: Design prototype and interactive prototype side by side

Chapter 4: Research methodology

This chapter presents different research strategies, data collection methods and data analysis methods that are all connected to this project in one way or another. The initial study design, as presented in section 4.3.2, was discarded as it proved not to be feasible in the allocated time with regards to receiving an ethics approval and recruiting participants in time, as thoroughly discussed in section 5.3.1. Although not all methods, plans and reflections are still relevant to the final evaluation, it remains an important part of the project, as it reflects the thought process and evolution of the thesis. It was therefore chosen, in accordance with the supervisors, to present a range of these theories and refer to it throughout the thesis whether it regards a discarded method, an executed strategy or a suggested future research plan.

In the book "Researching Information Systems and Computing", Oates (2006) presents a handful of research strategies and data collection methods relevant for conducting research in the fields of information systems and computing. Oates (2006) describes a model of research where the literature review builds the foundation for a conceptual framework as well as the research questions of the project at hand. In order to answer the research questions, one or more research strategies are chosen. To gather empirical data, one or more data generation methods are used with the chosen strategy. Lastly, a qualitative or quantitative data analysis method is applied to make sense of the data and draw a conclusion. The author looked into the variety of different strategies and methods available before choosing the ones that were most suitable to answer the research questions at hand.

4.1 Research paradigm

When conducting research, it is important to identify the paradigm in which the research is conducted, which lays the foundation for the methods and how the data is presumed to contribute to new knowledge. A research paradigm describes a certain way of thinking about how research

should be done and how knowledge can be acquired (Oates, 2006). Positivism was initially the most closely related research paradigm to the original research plan for this project. Carrying out experiments as initially planned would involve testing a hypothesis by gathering quantitative data and analysing it with the use of statistical techniques. In doing so, the researcher would have kept focus on analyzing the data as objectively as possible and not letting personal beliefs influence the findings. This approach would have been in accordance with the research paradigm of positivism.

However, when it comes to using thematic analysis to analyze transcribed audio recordings from players, as suggested for future work in section 6.4, a constructionist perspective would be a more appropriate mindset to approach the data with. As opposed to positivism that believes one correct answer can be found, a constructionist approach believes that meaning needs to be seen in a socio-cultural context, and that there is no one right answer (Braun & Clarke, 2006). The thematic analysis would seek to reveal how the game is interpreted and used by the players, as well as uncovering why this is. Looking at the data in the social and cultural context that it was collected and keeping an open mind to there being more than one valid answer to a question would be central, leaving a constructionist perspective to be the most fitting paradigm for future work.

4.2 Research triangulation

Triangulation of methods and strategies, that is, using more than one method or strategy to look at the same aspect from different angles, can increase the confidence of findings by detaching the results from a particular method or strategy, as well as presenting more data to draw conclusions from (Oates, 2006). The different data sources are also able to confirm or question each other - all procedures that enhance the research quality. Method triangulation was used in this project as both a focus group and a questionnaire was used to assess the usability of the game. The fact that both methods yielded similar responses, as presented in section 5.1, brings confidence to the results.

4.3 Research strategies

4.3.1 Design and creation

The design and creation strategy is among the most used in computer science and software engineering research today (Oates, 2006). This strategy focuses on developing a new artifact, be it a new IT product, a model, a method, or in this case a digital game.

An iterative process was used to develop the game, with knowledge and experience from each step contributing to inform the others, allowing for going back and forth in the cycle. The process includes the following steps (Oates, 2006):
- Awareness: using literature study to define the problem/challenge at hand
- Suggestion: presenting a tentative idea of how to address the problem
- Development: implementing the chosen idea
- Evaluation: assessing the value of the artefact and any deviations
- Conclusion: identifying the newly gained knowledge and future research areas

The awareness phase was tackled through the literature review as a theoretical foundation was established in the research area and existing solutions were examined. This helped guide the research questions in the same way that the research questions helped guide the research. These two aspects developed dynamically together as additional literature was explored and new ideas came to mind. The suggestion phase included sketching different ideas for the game concept before choosing the one presented in this thesis. The development, as in the actual implementation of the game, was carried out shortly after the game concept was chosen, taking up roughly two months of the semester. The prototype was then evaluated with a focus group, where feedback from domain experts resulted in changes that were later made to the game. Lastly, a conclusion was made regarding the contribution to knowledge and future work was presented.

4.3.2 Experiments

An experiment is a strategy that seeks to confirm or disprove a hypothesis by empirical testing (Oates, 2006). By manipulating an independent variable, seen as the cause, and measuring changes in one or more dependent variable(s), seen as the effect, a causal relationship is attempted proven. Both a pre-test and post-test need to be carried out for the researcher to be able to compare the results. However, it is very hard to prove such causal links, as one needs to be certain that no other factors than the one being tested is influencing the results. As an alternative to true experiments in a lab, quasi-experiments are carried out in real-life settings, however, they can not establish causal relationships with the same certainty (Oates, 2006). The initial research plan for this master's thesis was to use a quasi-experiment approach to examine the effect of the game presented in this thesis on its users.

An experiment has good internal validity if the observations can indeed be attributed to changes in the independent variable (Oates, 2006). As shown, this is a challenging task, and some common threats include differences in the experimental and control group, other events taking place between the pre- and post-test, maturation of participants (especially relevant with children), faulty instruments, as well as experimenter effects and biases. One way to control these variables is by using a control group, which was an integral part of the initial plan of conducting a quasi-experiment. Simultaneously, an experiment has good external validity if the results are generalizable and not unique to the present circumstances (Oates, 2006). Some common threats to the external validity would be too few participants, non-representative participants and test cases that are not typical of real-life (Oates, 2006). When planning the quasi-experiment for this project, focus was kept on recruiting participants that were representative of the target audience, as well as obtaining enough participants to ensure a statistically significant result.

The initial plan was to carry out a quasi-experiment with the target audience in Ann Arbor, Michigan, to measure if playing the game weekly over a five week period had any effect on their

empathy level, which was planned to be assessed by a questionnaire. The author was hoping to recruit 60 children from local schools between the ages of 8 and 14 to take part in the study. Out of the 60 students, 30 was thought to make up the control group, whereas the remaining 30 would play the game in groups of three for 20 minutes each week. The control group would only need to be present for the first and last session to fill out the empathy questionnaire alongside the other participants. Different questionnaires were considered for this purpose, but the author had yet to choose a specific one at the point of planning due to a lack of agreement in literature as to what the most accurate questionnaire would be. Table 12 summarizes the evaluation plan.

Week in 2019	Number of participants	Total duration of weekly session	Methods applied
14	30 x 2	~ 3 hours, 40 minutes	Empathy questionnaire and observation
15	30 x 1	~ 3 hours, 20 minutes	Observation
16	30 x 1	~ 3 hours, 20 minutes	Observation
18	30 x 1	~ 3 hours, 20 minutes	Observation
19	30 x 2	~ 3 hours, 40 minutes	Empathy questionnaire and observation

Table 12: Evaluation plan for quasi-experiment

When dealing with minors, it is especially important that the research subjects and their data are handled legally and ethically, and that all data is kept anonymous and only used for the intended purpose. Before conducting any experiments, the ethical guidelines and research intentions would have been clearly communicated to everyone involved in the research, including the childrens' guardians.

4.4 Data collection methods

4.4.1 Interviews

Interviews are planned discussions used for gathering information based on a set of questions asked by the researcher to one or more interviewees (Oates, 2006). Interviews can be structured, semi-structured or unstructured, depending on the degree to which the interviewer follows their script (if they have one). Interviews can be used to explore open-ended questions about feelings or experiences not easily observed (Oates, 2006). Although interviews can give the researcher a lot of detailed information, also outside of what was expected, they tend to be quite time-consuming for the researcher, both in preparing, conducting, transcribing and analysing the interviews. Although not executed in the end, semi-structured interviews were planned to be used as a data collection method to answer RQ2 about the real-world application of the game through talking to teachers, child psychologists, parents, children and others.

4.4.2 Observations

Observation is used to find out what people really do, rather than what they say they do (Oates, 2006). An observation can either be covert, when people do not know they are being studied, or overt, where they do know and are able to give consent, thus avoiding potential ethical issues (Oates, 2006). Another distinction is made between systematic observation and participant observation. During a systematic observation, the researcher has a pre-designed schedule to note the frequency or duration of events (Oates, 2006). Because of the defined structure, other researchers are able to conduct observations for the same study with some training. However, the quantitative data only explains what happened and not why it happened. In participant observation, on the other hand, the researcher has a central role in the observation. In this setting, the researcher should note as much as they can about the occurring events. The purpose of participant observation is to develop an explanation of why things are happening the way they are (Oates, 2006).

Overt observation of children playing the game presented in this thesis was originally planned as part of the data collection. Using this approach would let the researcher openly take notes and ask questions if suitable. However, it is important to be aware of the so-called Hawthorne effect, meaning that when participants know they are being observed, they may act differently than they normally would. In this particular research, being observed while coming up with a story could have caused the participants to feel shy or less talkative than they would have been in a more natural environment, or otherwise modify their behavior in different ways. A systematic observation would be the most suited for tracking interesting events like how often the participants struggle with the user interface or how long they spend to come up with a story. During the observation, the researcher was planning to document the following about the players:

1. Does it appear as though they are taking the perspective of the characters?
2. Does it appear as though they are being creative and engaged with the game?
3. Does it appear as though they are building on each other's stories?
4. Does it appear as though they know how to play the game?

4.4.3 Questionnaires

A questionnaire is a predefined set of questions in an arranged order that allow for collection of large amounts of standardized data with the use of relatively few resources (Oates, 2006). Respondents should answer the questions given in the format they are asked in order to give the researcher data that can be analysed and generalised for a larger population (Oates, 2006). Self-administered questionnaires do not require the researcher to be present, however, researcher-administered questionnaires have the researcher ask each question to a respondent and register the answer (Oates, 2006). The former makes it less likely that the respondents will try to give "correct" answers in order to please the researcher, and one can be certain that the questions are given in the same way to every respondent. The latter, however, may result in the researcher unconsciously having an influence on the respondent with their tone of voice or body language (Oates, 2006).

