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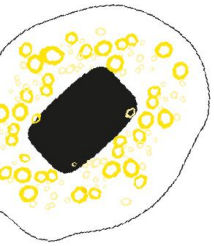

From Play to Growth: Exploring the Role of Procedural Rhetoric in Social and Emotional Development through Serious Games for Children with Cognitive Disabilities

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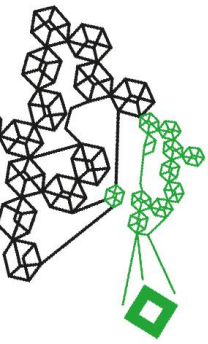

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10-03-2025

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Abstract

Objective. Serious games are widely used to support learning. They often simulate real-world concepts within their mechanics and rules to convey a compelling argument, a technique known as procedural rhetoric. However, little is known about how children with cognitive disabilities engage with these embedded messages and to what extent they can develop (social-emotional) skills through procedural rhetoric. This study investigated the role of procedural rhetoric in serious games designed for children with cognitive disabilities, and it also examined the influence of social factors in gameplay, such as the type of multiplayer games (e.g., competitive or collaborative), emotions, reflection, and guidance. It aimed to provide insights into whether children with special needs demonstrate an understanding of procedural rhetoric within games designed for social and emotional learning.

Methods. A qualitative approach combining participant observations and semi-structured interviews was used in this study. In total, 27 children with varying cognitive disabilities and a mean age of 10.3 years old were included in the observation sample, of which five children also participated in subsequent interviews. For the observations, the games of the company Tover were used as stimulus. Eight interviews were conducted with teachers who had experience with using the Tovertafel.

Results. Children with cognitive disabilities demonstrated varying levels of understanding procedural rhetoric in serious games. Especially older, more cognitively developed children were able to adhere to the rules or goals, could make certain connections to the real world, and learned skills from playing the game. Teacher guidance emerged as a crucial factor in this understanding. Regardless of whether they understood the procedural rhetoric or not, it was found that most children learned (social-emotional) skills through playing the games. Competitive games were found to be useful for learning such skills, and both hedonic and eudaimonic feelings seem to have a relationship with understanding procedural rhetoric.

Conclusion. This study highlights that while children with cognitive disabilities can learn through procedural rhetoric, for which guidance seems to be a crucial factor, they may also create their own gameplay, leading to alternative learning outcomes. Social factors further seem to play an important role in understanding procedural rhetoric. These findings call for a shift in focus toward *procedural comprehension,* which captures ways in which players interpret the mechanics. Future research should also explore how social aspects influence both procedural rhetoric and its interpretation.

Keywords: *serious games, serious play, procedural rhetoric, procedural comprehension, multiplayer game types, hedonic and eudaimonic emotions, reflection*

Contents

1. Introduction

It is increasingly recognized that games can serve as great tools for learning, rather than mere entertainment. Games designed with learning in mind are often called serious games, defined as digital games designed not only for entertainment but also to achieve at least one additional goal (or characterizing goal), such as education or health improvement (Dörner et al., 2016). One of the most prominent goals of serious games is to reflect aspects of the real world, for example to enhance learning, encourage problem-solving, or promote behavioural change. Further, serious games are closely related to serious play, which is defined as a process of immersion where players are fully engaged and absorbed in the game, likely leading to meaningful learning (de Castell & Jenson, 2003). Both serious games and serious play can be useful in education and for learning. The effectiveness of learning can partially be assigned to "the actual involvement of a participant playing the game, which in turn, creates increased cognitive links with real-life situations allowing the individual to make relevant associations, to use mnemonic strategies with the facilitation of multi-dimensional educational aids" (Ypsilanti et al., 2014, p. 515). In other words, serious games are effective because they blend interactive experiences with sensory-rich elements, supporting both understanding and retention.