One important quality of well-developed questionnaires is content validity, which focuses on generating the right data and requires the researcher to think about all the different aspects of the topic at hand (Oates, 2006). Construct validity is another important quality, which is concerned with having the questions actually measure what we think they are measuring (Oates, 2006). Last but not least, a good researcher should have reliability of the answers, meaning that the questionnaire optimally should yield the same results if it was completed again by the same respondents (Oates, 2006).

The original research plan for this project planned to use a self-administered questionnaire with a five-point Likert scale to assess the empathy levels of the participants before and after participating in the quasi-experiment. Although this was not carried out, a self-administered questionnaire with closed questions was used to assess the usability of the system with the focus group, as described in section 5.2.

4.4.4 Focus groups

A focus group is a qualitative data collection technique, in which selected individuals take part in a guided group discussion to give input on a research topic based on personal experience (Powell & Single, 1996). This means of data collection is especially fitting for complex subjects with multiple variables (Powell & Single, 1996). A focus group was deemed fitting to discuss the game prototype as there are a variety of features that make up the game, and discussing some of these in greater detail would be of great value to better understand what has been done well and what should be changed before testing the game with the target audience in the future. An advantage of focus groups is that it quickly provides an overview of different perspectives, while also allowing the participants to build on each other's input to trigger discussions that might not have come up in a traditional interview (Powell & Single, 1996).

A focus group should ideally consist of six to ten people from diverse backgrounds who do not know each other, so that sharing of honest and personal views and experiences are more likely to

take place as this will not affect any existing relationships (Powell & Single, 1996). Adding to this, the focus group should meet on neutral ground, without significance to the participants. It is the researcher's role to facilitate open dialogue and equal participation by offering a relaxed and non-judgemental atmosphere (Powell & Single, 1996). Making time for informal conversation before the session starts, where the researcher can introduce themselves and the participants interact, is a good start. It is also important to remember that participants may, consciously or unconsciously, self-censor and conform with others' views in a group setting (Carey, 1994).

The questions prepared by the researcher should be open-ended, and follow-up questions are welcomed to explore potentially interesting topics in more detail (Powell & Single, 1996). Furthermore, it is advised to give the participants a small reward for their time to participate in the session that usually lasts between 90 and 120 minutes (Powell & Single, 1996).

A focus group with domain experts was carried out to discuss the game prototype and collect data on aspects such as the following:
- What are their thoughts on the concept? Do they have any new ideas that should be considered?
- What are their thoughts on the traits, goals and feelings presented in the game? Should the selection be different?
- What do they think about the user interface? Was anything unclear?
- To what degree did they find it engaging to play and why?

Section 5.1 explains in detail how the focus group was executed and presents the results from this session.

4.5 Data analysis methods

The choice of data analysis method is an important one and should be discussed before starting to collect any data. The two data analysis methods available to researchers are quantitative data

analysis and qualitative data analysis. The two can be combined, but more often than not, researchers tend to stick with either one of them (Oates, 2006). In computer science and information systems, quantitative data analysis with a positivist research paradigm has traditionally been preferred, with some stating that quantitative data and analysis is the only valid form of research (Oates, 2006). However, more and more people are becoming aware of other alternatives, and both approaches can bring about interesting results.

4.5.1 Quantitative vs. qualitative data analysis

The quantitative data analysis method uses data, or evidence, based on numbers. This is the most common type of data generated from experiments and surveys, and is most often used with a positivist research paradigm, which claims there exists one correct answer (Oates, 2006). In quantitative data analysis, there are many well-established data analysis methods to help find patterns in the data set, as well as a variety of visual aids to present the findings. In addition, trusted statistical techniques can be used to establish whether a pattern is actually present, or if it has appeared by chance. A risk with a quantitative approach is that the analysis will only be as good as the data, which puts a lot of pressure on the initial data collection to be done right and thoroughly (Oates, 2006).

Qualitative data analysis is based on non-numeric data like words, images, audio, video and so on. The method seeks to find themes and patterns in the data sets - a task that is largely dependent on the researcher's interpretation and skills, and to a certain degree influenced by their background (Oates, 2006). Qualitative data is most often generated from the research strategies case studies, action research and ethnography, and researchers using a qualitative data analysis method have usually taken on the interpretive or critical research paradigm (Oates, 2006). Furthermore, Oates points out that qualitative data analysis does not have straightforward and fixed procedures like those of quantitative data analysis, which in conjunction with qualitative data often being high in volume, may lead the researcher to have a hard time knowing where to start and how to approach the data. On the other hand, the fact that qualitative data and its

analysis can be so comprehensive, gives the researcher a lot to base their interpretations and theories on. If an interpretivist philosophy is applied, a variety of equally valid explanations may be presented (Oates, 2006).

After having looked into both the quantitative and qualitative approach, the author found a mixture of the two approaches to be fitting for this project. The usability questionnaire used as part of the data collection produces ordinal data, which can easily be presented using charts and/or graphs. Furthermore, such quantitative data should, naturally, be analysed quantitatively. Simultaneously, audio recordings from the planned quasi-experiment was originally planned to be transcribed, which would have made use of qualitative data analysis. However, there are several ways in which text can be analyzed qualitatively, and the next section will go into detail on one of these, which is discussed in section 6.4 as a promising analysis method for future work.

4.5.2 Thematic analysis

Thematic analysis is a way of analysing qualitative data, and is defined by Braun and Clarke (2006, p. 6) as a "method for identifying, analysing, and reporting patterns (themes) within data". Braun and Clarke (2006) presents the six phases of thematic analysis, which they empathize is not a linear process, but rather one where moving back and forth between the steps is part of the process. These six phases of thematic analysis presented by Braun and Clarke (2006) are:

1. Familiarise yourself with the data
2. Generate initial codes
3. Search for themes
4. Review themes
5. Define and name themes
6. Produce the report

There are a number of questions that are important to answer when doing a thematic analysis, one of them being what counts as a theme (Braun & Clarke, 2006). Furthermore, the importance of a theme is not necessarily attributed to how often it occurs, but whether it contributes to the research question (Braun & Clarke, 2006). Another important decision is deciding if the focus should be on a rich description of the entire data set, in which the reader gets a good overview of the themes, but loses depth, or if it should go more into detail on a few themes to cover a specific area of interest. For use in this project, the latter would have been preferred as the research is focused on empathy specifically, and getting a closer look at this topic is more important than covering the variety of topics discussed during gameplay.

Another distinction in thematic analysis is that between an inductive and deductive approach. With an inductive, or bottom-up, approach, the themes are strongly related to the data itself and does not try to fit it into a pre-existing frame or interest of the researcher (Braun & Clarke, 2006). Contrary to this, a deductive, or top-town, approach, is rather grounded in the researcher's interest in an area and tends to focus more on one specific aspect of the data (Braun & Clarke, 2006). Because coding of data stemming from gameplay would have been centered around a specific research question, rather than trying to form one from the data, the deductive approach would be the most fitting for this project. The researcher therefore made it a priority to become familiar with the existing literature before starting the analysis process. In contrast, an inductive approach would benefit from not engaging with literature when first going into the data analysis, to avoid getting stuck in a theoretical frame (Braun & Clarke, 2006).

Furthermore, it is important to be aware of and make explicit whether the themes are found on a semantic, explicit, level, or on a latent, interpretive, level (Boyatzis, 1998). Using a semantic approach, the meaning of the data is taken directly from what has been said or written - taking the participant's word for what they are saying. Using a latent approach, however, requires the researcher to look beyond what is being said to look for other underlying meanings (Braun & Clarke, 2006). In this project, the researcher would have used a semantic approach, looking at what the children are actually saying and the stories they are telling while playing the game.

Chapter 5: Results and discussion

5.1 Focus group results

On February 21st 2019, a focus group session was executed at NTNU with nine participants from the Department of Computer Science. Some of the participants were experts in human-computer-interactions, while others in educative technologies in relation to children, which ensured a diverse expertise as advised by Powell and Single (1996). As the author waited for everyone to get settled, refreshments were laid out on the table and the participants started serving themselves and chatting informally. When everyone was seated around the tables in such a way that everyone could see each other, the author introduced herself and the research topic, stating the agenda and the purpose of the focus group. Permission was granted from all the participants to audio record the session, which made it easier for the author to be present in the discussion and not have to worry about taking notes. Next, the participants were divided into three groups that each got an iPad with the game preloaded. The groups then spent about 20 minutes playing the game as the author walked around and observed, listening in on their conversations. It became clear that the engagement was generally high, but that some of the game's instructions were unclear. After three rounds of playing the game, each participant was handed out a pen and a usability questionnaire, found in Appendix G, to fill out individually to assess the usability of the system. Lastly, the author had prepared a set of 10 questions about the design, content and flow of the game, found in Appendix H, that served as the main base of discussion. The participants contributed in several ways with their expertise, resulting in an hour-long discussion about the questions, resulting in a session of 90 minutes in total, as advised by Powell and Single (1996). After the focus group ended, the participants received a gift card of NOK 200 as compensation for their time.

From the audio recordings, the author set up a table, see Table 13, with the comments and suggestions made by the participants, linking them to the target audience and resources needed

for the modifications to be made. This resulted in a priority of whether or not the modification should be prioritized before the game would be ready to test with the target audience as initially planned. Additionally, the main points of feedback from the focus group are listed next.

Positive feedback:
- Felt happiness, joy, curiosity and engagement when playing the game
- The fact that the characters were conflicting in their traits made them humane
- It is interesting to be able to choose a goal, and the failure was emotional
- The game allowed the players to choose if they wanted to create a simple or complicated story
- Liked the colors, the graphics, and the diversity of the avatars. They felt happy when they opened the game and saw the start screen
- You got to know the character and wanted to help them

Miscellaneous:
- It would be useful to ask children what their goals are to make sure the game reflects the target audience
- It might be even easier for children to tell stories, as they have more imagination
- Should the character always fail their goal in the game?
- Is it okay for other players to interject on another's turn? That could be fun, and kids probably will
- It might be hard for children to concentrate over a period of time

The more concrete comments are presented in Table 13, along with an evaluation of its priority and whether or not a change has been made in that aspect during the master's thesis. Some of the changes that did not end up being implemented was due to a lack of resources, whereas others were kept unchanged because the suggestion was already considered, and discarded, during the design of the game.