Tover is a company that creates such serious games for individuals with cognitive challenges in elderly care, nursing homes, and special education. Specifically for children in special education, they "offer games that amaze and help children in inclusive education continue their development, as for children with additional support needs, growth is paramount" (Tover, n.d.). Tomé et al. (2014) support this by mentioning that games can facilitate growth in motor coordination and spatial orientation, help replicate certain situations in identical settings, be customized to meet specific requirements of each player, and can be played both individually and collaboratively. The special education target group of Tover includes a great range of developmental disabilities, including neurodiversity (e.g. Autism Spectrum Disorder, ADHD), intellectual and learning disabilities (e.g. dyslexia, down syndrome), and physical disabilities (e.g. chronic or acute illnesses, physical handicaps/disabilities, or palliative care). Additionally, children with other special needs or adverse childhood experiences (e.g. socio-economic hardship, immigration status, discrimination, trauma, unstable home and family situation) also fall in the target group of these games. The games can be projected onto a table or on the floor, creating an interactive environment where children move, explore, and play together. The games are developed to get the children moving as well as to train important social-emotional skills by encouraging children to engage with each other and their surroundings. Thus, they create an environment where children can potentially learn from and with each other when playing the games.

Serious games often incorporate procedural rhetoric into their design, which relates to the idea that games pursue a certain viewpoint, message, or behaviour with the use of processes. Game designers

can shape the rules and principles of games to simulate aspects of the real world, trying to guide players toward specific learning goals or viewpoints (Bogost, 2008). In this way, they use the game's mechanics and rules to present a compelling argument by mimicking real-world elements to try to persuade players about how the world functions (Jacobs et al., 2020). Thus, rather than explicitly telling players what to learn, games embed these lessons into their interactive systems. Through gameplay, the mechanics and rules can subtly teach and reinforce specific messages or behaviours, allowing players to engage actively with the learning process. For example, children may be able to internalize lessons about, amongst other things, cooperation, problem-solving and cause-and-effect relationships.

Looking at the players' perspective of this, previous research suggests that players of games typically understand the rhetorical purpose of a game (Anderson et al., 2019). This indicates that using procedural rhetoric can indeed change attitudes and beliefs according to the compelling argument. Interestingly, Anderson et al. (2019) are one of the only ones who have studied whether players themselves consciously understand the procedural rhetoric. As de la Hera (2013) noted, cognitive frameworks help players to create a connection between the environment of the game and the realities of everyday life, which seems to be key for understanding procedural rhetoric. This connection, however, may look different for children with cognitive disabilities, who develop these frameworks in unique ways compared to other players with no cognitive challenges. To my knowledge, no research has explored how players engage with procedural rhetoric, let alone children with cognitive challenges. Given that the games of Tover are designed for children with cognitive disabilities, it is important to understand how these children engage with the procedural rhetoric present in the games. Do they recognize the purpose behind the game mechanics and how the games relate to real-life skills, or do they play the game simply for enjoyment, without paying attention to the learning objectives? Since one of the goals of the games used in this study is to help children develop real-world skills, often enhanced by procedural rhetoric, it is crucial to determine whether children are aware of such an underlying message and can connect the gameplay to their everyday experiences.

To investigate the role of procedural rhetoric within serious games for children with cognitive disabilities, this research seeks to answer the following research question: *Do children with special needs (specifically cognitive disabilities) demonstrate an understanding of procedural rhetoric within serious games designed for social and emotional learning?* This study aims to investigate whether the current view towards procedural rhetoric is inclusive enough by conducting a qualitative study, including observations of children with cognitive disabilities while playing the games of Tover, as well as semi-structured interviews with teachers.

2. Theoretical framework

To delve deeper into serious games for children with special needs and the role of procedural rhetoric, key topics will be addressed. First, serious games and the games of Tover will be elaborated upon, followed by an explanation of procedural rhetoric and how it relates to children, particularly those with special needs. Some social aspects of playing serious games, such as the types of multiplayer games, hedonic and eudaimonic feelings, and reflection, will be examined, focusing on the effects of these aspects on understanding procedural rhetoric. Lastly, the study's expectations will be outlined.

2.1 Serious games

There is not one definition of serious games that is used widespread, rather, the definition of it depends on the context the games are used in. Most definitions involve positing that serious games are games, potentially digital, that are played for more than only entertainment (Susi et al., 2007). Looking at specific definitions, Bergeron (2006, as cited in Hammady & Arnab, 2022) includes several aspects in his definition, such as it being interactive games that can have a significant hardware component, they have challenging goals, are engaging and enjoyable, have any form of scoring system and they provide the player with useful skills, knowledge or attitude that can be applied in real life. Zyda (2005) defines it as "a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives" (p. 26). Moreover, serious games encompass a broad aspect of education, including teaching, training and informing (Michael & Chen, 2006, as cited in Susi et al., 2007). In the context of this study, important features for the definition of serious games are that there is at least one more goal than only entertainment, the games are interactive, skills, knowledge or attitudes that can be useful in real-life situations are learned through playing the games, and specific rules are incorporated that govern how the game is played.