Comment/suggestion	Value for target audience	Resources needed	Priority	Completed
Remove "get a sibling" as a goal	Low	Low	Medium	✓
Change button to say "I have told my story" (to make it clearer that it needs to be told before moving forward)	Medium	Low	High	✓
Change formulation to "give them a name"	Low	Low	Medium	✓
Make it clearer who's turn it is (larger font, different background color, splash screen or use their name in the text)	High	Low	High	✓
Add feedback and interactivity for more engagement (sound effects, animations)	Medium	High	Low	X
Change the font	Low	Low	Medium	X
Add initial guidance in the game	Low/medium	Medium	Low	X
Have a way of showing progression in the game	Low/medium	High	Low	X
Get rid of directly conflicting traits	High	Low	High	✓
Keep only a single task per page (separate "choose a trait" and "tell the story")	Low/medium	Medium	Low	X
Keep the language simple (remove words like "diplomatic" and "skeptical")	High	Low	High	✓
Give the option of choosing more than one trait to tell a story	Medium	Medium	Medium	✓
Add a back button (to make changes)	Medium	High	Medium	X
Animate the character to show different emotions (to make it easier to relate)	High	High	Low	X

Table 13: Changes suggested by the focus group

5.2 Usability questionnaire results

The System Usability Scale (SUS) was applied to evaluate the usability of the system developed in this project in a quick and easy manner. This ten item questionnaire using a five-point Likert scale (from strongly disagree to strongly disagree) was developed in 1986 and seeks to capture the subjective assessment of usability in a way that can be compared to other systems (Brooke, 1996). The SUS questionnaire has become a reliable industry standard that is put into use in both research projects and industrial evaluations, and has shown to correlate well with other subjective measures of usability (Brooke, 1996). The full SUS questionnaire can be found in Appendix G.

Brooke (1996) suggests having the participants fill out the questionnaire right after they have tested the system and before any discussion takes place, which is what the participants did in this study. The respondents were also asked to give their initial response, without overthinking it. The scores from the nine participants can be seen in Table 14, along with the corresponding grades. The average score was 71.4, and a score of 72 is considered to be "good", while anything above 68 is "above average" ("System Usability Scale (SUS)," n.d.). Considering the first statement was "I think that I would like to use this system frequently", and the respondents were not part of the target audience for the game, it is likely that the score would have come out higher had this question been omitted. Overall, the system can be considered usable, and above average, according to these results.

	Scales				Grading SUS Key	
Participant	**Odd items**	**Even items**	**SUS score (/100)**	**Grades**		
#1	15	18	82.5	B	92	Best imaginable
#2	14	17	77.5	C	85	Excellent
#3	11	19	75	C	72	Good
#4	12	18	75	C	52	OK/Fair
#5	15	18	82.5	B	38	Poor
#6	9	13	55	F	25	Worst imaginable
#7	9	12	52.5	F		
#8	10	17	67.5	D	90-100	A
#9	13	17	75	C	80-89	B
					70-79	C
					60-69	D
		Average score	71.39	C	Less than 60	F

Table 14: SUS scores

As the calculation method for the SUS score is quite intricate, an online resource ("SUS scoring sheet.ods," n.d.) was used to calculate the scores, albeit verified to make sure the calculation was accurate.

5.3 Challenges faced

5.3.1 Changing research plans

Research including human subjects conducted with affiliation to a U.S. institution is subject to approval of the Institutional Review Board (IRB). The IRB consists of board members with the authority to approve, disapprove or require modifications based on federal regulations and institutional policies (Oregon State University, 2017). This is done to protect the participant's rights, welfare and privacy. Since the author was doing research at the University of Michigan, it was agreed upon with the supervisors that getting an IRB approval would be an important first step in doing research in the U.S. However, the author did not have much prior research

experience, let alone in a foreign country. Before the author left to go to the U.S., she obtained a certificate needed to be able to conduct research with human subjects through an online course provided by the University of Michigan. Additionally, professor Marcu provided the author with a document briefly describing some of the main points that an IRB application would require, so she could start taking notes regarding motivation for the research, a plan of recruitment and execution, along with inclusion/exclusion criteria and ways to handle privacy concerns. A good amount of time was spent preparing for this application before leaving for the U.S., all along with the original research plan of doing an experiment over five weeks with a substantial amount of children from the target audience, as described in section 4.4.2. (where the original research plan is presented).

After arriving in the U.S., professor Marcu set up meetings with different professors at the University of Michigan who had experience with recruiting children in the area, applying for IRBs and executing research with a younger audience. After presenting the original research plan and the timeframe, the professors quickly helped the author realize that the plan was not feasible in the allocated time. One of their main concerns was getting an IRB approval soon enough so that there would also be time for recruitment, executing the plan and analyzing the data, all within a few months. Another concern the author was made aware of was the difficulty of, after having an IRB approval in place, recruiting children from primary and middle schools in the area. Not only would the schools likely be at their most busy towards the end of the semester (when the application was likely to be approved), but establishing trust between researchers and schools (both administrators and parents) in the area was in the trained researchers' experience something that had to be done over time.

After a few discouraging meetings, the author started looking into other ways that data could be collected to test the effect and/or application of the game that would not require the recruitment of a large group of children from schools. An idea that emerged in conversation with professor Marcu was talking to child psychologists, teachers, after-school program workers, as well as parents and their children, about how the game could be applied in real-world settings. The plan

was to recruit these professionals and families through existing contacts of professor Marcu by reaching out to her contacts and asking if they were interested in participating in the research project. Professor Marcu thoroughly supported this idea, and encouraged the change towards a more realistic research plan. However, having supervisors in different time zones at different continents, the author had not yet discussed this change with professor Jaccheri and was interested to hear what she had to say about the modifications. A Skype meeting was set up shortly after, and to the author's surprise, professor Jaccheri was glad that the author had come to this realization and had made plans to deal with the changing circumstances. However, this new research plan also needed an IRB approval, so the author started filling out the online application with nearly a hundred pages containing detailed questions about the research. For this application, the author needed to create consent forms, assent forms, recruitment scripts and flyers. These are attached in Appendix A-E.

With the new research plan, it took a couple of weeks to fill out the IRB application in its entirety. A few weeks later, towards the end of April, the review board returned the application with a list of changes that needed to be made in order for the application to be approved. A substantial amount of time was spent making these changes, however, certain practicalities and formulations was hard to figure out how to change for the better. The author reached out for help when needed, but not everything could be answered by the available contacts. By the month of May the initial deadline of June 10th (both for the master's thesis and the research exchange period) was approaching quickly neither an IRB approval nor a reassurance that the recruitment of experts and families would actually be manageable within a short period of time. The author yet again was worried that the data collection was hanging by a thread. After multiple discussions with professor Marcu at the University of Michigan and extensive email correspondence with professor Jaccheri at NTNU, both supervisors advised the author to move forward without doing further data collection. It was agreed that the thesis would hold its own with the existing data and that the game in itself is a unique contribution based on research. Soon after, the author applied both for an extended deadline of the master's thesis and the research exchange stay. Both applications were approved and the author focused her remaining time on

expanding the literature review, refining the game prototype and restructuring the master's thesis to reflect the changes that had been made and describing this process in a clear manner.

5.3.2 Lessons learned

Although the process of learning how research is conducted in the U.S., adjusting to new circumstances and realizing the limits of your own resources have been stressful and challenging, numerous lessons and valuable experiences have resulted from it. In the author's opinion, there are three key lessons to be learned from this experience, which would be useful to future students writing their thesis abroad. These can be summarized as follows:

1. Make yourself familiar with the requirements and regulations of the country you will be doing research in as early as possible
2. Be prepared that things may not go according to plan, so be sure to have a back-up plan
3. Set up regular meetings with supervisors from both your home and host university

For one, figuring out what is necessary to have in place before any recruitment or data collection can be done in a new country is crucial, and planning ahead for this and taking into account the time needed to get this approved is a necessity if you wish to use your time wisely. Taking the necessary precautions can save you from spending time in the new country filling out an application and waiting to hear back from an ethics board, and rather get you started with the actual research.

Another important lesson is that in research in general, especially being inexperienced and in a new environment, the research plan often has to be altered to some degree. During this master's thesis most of the research plan had to be changed, but also smaller discrepancies like not being able to recruit from the desired target audience or not getting as many participants as planned need to be accounted for. In such situations it is helpful to have thought these scenarios through beforehand, be flexible and have a back-up plan in mind so adjustments can be made to make use of the already conducted research.

Last but not least, the author wishes she would have organized more regular meetings not only with the supervisor at her host university, but also with her supervisor back at NTNU, as well as joint meetings. Providing frequent updates on not only the work that was being done, but especially the discussions taking place as the research plan changed would have ensured that everyone was on the same page and knew of the challenges that arose as they came up. Not only would it have been easier for the author to reach out to both of the supervisors for guidance, but it would likely also have facilitated more open discussions between the supervisors and disclosed any hidden discrepancies when it came to expectations of the research that the author was conducting. Undeniably, having supervisors working from within different academic cultures and practices could be confusing at times, as their expectations of what a master's thesis should and should not comprise did not always line up. The author would therefore advise future students to check in with both supervisors on a regular basis and make sure everyone is on the same page.

5.4 Research methodology evaluation

5.4.1 Critique of methodology

Design and creation was used as a research strategy to develop a new artifact, namely the digital game. This research strategy was effective in guiding the development of the game by first studying existing literature to define the challenge that was being tackled, making the author feel informed about the current state of the art and existing research in related fields before creating something new. The iterative nature of this strategy ensured that after having evaluated the prototype with a focus group, changes were made to reflect the feedback given from the experts.

The questionnaire used to evaluate the usability of the game is a widely used and popular usability measurement, making it easy to compare the score to tests of other systems. Although the questionnaire was self-administered and anonymous in the sense that the participants did not

put their names on the sheet, it is important to acknowledge that the participants' answers still can be influenced by the fact that the author was present in the room with them, and the fact that there were only nine participants may have made them feel more identifiable than intended with the questionnaire. However, the questionnaire did result in a definite usability score that helped shed light on the degree to which the system was usable. Another central critique is that the respondents were experts in human-computer-interaction and educative technologies, and not part of the target audience for the game. This means that the assessment is not necessarily generalizable to the target audience.