Serious games thus generally have the aim of teaching the player something. A literature review from Backlund and Hendrix (2013) reveals that most research performed on the effectiveness of serious games on learning show a positive relationship between the two (72.5%). Wouters et al. (2013), for example, found that serious games tend to be more effective in terms of learning than conventional instruction methods, although this effectiveness may depend on several factors such as whether players played in groups or not. One of the main suggested benefits of using serious games for learning is their ability to enhance motivation, a critical factor for effective learning. Looking from a Self-Determination Theory perspective, Ryan and Deci (2020) found that intrinsic motivation is linked to better outcomes in an educational context than extrinsic motivation is. Söbke et al. (2020) suggested that serious games can

contribute to increased intrinsic motivation, hence, making them valuable tools for learning. Nevertheless, while most research highlights the benefits of using serious games, not all research supports those claims. For example, Wouters et al. (2013) and Stege et al. (2011) found that serious games do not necessarily lead to higher motivation compared to traditional learning methods, such as textbooks. Similarly, Girard et al. (2012) conducted a meta-analysis and concluded that the impact of serious games on learning outcomes remains inconclusive due to varying research findings. However, studies rarely indicate negative effects compared to other methods, and advancements in game design may have further improved their impact over time.

2.1.1 Serious games as subset of serious play

In the context of this study, it is important to mention that serious games are a subset of serious play. Serious play refers to circumstances in which individuals purposefully engage in playful activities to accomplish goals that are often work-related (Statler et al., 2011). Rieber and Matzko (2001) define serious play as purposeful or goal-oriented, allowing individuals the flexibility to adjust their objectives as needed. They also mention that serious play emphasizes the inherently fulfilling and gratifying nature of play, valuing the experience itself as much as any outcome that may arise from it. Serious play is thus often defined by a high level of motivation combined with behaviour focused on achieving specific objectives (Rieber et al., 1998), which can be learning a particular skill, learning new information, solving a problem or analysing a situation (Hinthorne & Schneider, 2012). Serious play engages participants playfully while encouraging deep thinking, creativity, and collaboration. While it can take many forms, such as simulations or role-playing, serious play is generally more open-ended and less structured than serious games. While the focus within serious games is more on interaction with the game itself, the focus within serious play is more on collective exploration (Cheng & Chau, 2022).

Another difference between serious games and serious play is how procedural rhetoric is expressed. Procedural rhetoric, which will be elaborated upon in detail in section 2.2, refers to the use of processes (e.g. rules and mechanisms) to pursue a certain viewpoint, message or behaviour (Custer, 2017). Doucet and Srinivasan (2010) mention that procedural rhetoric goes beyond creating an interactive simulation, rather, this simulation is immersed in the rules and mechanics of a game. While the structured nature of serious games allows them to embed procedural rhetoric in the rules and mechanics, the open-ended nature of serious play can make it challenging, if not impossible, to embed procedural rhetoric into these rules and mechanics. In serious play, a possibility is for procedural rhetoric to be immersed in its design and the experiences created by social play, which may allow for the embedding of procedural rhetoric, though it is likely to be less less focused on a specific message compared to serious games.

The games examined in this study can be categorized as either serious games or serious play, while some straddle the line between these two categories. Section 2.1.2 provides a detailed categorization of these classifications, as well as an elaboration on the company Tover and the games they created. After that, section 2.2 explores how procedural rhetoric is implemented in serious games and serious play in detail, with a specific focus on the games of Tover.

2.1.2 Tovertafel for children with special needs

In this research, games developed by Tover will be used. Tover is a company that created the *Tovertafel*, which is a projector designed to facilitate serious games to promote purposeful play (see Figure 1). They have also developed serious games, which are highly interactive and can be projected on different surfaces, such as a table, the floor, a wheelchair tray or a floormat. The games react to hand movements (see Figure 2), movements of other body parts, paddles, balls, or other assistive devices.

Figure 1

Tovertafel

Figure 2

Children playing with the Tovertafel

One of the target groups of the *Tovertafel* is children with special needs, particularly those with cognitive disabilities. This includes children with developmental disabilities such as Autism Spectrum Disorder, ADHD, and intellectual or learning disabilities, as well as those with physical impairments, chronic or acute illnesses, or palliative care needs. Additionally, children affected by trauma, low socioeconomic status, or discrimination may also be considered part of this target group of children with special needs. The Tovertafel can be used in classrooms solely consisting of children with special needs, in mixed classrooms where non-special education children are also present, and in medical settings such as pediatric hospitals, rehabilitation facilities or hospices.

It is well known that children with special needs experience the world differently. Hence, Tover created the *Tovertafel* to help them connect with the world in their own way, by forming a bridge between the theory of social-emotional learning and the challenges of everyday life. Social and emotional learning (SEL) helps children develop the knowledge, skills, and attitudes needed to build supportive relationships, demonstrate empathy, regulate emotions, achieve personal and collective goals, and establish and maintain healthy self-identities (Casel, n.d.,a). The CASEL5 framework addresses five interconnected areas of competence related to SEL: self-awareness, social awareness, self-management, relationship skills, and responsible decision-making (Casel, n.d.,b). Each *Tovertafel* game supports at least one of these domains, while also fostering executive functioning, cognitive stimulation, physical activity, social interaction and sensory stimulation. Through these games, children thus practice social skills, develop gross motor skills and learn to express their feelings.

In total, there are forty-two games for this target group, divided into four different game levels based on difficulty and learning goals. Some games are also multi-level games for which the difficulty can be increased. In general, Level 2 games are developed to explore the concept of action-reaction and to get moving to release excess energy, while Level 3 games are developed to learn to work towards a certain goal, for which memory and concentration are needed. Level 4 games aim to make the players think and reason, and again, a goal can be reached, while Level 5 games are developed to practice more advanced social and cognitive skills such as recognizing (complex) emotions, arithmetic, spelling, telling the time and expanding vocabulary. As mentioned, some games can be categorized as a serious game and some as serious play, while some are edge cases. All games include a learning aspect or goal, and some games (e.g. *Animal Letters* or *Emotions*) try to achieve this via the rules and mechanisms of the game while others (e.g. *Minecarts* or *Bubble Bath*) try to achieve this more via collaborative play and experiences during playing the game. Most edge cases are classified as serious play, however, show possibilities of including rules which can recategorize these games as a serious game. *Soccer Game,* on the other hand, is seen as a serious game, as there are structured aspects visible that support scoring and competition, however, other learning goals, such as social interaction and sharing, are not necessarily embedded in the rules, rather, are supported through collaborative play. An overview of all the games along with their categorization as either a serious game or serious play is provided in Table 1. A more detailed description of all the games and why they fit in either category can be found in Appendix I.

Table 1

Games of Tover listed as a serious game or serious play

Serious game	Farm Pairs, Monster Pairs, Sound Memo, Emotions, Seasonal Trios, Frog Kings, Emotion Words, Word Treasure, Rocket Sums, Animal Letters, Mindset, Safe Cracker, Baby Monsters, Bookworm, Time Bomb, Marble Snake, Hamster Maze, Letter Board
Serious game (edge case)	Soccer Game
Serious play	Bubble bath, Fairy-tale mist, Stardust, Rainbow, Pond, Windmills, Puppies, Birthday cake, Sandy Beach, Constellations, Fingerpaint, Unfold Photos
Serious play (edge case)	Flying saucer, Paint splatters, Steam Train, Ducklings, Ball Toss, Candy Fish, Race Cars, Minecarts, Moles

2.2 Procedural rhetoric

While procedural rhetoric has already been introduced, this section expands on its role in game design, also addressing the player's perspective. Procedural rhetoric, a concept coined by Bogost (2008), can be defined as "the practice of effective persuasion and expression using processes" (p. 125). In his viewpoint, games enable designers to create sets of rules and principles that help with creating and expressing particular perspectives or ways of understanding the world within the game. Video games can try to simulate real-world situations, simplifying them to highlight relevant aspects, and procedural rhetoric is a way in which those simulations can persuade players or convey a certain message (Matheson, 2015). Breaking it up, the procedural part of procedural rhetoric relates to the processes and rules that define how the game functions, while the rhetoric part relates more to the actual persuasion part of the games. Combining them thus means that the game pursues a certain viewpoint, message or behaviour with the use of processes. By playing the games, players can learn the embedded message of the simulation and use those insights in the real world. However, what remains unclear is whether players fully internalize such messages when playing the games. Anderson et al. (2019) found that players often understand the procedural rhetoric of the games they play, supporting that it is possible to learn something relevant for the real world. However, it is still uncertain whether understanding the rhetoric is necessary for the ability to learn from such games. Or could simply playing the game lead to learning the intended message, knowledge, or skills, even without an explicit link between the game and the real world?