The focus group as a method for data collection was effective in collecting feedback on different aspects of the application from experts with relevant expertise and experience. Although the method was fitting for the purpose, there are some aspects worthy of critique when it comes to the execution. First of all, the participants were all recruited from the same department at NTNU, meaning that most of them knew, or knew of, each other in advance. There is a risk that this may have led to the participants censoring themselves and holding back certain opinions, although this is not likely to have played a big role as the questions were about their thoughts on different aspects of the game and not personal self-disclosing experiences. However, peer pressure and conformity are effects that any researcher should be aware of. Secondly, the focus group was organized in a meeting room at the participants' department at NTNU, which may not necessarily feel like neutral ground and could have pre-existing meaning to the participants, as presented by Powell and Single (1996) to be a potential disadvantage. Furthermore, the game presented to the participants was a high-fidelity prototype, and there is a risk that the participants refrained from giving certain comments because the game may have looked like it was already finished. Had the author evaluated a paper-prototype with the participants, chances are more input would have been given about the design of the game. Additionally, organizing more than one focus group session with this group of experts would have been helpful to present an updated version of the game and get additional feedback. However, since the author left to continue her research in the U.S. shortly after, this was not possible.

5.4.2 Threats to reliability

Reliability in research is the degree to which research methods produce consistent results (Carmines & Zeller, 1979). This means that a measure of the same phenomenon should give the same results if measured multiple times. In this project, a focus group was used to collect data on the expert participants' experiences with the game. As experts are individual people with a different set of experiences and expertise, such focus group sessions are likely to produce different results with different people. However, the author would argue that nine participants is a substantial number, generating data from a variety of experts. The final SUS score from the questionnaire answered by the nine focus group participants is an average of their individual scores, resulting in a higher degree of reliability than that of only one or a few respondents.

5.4.3 Threats to validity

Validity in research is an indication of whether the targeted phenomenon is actually what is being measured (Carmines & Zeller, 1979). This is extremely important, because if the data collection does not measure what we believe, we can end up drawing false conclusions. The data collection, being the focus group and questionnaire, in this thesis was conducted with adult experts rather than the target audience of the game, and it is therefore very important to remember that the claims being made of whether or not the game is usable, along with the general feedback given, comes from the perspective of experts in human-computer-interaction and educative technologies. The author can therefore not make claims about what impact the game has on children, because that is not what was being measured.

5.4.4 Limitations to the study

A point worthy of critique is the lack of involvement of the target audience in the design and evaluation process of the game concept. As previously discussed, the initial plan was to test the game with a large group from the target audience with the intention of measuring potential

change in the players' empathy from playing the game. However, this task proved to be unrealistic, not only because empathy is a difficult concept to measure, but because of the resources available in the scope of this project. A limitation to the study is therefore the lack of empirical data gathered from the target audience, as previously mentioned in terms of threats to validity.

Furthermore, another limitation to the study is the lack of user involvement in the design process. The focus group did inform some adjustments in terms of the game design, however, the game was never presented to the intended users. This means that even if the game is theoretically substantiated with mechanisms supported by research, there is no guarantee that the game will have the intended effect on the target audience, or that they will perceive and experience the game in the intended way. Conducting a co-design session or using participatory design would have been useful methods to involve end users early on and make sure the intervention was tailored specifically to them (Sanders & Stappers, 2008).

5.5 Evaluation of development and requirements

Using HTML5, CSS3, JavaScript and React to build a one-page web application for the game worked out well. The game is compatible with a variety of browsers and the data is stored correctly in Firebase's online database. The extensive online documentation was helpful in the development process and the user interface was implemented so that it looks similar to the design prototype, receiving praise from the focus group participants. Over all, the development of the application can be seen as a success.

However, the development of the game took two whole months, in addition to smaller adjustments being made as a result of the focus group. Because the planned experiment with users from the target audience was not carried out, as discussed in section 5.3.1, part of the development time that was spent on making sure the audio recording was working and stored properly along with the textual data ended up being of no practical use for this particular thesis.

However, the development effort is still highly valuable for future testing, as the game is already set up and ready to go through initial testing with actual users. The author does not discard the efforts as wasted time, but rather sees it as an investment in the project going forward.

As for the requirements presented in section 3.6, all functional requirements with a high or medium priority, as well as one low priority item, was fulfilled. The two items with low priority that was not implemented are presented and discussed next.

FR10, stating that the game should have a start-screen explaining the purpose of the game and how it is played, was not prioritized because of the amount of work it would require in relation to its priority. Its low priority stems from the fact that this was not deemed a necessary feature for the circumstances in this master's thesis as any users testing the game would be made familiar of its purpose, and seeing how they learned to play it would make an interesting observation in itself. However, having a start screen would be a useful feature if the game was to be commercialized in the future.

FR12, stating that the game should have an end-screen summarizing the game, was another feature the author did not consider important for the planned testing. Implementing this would require quite a lot of work and was therefore not prioritized for the scope of this thesis.

The non-functional requirements have not been formally tested so definite conclusions about whether or not the requirements have been met can not be drawn. However, from informal testing and the author's experience with the game, they seem to have been met to a sufficient degree. NFR1, stating that the game should adapt to different screen sizes is partly met by the game being designed for a tablet but also being usable on a computer, however not suited for mobile use. From the data collected from the SUS schemes during the focus groups, NFR2, stating that the game should be usable and more than 90 % of users should be able to navigate the game after having played it once, seems promising. Judging by the fact that all participants submitted a usability score evaluated as "Ok/Fair" or higher, with 6/9 participants giving scores

of "Good" or higher, this requirement seems at least somewhat fulfilled. However, this depends on what is considered "users", as the focus group participants were not in the target audience, and one can therefore not draw any conclusions as to how this group would have perceived the usability of the game. Last but not least, NRF3, stating that the game should work with a stable internet connection, is seemingly met by the repeated testing measuring 0.9 seconds load time with a 150 Mbps download speed. According to Bird (2016), sites loading in 0.8 seconds are faster than 94 % of the web, leaving the results very favorable. The fact that it is a one-page application makes the whole game load at once, leaving the subsequent navigation feeling smooth. However, transmitting the data to the server at the end of the game takes a few seconds, depending on the size of the audio file, before the page refreshes and is set up for a new game.

Chapter 6: Conclusion and future work

6.1 Conclusion

Design and creation was used to design and develop a game intervention with the purpose of helping children between the ages of 8-14 practice empathy. After an extensive preliminary study, a few game concept ideas were sketched out on paper before one was chosen and refined using Sketch to make a design prototype. Web technologies were then used to implement the design, working from a set of functional and non-functional requirements. This resulted in an interactive prototype being presented and discussed in a focus group with domain experts, informing some changes that were later made to the game. A usability questionnaire revealed that the experts rated the usability of the game fairly high. As such, this master's thesis presents a proof-of-concept game combining existing research and literature in a new way to create a unique contribution. The game is freely available online and set up for further testing.

In addition to the game itself, the preliminary study presenting relevant theory and an overview of existing games is another contribution of this master's thesis that other researchers looking to create a similar game can build upon. Furthermore, material created for the IRB application for human subject research in the U.S. is attached in the Appendix A-E and can serve as guidance to future students going abroad dealing with the same application process.

The focus on usability and technical stability, as suggested by Skaraas' (2018) future work section, resulted in the game prototype receiving a rather high usability score, as presented in section 5.2., and fulfilling most of the requirements in a satisfactory way, as discussed in section 5.5. In this sense, the project vision was a success.

6.2 Contribution to RQ1

RQ1: How can digital games facilitate empathy practice in children using storytelling?

This master's thesis presents a proof-of-concept game, Pathos, that seeks to help children practice empathy through the use of storytelling to facilitate perspective-taking, active engagement and collaboration.

The author originally set out to answer RQ1 by designing and implementing a proof-of-concept game based on previous research, and testing this game with the target audience to draw conclusions about how different mechanisms and design features of the game were perceived by the players, to then be able to suggest a set of guidelines for future similar projects. However, as the proof-of-concept game designed and developed in this thesis was not tested with the target audience, there is no current data pointing to whether or not the way the game was designed, in terms of graphics, user interface, content, tasks and game flow, is indeed contributing to children's practice of empathy. This is an obvious limitation to the research presented in this thesis.

However, the design and implementation of the game was carried out successfully, and resulted in a proof-of-concept game that is ready to be tested with the target audience. The current contribution to research is therefore this game, intentionally designed with promising concepts in the realm of digital games and SEL, namely using storytelling to incorporate perspective-taking, active engagement and collaboration, as thoroughly described in section 3.3. Based on previous research of similar games as well as feedback from the focus group, the game concept seems promising and worthy of further exploration.

6.3 Contribution to RQ2

RQ2: In which contexts could such a game be useful?

As discussed in section 2.9, using games are shown to be more motivational and effective in terms of learning than traditional classroom lectures, showing the potential for Pathos to be an attractive supplement to existing SEL programs in schools for practicing empathy specifically, preferably in classes such as social sciences where such topics are brought up. With all of the different characters and stories the game sets up, using Pathos in a classroom setting could help quickly generate different scenarios to be discussed in smaller groups or a plenary session. The fact that the game is played in fairly short rounds is also likely to make it easier for teachers to find time for it in their busy schedule to implement SEL in the classroom.

Furthermore, Pathos can be a useful tool in starting important conversations between children and their parents or additional family. As discussed in section 3.4, there is currently a lack of support for continued learning of social and emotional skills outside of the classroom. This is another area in which the game can be of use, taking on a role as the common framework for which important discussions are being facilitated, both in school and at home. As such, a more continuous learning may take place and the game may be a first step in bridging the home-school collaboration gap.

These possible applications of Pathos discussed in this thesis are based on literature, which may very well be a correct interpretation of the contexts in which the game would be useful. However, to better inform this research question in the future, empirical data should be collected by observing and talking to people who regularly work with children on social and emotional skills, to gain a better understanding in the ways that such an intervention could be useful and applied in a real-world context.