Regarding the effectiveness of procedural rhetoric, some researchers have explored how embedding learning within the game's processes can possibly enhance understanding and behaviour

change. Bellotti et al. (2010), for example, mentioned that games provide a meaningful context for learning, as what you learn in a game is not abstract or disconnected from the experience, but is embedded in the game's environment, story and mechanics. Additionally, players immediately practice and apply what they learn within that same context, which is also referred to as situated cognition (Bellotti et al., 2010). Procedural rhetoric works within this context to influence players' behaviour and beliefs, indicating that serious games using procedural rhetoric can serve their persuasive purposes by merging the process of learning with the game's mechanics and rules. Players do not just passively receive information, rather they actively participate in the learning experience.

Further, Anderson et al. (2019) and Ndulue and Orji (2022) found that using procedural rhetoric is beneficial for behaviour change, indicating that procedural rhetoric is likely useful in games promoting the goal of learning a skill such as the games of Tover. However, as mentioned by Anderson et al. (2019) and Sicart (2011), there is still a lack of empirical evidence of the effects of procedural rhetoric on the use of learned behaviour or insights in real life. It is, for example, possible that players behave in ways that are unexpected and therefore different from the intended procedure (e.g. misinterpreting the rules or using them in ways not intended by the creator) (Sicart, 2011), meaning that the proposed procedural rhetoric may not always be conveyed effectively. Apart from that, Jacobs et al. (2020) mentioned that the gameplay must find a balance between the player's cognitive limitations and the simulation's depth for procedural rhetoric to be convincing. This relates to the cognitive resource theory, which states that there is a limit to the brain's capacity for information processing (i.e. cognitive resources), and the available resources are competitively and reciprocally shared between concurrent tasks (Watanabe & Funahashi, 2017). So, if the procedural rhetoric of the game is difficult, players might have to use too many cognitive resources to understand and play the game, resulting in too few resources left for processing the underlying message.

Despite these challenges, procedural rhetoric makes games unique compared to other forms of media such as film, art or narrative (Anderson et al., 2019). In games, players need to actively participate and make choices, which can enhance engagement and reinforce intended messages. As procedural rhetoric contributes to this, video games with effective procedural rhetoric in them might have the potential to be highly effective and beneficial in settings like education. In the context of this research, it is argued that most of the games included make use of procedural rhetoric. As they target children rather than adults, who often have more limited cognitive resources, it is important to keep the procedural rhetoric simple to ensure its effectiveness. In the section below, a more detailed elaboration will be given on procedural rhetoric and children.

2.2.1 Children and procedural rhetoric

Only limited research has been conducted on procedural rhetoric within games for children. Maqsood et al. (2018) designed a digital game with simple mechanics and narrative supported by procedural rhetoric for children to explore meaningful digital literacy scenarios, simultaneously learning about the consequences of their actions. Their findings suggest that the game helped children become more conscious about their decisions, which is thought to be at least partly due to the procedural rhetoric. Similarly, Vermeulen et al. (2022) used procedural rhetoric in a board game to improve peer communication with children who have chronic diseases. They found that the peers did get a better understanding of what it is like living with a chronic disease, however, it remained unknown whether it also resulted in behavioural changes towards these children. Apart from those studies, little research exists on procedural rhetoric and children.

Nevertheless, there are likely differences between adults and children when it comes to procedural rhetoric, as (young) children are still developing their cognitive abilities, while those are already developed for adults. Hence, the type of message someone wants to convey with procedural rhetoric is likely different in games for children. For example, children aged two to five are often not able to find logical cause-and-effect relationships, and children aged six to twelve may still be limited in abstract thinking and their reliance on logical answers (Malik & Marwaha, 2023). This possibly causes difficulties in fully grasping the procedural rhetoric embedded in a game and in understanding the underlying message of it. Rather, children might focus more on simpler aspects of the games, like the outcome of the game (e.g. winning or losing), or seeking approval from others (Blumberg, 1998). However, as previously mentioned, is not known yet whether fully understanding procedural rhetoric is necessary for learning or if simply playing the game, without fully grasping the procedural rhetoric, is enough to convey a message or to learn a skill from the game.