6.4 Future work

For future work, the game presented in this thesis should be tested with the target audience. The author suggests this is done by having children play the game in groups while their stories are being audio recorded and in-game choices saved, as already ensured by the way the game is set up. As opposed to the original plan with the experiments, as presented in section 4.3.2, the initial goal should not be to measure whether or not the participant's empathy increases from playing the game, but rather use the game data to uncover how the target audience interprets and uses the game in practice. It would be interesting to use thematic analysis, as presented in section 4.5.2, to analyze audio recordings of players to depict what kind of stories are being told, how the target audience relate to the game characters and how the different mechanics are used in practice - do they show signs of perspective-taking, do they collaborate in the intended way and are they being curious and creative while playing the game? Using thematic analysis to analyze the game would be a new approach that the author did not find any of the existing games to have done before.

The author also suggests arranging a focus group with the players after having played the game, to openly discuss their thoughts on the game concept. This would make it possible to directly ask the target audience about their experiences with the game, how they felt about the design and whether or not the situations presented felt realistic and relatable to them. This would also be a good opportunity to discuss what goals they have for themselves, to inform what type of situations the game should be presenting and facilitating discussion around. As previously discussed, arranging interviews and/or focus groups with potential users and stakeholders of the game who in their professional or personal lives work with children on social and emotional skills would be an important step to make sure the game meets the desires and needs of its users.

Professor Jaccheri and her colleagues have expressed interest in taking the game further and have hired another student to develop a mobile version of Pathos, which is currently in the works. Furthermore, other researchers who have taken an interest in this project will continue to build on the research from this master's thesis, helping Pathos reach its full potential.

References

Albright, M. I., & Weissberg, R. P. (2010). School–family partnerships to promote social and emotional learning. In S. L. Christensen & A. L. Reschley (Eds.), *The handbook of school-family partnerships for promoting student competence* (pp. 246–265). New York, NY: Routledge/Taylor & Francis Group.

Allemand, M., Steiger, A. E., & Fend, H. A. (2014). Empathy Development in Adolescence Predicts Social Competencies in Adulthood. *Journal of Personality, 83*(2), 229–241. https://doi.org/10.1111/jopy.12098

Bachen, C. M., Hernández-Ramos, P., Raphael, C., & Waldron, A. (2016). How do presence, flow, and character identification affect players' empathy and interest in learning from a serious computer game? *Computers in Human Behavior*, *64*, 77–87. https://doi.org/10.1016/j.chb.2016.06.043

Bal, P. M., & Veltkamp, M. (2013). How Does Fiction Reading Influence Empathy? An Experimental Investigation on the Role of Emotional Transportation. *PLoS ONE*, *8*(1). https://doi.org/10.1371/journal.pone.0055341

Bernard, M. E. (2006). It's Time We Teach Social-Emotional Competence as Well as We Teach Academic Competence. *Reading & Writing Quarterly*, *22*(2), 103–119. https://doi.org/10.1080/10573560500242184

Bird, C. (2016, November 25). How Fast is Fast Enough? Page Load Time & Your Bottom Line. Retrieved July 16, 2019, from https://www.semrush.com/blog/how-fast-is-fast-enough-page-load-time-and-your-bottom-line/

Bloom, P. (2016). *Against Empathy: The Case for Rational Compassion*. New York, USA: HarperCollins.

Boyatzis, R. E. (1998). *Transforming Qualitative Information: Thematic Analysis and Code Development*. Thousand Oaks, CA: SAGE Publications.

Bratitsis, T. (2016). A Digital Storytelling Approach for Fostering Empathy Towards Autistic Children. *Proceedings of the 7th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion - DSAI 2016*, . https://doi.org/10.1145/3019943.3019987

Bratitsis, T., & Ziannas, P. (2015). From Early Childhood to Special Education: Interactive Digital Storytelling as a Coaching Approach for Fostering Social Empathy. *Procedia Computer Science*, *67*, 231–240. https://doi.org/10.1016/j.procs.2015.09.267

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bridgeland, J., Bruce, M., & Hariharan. (2013). *The Missing Piece: A National Teacher Survey on How Social and Emotional Learning Can Empower Children and Transform Schools*. Retrieved from https://casel.org/wp-content/uploads/2016/01/the-missing-piece.pdf

Brooke, J. (1996). SUS - A quick and dirty usability scale. In P. W. Jordan, B. Thomas, I. McLelland, & B. A. Weerdmeester (Eds.), *Usability Evaluation in Industry* (pp. 189-194). London: Taylor and Francis.

Buchanan, R., Gueldner, B. A., Tran, O. K., & Merrell, K. W. (2009). Social and Emotional Learning in Classrooms: A Survey of Teachers' Knowledge, Perceptions, and Practices. *Journal of Applied School Psychology, 25*(2), 187–203. https://doi.org/10.1080/15377900802487078

Carey, A. (1994). The group effect in focus groups: Planning, implementing and interpreting focus group research. In J. M. Morse (Eds.), *Critical Issues in Qualitative Research Methods* (pp. 225-241). Thousand Oaks, CA: SAGE Publications.

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and Validity Assessment*. Beverly Hills, CA: SAGE Publications.

CASEL. (2017). Core SEL Competencies [Illustration]. Retrieved from https://casel.org/core-competencies/

Collaborative for Academic, Social, and Emotional Learning (CASEL). (2013). *CASEL Guide: Effective social and emotional learning programs*. Retrieved from http://www.casel.org/preschool-and-elementary-edition-casel-guide/

Cotton, K. (n.d.). *Developing Empathy in Children and Youth*. Retrieved from
https://www.antelopespringscounseling.com/documents/articles/EmpathyChildrenYouth.
pdf

Cramer, D. (2003). Facilitativeness, Conflict, Demand for Approval, Self-Esteem, and
Satisfaction With Romantic Relationships. *The Journal of Psychology*, *137*(1), 85–98.
https://doi.org/10.1080/00223980309600601

Crook, C. (2000). Motivation and the ecology of collaborative learning. In R. Joiner, D. Miell, K.
Littleton, & D. Faulkner (Eds.), *Rethinking collaborative learning* (p. 2000). London:
Free Association Press.

De Wied, M., Branje, S. J., & Meeus, W. H. (2006). Empathy and conflict resolution in
friendship relations among adolescents. *Aggressive Behavior*, *33*(1), 48–55.
https://doi.org/10.1002/ab.20166

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The
Impact of Enhancing Students' Social and Emotional Learning: A Meta-Analysis of
School-Based Universal Interventions. *Child Development, 82*(1), 405–432.
https://doi.org/10.1111/j.1467-8624.2010.01564.x

Eisenberg, N., & Miller, P. A. (1987). The relation of empathy to prosocial and related
behaviors.. *Psychological Bulletin*, *101*(1), 91–119.
https://doi.org/10.1037/0033-2909.101.1.91

Elias, M. J., Zins, J. E., Weissberg, R. P., Frey, K. S., Greenberg, M. T., Haynes, N. M., …
Shriver, T. P. (1997). *Promoting Social and Emotional Learning: Guidelines for
Educators*. Alexandria, VA: Association for Supervision and Curriculum Development.

Empathy | Origin and meaning of empathy by Online Etymology Dictionary. (n.d.). Retrieved
July 16, 2019, from https://www.etymonline.com/word/empathy

Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., &
Beechum, N. O. (2012). *Teaching adolescents to become learners - the role of
noncognitive factors in shaping school performance: A critical literature review*.
Chicago, IL: The University of Chicago Consortium on Chicago School Research.

Freud, S. (1958). *Civilization and its discontents*. New York, USA: Doubleday Anchor Books.

Garbacz, S. A., Swanger-Gagné, M. S., & Sheridan, S. M. (2015). The role of school-family partnership programs for promoting student SEL. In J. A. Durlak, C. E. Domitrovich, R. P. Weissberg, & T. P. Gullotta (Eds.), *Handbook of social and emotional learning: Research and practice* (pp. 244-259). New York, NY: The Guilford Press.

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics, 66*(1), 64–74. https://doi.org/10.1119/1.18809

Hoffman, M. L. (2000). *Empathy and Moral Development: Implications for Caring and Justice*. Cambridge, England: Cambridge University Press.

Humphrey, N., Barlow, A., Wigelsworth, M., Lendrum, A., Pert, K., Joyce, C., … Humphrey, N. (2015). *Promoting Alternative Thinking Strategies (PATHS): Evaluation report and Executive summary*. Retrieved from https://files.eric.ed.gov/fulltext/ED581278.pdf

International Children's Day: What do kids wish for? (2016, June 1). [YouTube]. Retrieved January 30, 2019, from https://www.youtube.com/watch?v=1oJ5iLvbQIc

Issroff, K., & del Soldato, T. (1996). *Incorporating motivation into computer-supported collaborative learning*. Lisbon.

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research, 79*(1), 491–525.

Jin, F., Cico, O., & Jaccheri, L. (2018, November 14). International Partnerships for Excellent Education and Research in Information Technology (IPIT). Retrieved December 14, 2018, from https://ipit.network/

Johnson, D., Johnson, R., and K. Smith. (1998). *Active Learning: Cooperation in the College Classroom* (2nd ed.). Edina, MN: Interaction Book Company.

Jones, S. M., Brown, J. L., & Aber, J. L. (2011). Two-Year Impacts of a Universal School-Based Social-Emotional and Literacy Intervention: An Experiment in Translational Developmental Research. *Child Development, 82*(2), 533–554. https://doi.org/10.1111/j.1467-8624.2010.01560.x

Jones, S., Brush, K., Bailey, R., Brion-Meisels, G., McIntyre, J., Kahn, J., … Stickle, L. (2017). *Navigating Social and Emotional Learning from the Inside Out.* Retrieved from https://www.wallacefoundation.org/knowledge-center/pages/navigating-social-and-emotional-learning-from-the-inside-out.aspx

Knafo, A., Zahn-Waxler, C., Van Hulle, C., Robinson, J. L., & Rhee, S. H. (2008). The developmental origins of a disposition toward empathy: Genetic and environmental contributions.. *Emotion*, *8*(6), 737–752. https://doi.org/10.1037/a0014179

Kralicek, D., Shelar, S., Von Rabenau, L., & Blikstein, P. (2018). Inside out. *Proceedings of the 17th ACM Conference on Interaction Design and Children - IDC '18*, . https://doi.org/10.1145/3202185.3213525

Lyckvi, S., & Torgersson, O. (2018). Privacy and design ethics vs designing for curiosity, communication and children. *Proceedings of the 20th International Conference on Human-Computer Interaction with Mobile Devices and Services - MobileHCI '18*, . https://doi.org/10.1145/3229434.3229480

Manney, P. J. (2008). Empathy in the Time of Technology: How Storytelling is the Key to Empathy. *Journal of Evolution and Technology*, *19*(1), 51–61. Retrieved from https://jetpress.org/v19/manney.htm

Marsella, S. C., Johnson, W. L., & LaBore, C. (2000). Interactive pedagogical drama. *Proceedings of the Fourth International Conference on Autonomous Agents - AGENTS '00*, 301–308. https://doi.org/10.1145/336595.337507

Martin, G. B., & Clark, R. D. (1982). Distress crying in neonates: Species and peer specificity.. *Developmental Psychology*, *18*(1), 3–9. https://doi.org/10.1037/0012-1649.18.1.3

McDonald, N. M., & Messinger, D. S. (2011). *The Development of Empathy: How, When, and Why*. Retrieved from https://www.researchgate.net/publication/267426505_The_Development_of_Empathy_How_When_and_Why

Muller, D. A., Van Kessel, C. R., & Janssen, S. (2017). Through Pink and Blue Glasses. *Extended Abstracts Publication of the Annual Symposium on Computer-Human*

Interaction in Play - CHI PLAY '17 Extended Abstracts, .

https://doi.org/10.1145/3130859.3130862

Muravevskaia, E. (2017). Empathy Development in Young Children Using Interactive VR

Games. *Extended Abstracts Publication of the Annual Symposium on Computer-Human*

Interaction in Play - CHI PLAY '17 Extended Abstracts, .

https://doi.org/10.1145/3130859.3133229

Muravevskaia, E., Tavassoli, F., & Gardner-McCune, C. (2016). Developing children's cultural

awareness and empathy through games and fairy tales. *Proceedings of the The 15th*

International Conference on Interaction Design and Children - IDC '16, .

https://doi.org/10.1145/2930674.2935998

Neuenhaus, M., & Aly, M. (2017). Empathy Up. *Proceedings of the 2017 CHI Conference*

Extended Abstracts on Human Factors in Computing Systems - CHI EA '17, .

https://doi.org/10.1145/3027063.3049276

Oates, B. J. (2006). *Researching information systems and computing*. New York, USA: SAGE.

Oberle, E., Domitrovich, C. E., Meyers, D. C., & Weissberg, R. P. (2016). Establishing systemic

social and emotional learning approaches in schools: a framework for schoolwide

implementation. *Cambridge Journal of Education, 46*(3), 277–297.

https://doi.org/10.1080/0305764X.2015.1125450

OECD. (n.d.). *Social and Emotional Skills: Well-being, connectedness and success.* Retrieved

from

http://www.oecd.org/education/school/UPDATED%20Social%20and%20Emotional%20

Skills%20-%20Well-being,%20connectedness%20and%20success.pdf%20(website).pdf

Oregon State University. (2017, May 17). What is the Institutional Review Board (IRB)?

Retrieved June 21, 2019, from

https://research.oregonstate.edu/irb/frequently-asked-questions/what-institutional-review-

board-irb

Papastergiou, M. (2009). Digital Game-Based Learning in high school Computer Science

education: Impact on educational effectiveness and student motivation. *Computers &*

Education, 52(1), 1–12. https://doi.org/10.1016/j.compedu.2008.06.004

Piaget, J. (1965). *The moral judgment of the child*. New York, USA: Harcourt Brace.

Powell, R. A., & Single, H. M. (1996). Focus Groups. *International Journal for Quality in Health Care, 8*(5), 499–504. https://doi.org/10.1093/intqhc/8.5.499

Prendinger, H., & Ishizuka, M. (2005). The empathic companion: A character-based interface that addresses users' affective states. *Applied Artificial Intelligence, 19*(3–4), 267–285. https://doi.org/10.1080/08839510590910174

Prince, M. (2004). Does Active Learning Work? A Review of the Research. *Journal of Engineering Education, 93*(3), 223–231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x

Princeton Survey Research Associates International. (2015). *State of parenting poll*. New York, NY: NBC News Education Nation.

Raminhos, C., Cláudio, A. P., Carmo, M. B., Carvalhosa, S., De Jesus Candeias, M., & Gaspar, A. (2015). A serious game-based solution to prevent bullying. *Proceedings of the 13th International Conference on Advances in Mobile Computing and Multimedia - MoMM 2015*, . https://doi.org/10.1145/2837126.2837135

Redish, E. F., Saul, J. M., & Steinberg, R. N. (1997). On the effectiveness of active-engagement microcomputer-based laboratories. *American Journal of Physics, 65*(1), 45–54. https://doi.org/10.1119/1.18498

Rosas, R., Nussbaum, M., Cumsille, P., Marianov, V., Correa, M., Flores, P., … Salinas, M. (2003). Beyond Nintendo: design and assessment of educational video games for first and second grade students. *Computers & Education, 40*(1), 71–94. https://doi.org/10.1016/S0360-1315(02)00099-4

Sagi, A., & Hoffman, M. L. (1976). Empathic distress in the newborn.. *Developmental Psychology*, *12*(2), 175–176. https://doi.org/10.1037/0012-1649.12.2.175

Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign, 4*(1), 5–18. https://doi.org/10.1080/15710880701875068

Simner, M. L. (1971). Newborn's response to the cry of another infant.. *Developmental Psychology*, *5*(1), 136–150. https://doi.org/10.1037/h0031066

Skaraas, S. B. (2018). *Tappetina's Empathy - A Study of Serious Games Facilitating Empathy with Storytelling*. Retrieved from https://brage.bibsys.no/xmlui/handle/11250/2567689

Slovák, P., & Fitzpatrick, G. (2015). Teaching and Developing Social and Emotional Skills with Technology. *ACM Transactions on Computer-Human Interaction*, *22*(4), 1–34. https://doi.org/10.1145/2744195

Slovák, P., Frauenberger, C., Gilad-Bachrach, R., Doces, M., Smith, B., Kamb, R., … Fitzpatrick, G. (2016). Scaffolding the scaffolding: Supporting children's social-emotional learning at home. *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing - CSCW '16*. https://doi.org/10.1145/2818048.2820007

Smiley, J. (2006). *Thirteen Ways of Looking at the Novel*. London, England: Faber & Faber.

Social Awareness (Social Emotional Learning) - Landmark Outreach. (2019, June 11). Retrieved May 22, 2019, from https://www.landmarkoutreach.org/strategies/social-awareness-sel/

Sugishita, J. L. (2019). Social-Emotional Learning (SEL) in a Field Course: Preservice Teachers Practice SEL-Supportive Instructional Strategies. *Journal of Inquiry and Action in Education, 10*(1), 2.

SUS scoring sheet.ods. (n.d.). Retrieved April 10, 2019, from https://drive.google.com/file/d/0B84vGUMfv2_ONUJ0RmdiWF9UcGs/view

System Usability Scale (SUS). (n.d.). Retrieved May 21, 2019, from https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html

Tüzün, H., Yılmaz-Soylu, M., Karakuş, T., İnal, Y., & Kızılkaya, G. (2009). The effects of computer games on primary school students' achievement and motivation in geography learning. *Computers & Education, 52*(1), 68–77. https://doi.org/10.1016/j.compedu.2008.06.008

Vass, E. (2002). Friendship and collaborative creative writing in the primary classroom. *Journal of Computer Assisted Learning, 18*(1), 102–110. https://doi.org/10.1046/j.0266-4909.2001.00216.x

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-Analysis of Theory-of-Mind

    Development: The Truth about False Belief. *Child Development*, *72*(3), 655–684.

    https://doi.org/10.1111/1467-8624.00304

What do kids wish for? (2010, December 5). [YouTube]. Retrieved January 30, 2019, from

    https://www.youtube.com/watch?v=DrqKXKa-VFM

Yoder, N. (2014). *Teaching the Whole Child: Instructional Practices That Support*

    Social-Emotional Learning in Three Teacher Evaluation Frameworks. Retrieved from

    https://casel.org/wp-content/uploads/2016/06/TeachingtheWholeChild.pdf

Zahn-Waxler, C., Robinson, J. L., & Emde, R. N. (1992). The development of empathy in twins..

    Developmental Psychology, *28*(6), 1038–1047.

    https://doi.org/10.1037/0012-1649.28.6.1038

Zero to Three. (2016). *Tuning In: Parents of Young Children Speak Up About What They Think,*

    Know and Need. Retrieved from

    https://www.zerotothree.org/resources/1425-national-parent-survey-report

Zhao, L., Wang, J. J., & Apperly, I. A. (2018). The cognitive demands of remembering a

    speaker's perspective and managing common ground size modulate 8- and 10-year-olds'

    perspective-taking abilities. *Journal of Experimental Child Psychology*, *174*, 130–149.

    https://doi.org/10.1016/j.jecp.2018.05.013

Appendix

Appendix A: Recruitment flyer for parents

Research study

Do you have a child between the ages of 8-14?

Are you teaching them about empathy?

We are interested to speak with you and your child about how a digital storytelling game made to foster empathy in children can be improved and used in a real-world setting.

- Discuss experiences with empathy learning

- Give feedback on an empathy game for children

- 1 hour session

- $20 for participation

If you want to participate, or have any questions about the study, please contact:

SCHOOL OF INFORMATION
UNIVERSITY OF MICHIGAN

Dr. Gabriela Marcu
gmarcu@umich.edu
(734)615-7507

Appendix B: Recruitment flyer for experts

Research study

Are you working with children on building their social and emotional skills?

Do you make use of games, or are you curious about how technology could be incorporated in this setting?

We are interested in how a digital storytelling game made to foster empathy in children can be improved and used in a real-world setting.

- Discuss experiences with empathy learning

- Give feedback on an empathy game for children

- 1 hour session

- $20 for participation

If you want to participate, or have any questions about the study, please contact:

SCHOOL OF INFORMATION
UNIVERSITY OF MICHIGAN

Dr. Gabriela Marcu
gmarcu@umich.edu
(734)615-7507

Appendix C: Email recruitment script

Email Recruitment Script

About the project: *A digital game using collaborative storytelling to foster empathy in children* is a research project led by Dr. Gabriela Marcu at the University of Michigan.