Another difference between adults and children when playing games is that children are often more guided, as children likely receive support from parents, teachers or peers. Such guidance or supervision can be quite effective for learning. Vandermaas-Peeler et al. (2018) found that, from a sociocultural theoretical perspective, tailored support, within a zone of proximal development (ZPD), is ideal for fostering learning in children. In other words, children likely are able to perform tasks that they cannot yet do independently (provided they are only slightly above their skill level) with the guidance of a more knowledgeable person. Guiding children in this way is found to be one of the most optimal learning conditions, and social interactions included in this type of learning further improve the effectiveness of it. Such adult supervision when playing games with procedural rhetoric can possibly influence how the procedural rhetoric is understood (if it is understood at all), as the interpretation of the procedural rhetoric by the person guiding the children might be different from the interpretation of the child itself. This is

also referred to as the simulation gap, suggesting that there is a difference between what a game explicitly conveys through its procedural rules and how players interpret or make sense of those simulations based on their own experiences, emotions, and perceptions (Gekker, 2012). In the context of this research, the games are most likely supervised by teachers or caregivers, who can show their interpretation of the procedural rhetoric, which can possibly result in no or little room left for the children to interpret the procedural rhetoric themselves. Although SEL is not necessarily universal (Tiwari & Ruedas-Gracia, n.d.), it is likely that teachers and caregivers interpret the procedural rhetoric quite similarly to the children in the context of this research, as within one country, social-emotional concepts are generally more universally understood. Regardless, the teachers and caregivers likely play a crucial role in the learning process of the children when playing the games (Wendel & Konert, 2016), so it is important to take the role of these supervisors into account.

2.2.1.1 Children with special needs. The target group of this study is not just children, but children with cognitive disabilities, who often experience even greater delays in cognitive abilities. They can have more difficulties with switching between different rules, with complex task demands, with focusing and keeping attention on a task, and with controlling their cognitive activities for example (Michel & Roebers, 2008). Hence, games for children with special needs should emphasize visual cues, instant rewards, and immediate feedback, making sure they are not overwhelmed game's complexity (Ke & Abras, 2012). Murrey et al. (2007, as cited in Ke & Abras, 2012) also noted that teachers should avoid complex games for students with special learning needs, as such games may overwhelm them with both the game's rules and the material being taught. As a result, games for these children are likely to be even more simplified than those for children without special needs.

The games of Tover are indeed simplified and created to learn rather basic social and emotional skills such as waiting for your turn, dealing with winning and losing and playing together. Verbal and text instructions are limited as much as possible, especially in lower-level games, as children with special needs likely have delays in language comprehension. As a result, these children probably receive even more guidance or supervision during gameplay, which may influence the perceived procedural rhetoric as previously mentioned. Further, these children likely have difficulties understanding procedural rhetoric in games, as playing the game itself may demand too many cognitive resources. Even if they are able to show an understanding, they may also struggle to verbally express this understanding due to delays in language development and speaking abilities. Nevertheless, they might demonstrate implicit understanding through behaviours that reflect recognition of game rules or mechanics. This understanding, however, may vary greatly among individuals due to the great variability in cognitive disabilities and individual differences in abilities.

Thus, using procedural rhetoric for this target group would mainly be beneficial if it is not needed to explicitly understand the procedural rhetoric in games to learn the intended behaviour, skills or knowledge. As there is, to my knowledge, no previous research carried out on this topic, the current study seeks to explore this aspect. Hence, the following sub-question is formulated:

> ***Sub question 1:*** *Is understanding the procedural rhetoric of games needed for learning and gaining social and emotional skills for children with special needs (specifically cognitive disabilities)?*

2.2.2 Analyzing games on procedural rhetoric

For the purpose of this study, the researcher analyzed the forty-two games of Tover on procedural rhetoric. A general overview of this analysis is provided in this section, while a detailed description of the procedural rhetoric within all games can be found in Appendix I. To conduct the analysis, the researcher reviewed gameplay videos, played the games herself, and examined documents about the games provided by Tover. The analysis of procedural rhetoric was further based on the previously discussed literature review, as well as on de la Hera's (2013) framework, which includes different rules that can be manipulated to persuade players via procedural rhetoric. These include model rules, which set boundaries for players' actions, grade rules, which relate to all measurable aspects of the game such as scores or energy levels, and goal rules, which define the objectives that determine victory or defeat (de la Hera, 2013). This section first evaluates the strength of procedural rhetoric in the games, followed by a brief discussion of the specific types of procedural rhetoric present in the games of Tover.