With this research, we hope to improve a digital storytelling game made to foster empathy in children and learn how the game can be incorporated and tested in real-life settings in the future. In this study, we are interested in speaking with parents with children between the ages of 8-14, educators, psychologists and others who teach children about empathy.

Taking part in this study is voluntary. If you choose to be part of the research study, we will ask you to play the game, answer a short questionnaire about it, and take part in a conversation about the game and your experiences with empathy learning in regard to children. The session is estimated to take about 1 hour at a time and location of your choice. You will be compensated $20 for your time and expertise.

If you would like to be part of our study, or have any questions, you may contact **Gabriela Marcu** at **gmarcu@umich.edu** or (734)615-7507.

Appendix D: IRB consent form

Consent to be Part of a Research Study

Title of the Project: Digital storytelling game to foster empathy in children
Principal Investigator: Gabriela Marcu, PhD, University of Michigan

Invitation to be Part of a Research Study

You are invited to participate in a research study. In order to participate, you must be over the age of 18, and your child(ren) must be between the ages of 8-14. Taking part in this research project is voluntary.

What is the study about and why are we doing it?

The purpose of the study is to understand how a digital storytelling game made to foster empathy in children can be improved and used in a real-world setting. If you choose to participate, you and your child(ren) will be asked to play the game, answer a short questionnaire about the game and take part in a conversation to give feedback on the game and answer questions regarding your experiences with empathy learning. This will take approximately one hour in total.

What will happen if you take part in this study?

If you agree to take part in this study, there will be three optional parts to your participation, which are all voluntary:

1. We will ask you and your child(ren) to play a game that we provide, made to foster empathy in children. This will take place at a location of your choice, such as your home, an office or a room at the University of Michigan. This is estimated to take about 10 minutes during one session.
2. We will ask you and your child(ren) to fill out a short questionnaire to evaluate the usability of the game. This will take approximately 5 minutes during one session.
3. Afterwards, we will ask you and your child(ren) to participate in a conversation to get your feedback on the game and ask questions regarding your experiences with empathy learning. This is estimated to take about 45 minutes and is expected to be done in one session. However, if you have more information to share with us or if you prefer to schedule multiple conversations, we can meet you more than once.

We will audio record the gameplay and interview, while protecting you and your child(ren)'s anonymity. Recordings will be transcribed, removing all names and other identifying

information, and then the audio file will be deleted. The choices you make in the game will also be recorded, but we will remove anything that may identify you or your child(ren).

How could you benefit from this study?

Although you will not directly benefit from being in this study, others might benefit because we hope to get insights on how the game can be used in a real-world setting to help foster empathy in children.

What risks might result from being in this study?

We don't believe there are any more than minimal risks from participating in this research. You may experience stress with finding time for this participation, but we will minimize this by meeting you at a time and location of your choice.

How will we protect your information?

We plan to publish the results of this study in a master thesis and possibly a scientific paper. To protect your privacy, we will not include any information that could directly identify you.

We will protect the confidentiality of your research records by removing all names and other identifying information after the audio recordings are transcribed. Then, the audio files will be deleted. All data will be stored on a secure computer. Your name and any other information that can directly identify you will be stored separately from the data collected as part of the project.

It is possible that other people may need to see the information we collect about you. These people work for the University of Michigan, and government offices that are responsible for making sure the research is done safely and properly.

What will happen to the information we collect about you after the study is over?

We will keep your research data to use for future research, but we will remove anything that may identify you. Your name and other information that can directly identify you will be deleted from the research data collected as part of the project.

We may share your research data with other investigators without asking for your consent again, but it will not contain information that could directly identify you.

How will we compensate you for being part of the study?

You will receive $20 for your participation in the study. If you choose to withdraw from the study, you still get to keep the money.

Your Participation in this Study is Voluntary

It is totally up to you to decide to be in this research study. Participating in this study is voluntary. Even if you decide to be part of the study now, you may change your mind and stop at any time. You do not have to answer any questions you do not want to answer. You will not be able to withdraw data after the identifiers are removed.

Contact Information for the Study Team and Questions about the Research

If you have questions about this research, you may contact **Gabriela Marcu, gmarcu@umich.edu, (734)615-7507.**

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the following:

University of Michigan
Health Sciences and Behavioral Sciences Institutional Review Board
2800 Plymouth Road
Building 520, Room 1169
Ann Arbor, MI 48109-2800
Phone: (734) 936-0933 or toll free, (866) 936-0933
Email: irbhsbs@umich.edu

Your Consent

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. We will give you a copy of this document for your records. We will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I understand what the study is about and my questions so far have been answered. I agree to take part in this study.

_____

Printed Subject Name

_____

Signature   Date

Consent to be Audio Recorded

I agree to be audio recorded.

YES_____   **NO**_____

_____

Signature   Date

Consent for Child

By signing this document, you are agreeing to your child's participation in this study. Make sure you understand what the study is about before you sign. We will give you a copy of this document for your records. We will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I understand what the study is about and my questions so far have been answered. I agree for my child to take part in this study.

_____
Printed Subject Name

_____
Printed Parent/Legally Authorized Representative Name and Relationship to Subject

_____
Signature   Date

Appendix E: IRB assent form

Assent to be Part of a Research Study

Title of the Project: Digital storytelling game to foster empathy in children
Principal Investigator: Gabriela Marcu, PhD, University of Michigan

Invitation to be Part of a Research Study
You are invited to help us with a project. You do not have to be in this project, it is your choice.

What is the study about and why are we doing it?
We are interested in how children can learn about how other people feel by playing a game.

What will happen if you take part in this study?
If you agree to help us with this project, we will have you play a game on an iPad with your siblings or parents. Then, we will ask you some questions about what you thought of the game.

How could you benefit from this study?
Being in this project will not help you in any way, but we hope that what we learn during this project will help others in the future.

What risks might result from being in this study?
Being in this project will not hurt you in any way, but you are free to leave at any time.

How will we protect your information?
We will share what we learn during this project. But we will not use your name or say anything about you.

Your Participation in this Study is Voluntary
It is totally up to you to decide to be in this project. Even if you decide to be part of the project now, you may change your mind and stop at any time.

Your Consent
Do you have any questions about this project?

Would you like to help us with this project?

If you are okay with it, we will audio record this session, but will delete it as soon as we have written down your answers. Is this okay with you?

Appendix F: Conference paper for IDC'19

A digital game using collaborative storytelling to foster empathy in children

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ABSTRACT

Empathy is shown to be an important skill in daily functioning and is a part of many schools' curriculum. Serious games can be effective in teaching theoretical skills and have great potential to also enhance interpersonal skills. This paper presents a digital game that aims to foster empathy in children through the use of collaborative storytelling, where the players put themselves in the shoes of a character. The evaluation of the game will include a focus group session with experts in human-computer-interaction and educative technologies, and a quasi-experiment with the target audience. A group of children aged 8-14 will be asked to play the game for five weeks, and through empathy questionnaires, the authors are interested to see if playing the game will foster empathy in the participants.

KEYWORDS

Storytelling, empathy, children, serious games, collaboration

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INTRODUCTION

Empathy, as the ability to feel for others and take their perspective, is an important social-emotional skill in daily functioning. Simultaneously, the digital game industry is fostering an arena of enjoyment and connection for children and adults alike, and multidisciplinary professions are now working together to create games that provide more than just a source of entertainment. As a result, more games are made with the purpose of teaching a lesson or a skill, so-called serious games [1]. Storytelling has been a way for humans to pass on knowledge and learn about the experience of other people, thus also exercising the ability to empathize with them, for as long as language has been around. Even though storytelling has been used to foster empathy in this way for a long time, there has been little research done on how storytelling can be used as a means of fostering empathy with digital games. The authors present research questions related to the development of a serious game that uses storytelling to foster empathy in children, with the aim of promoting pro-social behaviour and all the benefits it is shown to have on society.

- **RQ1:** How can digital games be used to foster empathy in children?
- **RQ2:** What elements are needed in a serious game to sustain the interest of the players?
- **RQ3:** What methods are available to measure the impact of a digital game on players' empathy?
- **RQ4:** What elements of a serious game using storytelling appear to be the most effective in increasing children's empathic abilities?

BACKGROUND

Emotional empathy is the ability to vicariously experience the emotional state of another person, whereas cognitive empathy is being able to imagine what others are going through and see it from their perspective [7]. Among the most widely used methods in learning of social and emotional skills (SEL) in schools are role play, positive reinforcement, dialoguing, play and games [8]. Although such SEL programs have been a part of school education for more than 20 years with tens of millions of pupils, there has not been much technology involved in the learning process [8]. In addition, one of the main challenges with the SEL programs in school is the lack of support for continued learning of these skills outside of school in their everyday environment, including the difficulty of involving parents in the learning process [8]. This is where technology has a great potential.

Slovák and Fitzpatrick [8] identified four central skills that most of the social and emotional learning programs have incorporated, building on each other in the presented order. These skills are
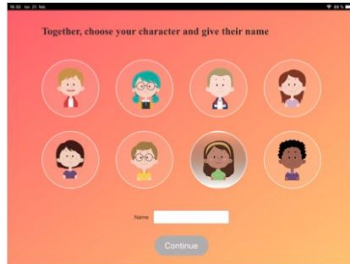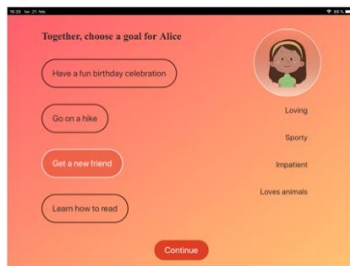
Figure 1: Choose a character for the game

Figure 2: Pick a goal for the character

(1) identifying and understanding emotions (own and of others), (2) managing one's emotions, (3) developing communication and relationship skills and (4) dealing with conflicts and problematic situations.

Furthermore, storytelling is a part of our everyday lives through conversations, music, movies and books to name a few, and Manney [6] argues that storytelling indeed has a large part in fostering empathy. She points out the growing complexities of human interaction with the emergence of technology, and her concern that the human species may bring about their own demise if their empathic abilities don't catch up to society's needs [6]. Some researchers have seen the potential of storytelling as a means of fostering empathy, and have developed digital games that combine these two. A study conducted by Bratitsis and Ziannas [2] looked at whether using interactive digital stories can foster empathy in young children, and the results indicated that this is indeed possible.

As opposed to most games, serious games are designed with the primary purpose of teaching the players something rather than entertaining them [1]. Hamari et al. [4] showed that engagement in the game is an important factor when it comes to players' learning, and is therefore something that should be prioritized when designing an educational game. One of the most popular concepts to describe player experience, that can also be used as a framework for designing educational games, is flow theory. The concept was first presented by Csikszentmihalyi in 1990, who defined flow as an intrinsically enjoyable state where one is completely absorbed [3]. Kiili, Lainema, De Freitas, and Arnab [5] presented an altered version of the flow framework based on associative, cognitive and situative learning theory, tailored to incorporate both engagement and educational effectiveness, to guide the game design process.

DESCRIPTION

Pathos is a digital game designed for three players between the ages of 8-14, where they collaborate on telling the story of a fictional character facing challenges on their journey to reaching a goal chosen by the players. The intention of the game is to foster empathy in the players by having them relate to the character. This is done by putting themselves in the characters' shoes and working through their goals and challenges with the traits they are given as a point of reference. As the game makes use of collaborative storytelling and decision making, these will be secondary learning outcomes of the game. During the game, it is crucial that the players pay close attention to each other's stories, as each part is building on the previous ones.

When playing the game, the group will play together on one screen that presents the tasks, choices and cues. However, what is actually bringing value to the game are the stories and discussions among the players, looking up from the screen. When the given task is completed, the continue button at the bottom of the page will take the players to the next task, as seen in Figure 3. The game consists of ten pages that are easily navigated through this way.
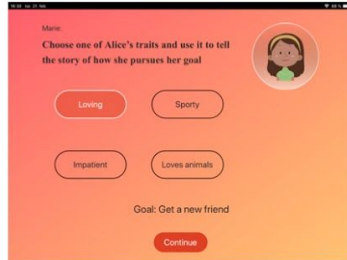
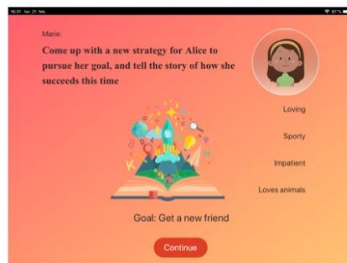**Figure 3: Use traits to pursue their goal**

Figure 4: Overcome obstacles on the way

The first four pages of the game are for all three players to collaborate on and pay equal attention to. This includes typing in the players' names, as well as choosing a character and giving them a name, as seen in Figure 1. Furthermore, the players are presented with a set of random character traits, and are asked to choose one of four presented goals for the character, as seen in Figure 2. Next, each individual player will be given two individual tasks after turn. These tasks include telling the story of how the character pursues their goal and overcome a challenge, describing what the character is feeling, and finishing with a lesson learned from the story. Some of the tasks will ask the players to base their stories and decisions on one or more of the character's traits, ensuring that the story is told with the character and their preconditions in mind.

Because the traits, goals and feelings presented are chosen at random from rather long lists, there are numerous different character combinations that can make the game feel interesting and new even after playing it multiple times. Adding the fact that the players have different experiences and thought processes themselves, the stories told in the game can be extremely varied and take many different directions.

EVALUATION

The game will be evaluated by means of a user experiment and supported by the assessment from questionnaires and a focus group with experts.

Focus group with domain experts in Trondheim

A focus group session will be carried out with nine experts in human-computer interaction and educative technologies at the Norwegian University of Science and Technology. The session will last about an hour and will consist of an introduction to the project and its research questions, as well as the intended target audience. The experts will be divided into groups of three, and each group will be given an iPad with a working prototype of the game. They will then be asked to play the game while thinking out loud and highlighting any questions or hardships they have with both the user interface and the tasks themselves. After having played a few rounds, the researcher will ask the experts to fill out a SUS scheme to measure the usability of the application. Lastly, a set of questions will be used to guide the following talk about the experts' experiences with the game. The researcher will take this feedback into consideration when moving forward.

Quasi-experiment with target group in Michigan

Later, the quasi-experiment will be carried out at the University of Michigan in order to answer RQ1 and RQ4 with empirical data. To evaluate the efficacy of the game in fostering empathy in the target audience, the intention is to recruit 90 students in the Ann Arbor area in Michigan, USA, around the age of 8-14 years to take part in the longitudinal quasi-experiment. Out of the 90 students, 30 will

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make up the control group, and the remaining 60 students will be split into two equal groups, playing two different versions of the game. Inside of these equally sized groups, sub-groups of three will go together to play the game. The control group will, however, not be playing the game and only need to be involved during the first and last week. All three groups of 20 students will take an empathy questionnaire using a Likert-scale before the first game session, the pre-test, and after the last session, the post-test. The test sessions will take place once a week and last for five consecutive weeks.

When conducting the quasi-experiment, one group will play the game at a time, giving the researcher the opportunity to carefully observe the players while they play. This will also reduce the amount of equipment needed to a single tablet. During this overt observation, notes will be taken to document the following about the participants:

- Does it appear as though they are immersed in the game?
- Does it appear as though they feel involved with the character and their goal?
- Does it appear as though they know how to play the game?

The researcher will be responsible for planning and conducting the test sessions of the game. When dealing with minors, it is especially important that the research subjects and their data are handled legally and ethically. Before conducting any experiments, an IRB approval will be obtained for the research.

CONCLUSIONS AND FUTURE WORK

In this paper we have presented a digital game that aims to foster empathy in children through the use of collaborative storytelling. We have also presented the methodology that we will follow to validate the efficacy of the game, which will include a focus group session with experts in human-computer-interaction and educative technologies, as well as a quasi-experiment with the target audience in Michigan. Following the focus group session, a prioritized list of enhancements will be made based on the feedback form the domain experts. The highest prioritized changes will be implemented before the quasi-experiment starts with the target audience. From having a group of children aged 8-14 play the game over a period of time, the authors are interested to see if playing the game will foster empathy in the participants.

Additional concerns that will be tackled as future work will be whether the player's in-game choices of goals, traits and feelings should be stored, as well as whether the stories players tell should be recorded, all to be used for further detailed analysis. This could bring about some interesting outcomes and new knowledge. It would also be interesting to look at whether the goals presented in the game could be formulated to bring attention to other meaningful topics, like sustainability, poverty and gender equality.

ACKNOWLEDGMENTS

REFERENCES

[1] Christine M. Bachen, Pedro Hernández-Ramos, Chad Raphael, and Amanda Waldron. 2016. How do presence, flow, and character identification affect players' empathy and interest in learning from a serious computer game? *Computers in Human Behavior* 64 (2016), 77 – 87. https://doi.org/10.1016/j.chb.2016.06.043

[2] Tharrenos Bratitsis and Petros Ziannas. 2015. From Early Childhood to Special Education: Interactive Digital Storytelling as a Coaching Approach for Fostering Social Empathy. *Procedia Computer Science* 67 (2015), 231 – 240. https://doi.org/10.1016/j.procs.2015.09.267 Proceedings of the 6th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion.

[3] Mihaly Csikszentmihalyi. 1990. *Flow: The psychology of optimal experience.* Harper Row.

[4] Juho Hamari, David J. Shernoff, Elizabeth Rowe, Brianno Coller, Jodi Asbell-Clarke, and Teon Edwards. 2016. Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. *Computers in Human Behavior* 54 (2016), 170 – 179. https://doi.org/10.1016/j.chb.2015.07.045

[5] Kristian Kiili, Timo Lainema, Sara de Freitas, and Sylvester Arnab. 2014. Flow framework for analyzing the quality of educational games. *Entertainment Computing* 5, 4 (2014), 367 – 377. https://doi.org/10.1016/j.entcom.2014.08.002

[6] P.J. Manney. 2008. Empathy in the Time of Technology: How Storytelling is the Key to Empathy. *Journal of Evolution and Technology* 19, 1 (09 2008), 51 – 61.

[7] Nicole McDonald and Daniel Messinger. 2011. The Development of Empathy: How, When, and Why. *Moral behavior and free will: A neurobiological and philosophical approach* (01 2011).

[8] Petr Slovák and Geraldine Fitzpatrick. 2015. Teaching and Developing Social and Emotional Skills with Technology. *ACM Trans. Comput.-Hum. Interact.* 22, 4, Article 19 (June 2015), 34 pages. https://doi.org/10.1145/2744195

Appendix G: Usability questionnaire

System Usability Scale

Instructions: For each of the following statements, mark <u>one</u> box that best describes your reactions to the application *today*.

	Strongly disagree				Strongly agree
1. I think that I would like to use this application frequently	1	2	3	4	5
2. I found the application unnecessarily complex	1	2	3	4	5
3. I thought the application was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this application	1	2	3	4	5
5. I found the various functions in this application to be well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this application	1	2	3	4	5
7. I would imagine that most people would learn to use this application very quickly	1	2	3	4	5
8. I found the application very cumbersome/awkward to use	1	2	3	4	5
9. I felt very confident using the application	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this application	1	2	3	4	5

If you have any further comments, please provide them here:

Appendix H: Focus group questions

Questions to be discussed in the focus group:

1. Have you played anything similar before or was this type of game totally new to you?
2. How did you feel when playing the game?
3. To what extent did the story naturally evolve (did you have to think for a long time)?
4. Did you, at any point in the game, feel stuck (didn't know what to do or how to move forward)? If so, when, where and why?
5. Did you find any of the tasks to be confusing/unnatural/pointless?
6. Is there anything you liked particularly well in the game?
7. What did you think about the content presented in terms of traits, goals and feelings? Did it give enough/the right information to perform the tasks?
8. What did you think about the distribution of tasks between the three players? Was it fair?
9. Do you have any experience with the intended target audience (8-14 years old), and if so, do you think the game is suited for them? Why (not)?
10. Any comments on the look and feel/design of the game?

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A digital game using collaborative storytelling to help children practice empathy

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