The strength of procedural rhetoric appears to vary across the games. Some Level 2 and Level 3 games were assessed to have relatively weak procedural rhetoric, meaning they focus primarily on encouraging exploration rather than conveying a message or learning a goal through their rules. Often, these games do not have specific rules, and especially no grade and goal rules. The other Level 2 or Level 3 games, along with one Level 4 game, were evaluated as having moderately strong procedural rhetoric, meaning they communicate a message or learning goal through their rules, however, certain aspects may not closely simulate real-world scenarios, or their goals may be somewhat abstract. Often, these games offer multiple learning opportunities, some embedded within the rules and others not (e.g., exploration). Lastly, nearly all Level 4 games, and all Level 5 games, were assessed to have strong procedural rhetoric, with a clear and specific message or learning goal conveyed through model, grade and goal rules.

Further, the procedural rhetoric in these games was categorized into five groups by the researcher: 1) presenting a (highly) simplified version of real-life situations, 2) supporting physical

movement, 3) learning cognitive skills, 4) learning social-emotional skills, and 5) showing no clear procedural rhetoric. The first category includes games that depict a highly simplified version of real-life situations, such as taking a bath, petting puppies, or celebrating a birthday. These representations intentionally leave out some realistic elements such as a puppy that might run away or a birthday cake that might not look perfect. The second category consists of games that encourage physical movement, for example, by prompting children to move across the entire playing field. The majority of Tover's games fall into the third and fourth categories, which aim to teach players cognitive or social-emotional skills through the game's rules and mechanics. Table 2 provides an overview of the specific skills that can be learned through the procedural rhetoric of these games. Lastly, a few games do not demonstrate procedural rhetoric. These games primarily encourage exploration. promote social engagement, try to calm players or teach skills such as learning about colors or counting. However, these effects are not embedded in the rules of the game, so they are not considered as part of the procedural rhetoric. These are also elaborated upon in Appendix I.

Table 2

Different skills that are demonstrated through the procedural rhetoric of the games of Tover

Cognitive skills	**Social-emotional skills**
Matching (e.g. shape, color, sequential matching)	Recognizing emotions
Pattern recognition	Learning about social situations
Memory training	Dealing with winning/losing and/or recognizing competition
Hand-eye coordination	Working together
Learning about timing and planning	Impulse control
Mathematical skills	
Letter/word recognition and spelling	
Clock reading	
Cause-and effect relations	

2.3 Social aspects of playing serious games

Apart from procedural rhetoric within games, the social aspect of playing games also supports learning (Wendel & Konert, 2016). Since the games used in this study are often played together, it is important to examine how social interaction influences learning and the understanding of procedural rhetoric for children with cognitive disabilities. This section focuses on three key aspects: multiplayer

game type, emotions and reflection. Multiplayer game type was chosen because the games support different game types (e.g. competitive or collaborative), which may shape engagement with procedural rhetoric. Furthermore, emotions influence motivation, engagement, and cognitive processing, making them potentially relevant for understanding procedural rhetoric. Reflection is crucial for transferring in-game experiences to real life, making it a relevant aspect to investigate in relation to procedural rhetoric. By examining these elements, this section aims to shed light on how social interactions during gameplay impact learning and the comprehension of procedural rhetoric.

2.3.1 Playing together

The games used in this study can be played either individually or in groups. Certain games cannot be played alone due to their competitive nature, for which the projection is sometimes divided into two sections, allowing players to compete against each other on opposite sides of the playing field. The following section explores the different types of multiplayer interactions in relation to procedural rhetoric.

There are several multiplayer game types possible, including competitive play, collaborative play, or a mixture of both (Wendel & Konert, 2016). In competitive games, players compete against each other, whereas in collaborative games, they work together. Some games combine both, meaning that teams compete against each other. Both competitive play and collaborative play can be beneficial for learning outcomes. For example, a competitive nature can enhance in-game learning, leading to better outcomes while also increasing motivation (Cagiltay et al., 2014; Plass et al., 2013). Collaborative gameplay, on the other hand, can enhance players' understanding of concepts as well as their ability to apply skills, while it also enhances learning outcomes through increased verbalisation amongst other things (Baek & Touati, 2020; Tolmie et al., 2010; van der Meij et al., 2011). However, since not all children with cognitive disabilities are verbal, the benefits of collaborative play may be less visible for this target group.

Playing together can also increase emotional engagement, as children tend to express themselves more and show heightened emotional reactions compared to when they play individually (Shahid et al., 2008). This is particularly relevant for learning, as emotions seem to play an important role in cognitive and social development. When individuals feel in control of their learning process and outcomes, they likely show different emotions compared to when they feel a lack of control (Cheng et al., 2019). Furthermore, emotional experiences can also enhance memory retention, making it more likely that players will remember what they have learned in the long term (Wilkinson, 2013). In the context of this study, emotional engagement through playing together is of importance as it can potentially shape how children interpret the game's procedural rhetoric. A detailed discussion on the role of emotions in relation to procedural rhetoric can be found in section 2.3.2.

When looking at procedural rhetoric within multiplayer games, it becomes visible that its influence extends beyond game mechanics alone, and player interactions and collective interpretation are also important. Gekker (2012) argued that procedural rhetoric in multiplayer games should evolve based on players' collective actions rather than a pre-made structure. This makes the game environment dynamic, where the meaning is not only represented by rules and mechanics, but also by player interaction and their collective interpretation of open-ended elements. In this study's context, multiplayer game mechanics typically emphasize either competition or collaboration, each conveying different procedural messages. Competitive games often simulate rivalry, winning and losing, and conflict situations, while collaborative games encourage mutual support, collective problem-solving and teamwork. Additionally, in collaborative games, players work toward a shared goal, which likely reflects the intended message. In competitive games, on the other hand, the focus on winning may overshadow the broader message unless it directly relates to handling competition, such as dealing with winning/losing. The presence of other players further shapes interpretation, as different individuals may perceive the game's intended message, skills, or behaviours in different ways. However, there is currently no research on how different game types affect the understanding of and learning through procedural rhetoric. Hence, the following sub question is formulated:

> ***Sub question 2:*** *How does the type of multiplayer game (collaborative vs. competitive) relate to the understanding of and learning through procedural rhetoric within games for children with special needs?*

2.3.2 Hedonic and eudaimonic feelings

As mentioned in the previous section, emotions play a crucial role when playing serious games, as they can support cognitive and social development, influence perceptions of control over learning, and improve long-term memory retention (Shahid et al., 2008; Cheng et al., 2019; Wilkinson, 2013). Emotions during gameplay are often categorized as hedonic or eudaimonic emotions, both of which may potentially influence how players interpret and engage with procedural rhetoric.

Hedonic emotions are the more basic emotions related to pleasure, including feelings such as fun, enjoyment, or excitement (Kümpel & Unkel, 2017). These emotions are essential for player engagement, but they tend to be rather short-term and fade rather quickly after gameplay (Poels et al., 2012). Further, Zaharia and Chatzeparaskevaidou (2013) found that hedonic emotions are significant for the motivation to learn; when playing serious games, hedonic feelings seem crucial to keep players engaged and ensure they enjoy the learning process. Since hedonic emotions can keep the player invested (Hollebeek et al.,

2022), they may support the understanding of procedural rhetoric as prolonged playing behaviour and full engagement are likely beneficial for this. Eudaimonic emotions, on the other hand, are seen as more meaningful emotions relating to, for example, personal growth and accomplishments (Seaborn et al., 2020). These feelings tend to have a longer-lasting impact and can be triggered by a sense of accomplishment or satisfaction experienced when achieving a goal or when needs are fulfilled (Oswald et al., 2014). Research suggests that eudaimonic emotions can enhance motivation and even promote prosocial behaviour (Possler, 2024). Tear and Nielsen (2013) found that eudaimonic experiences in games are often linked to the game's story or the perceived cognitive challenges within the game, indicating that they might potentially relate to the procedural rhetoric of a game. Hence, it is suggested that these feelings lead to a more profound understanding of procedural rhetoric.

Hedonic and eudaimonic emotions do not function in isolation and integrating both types of emotions might enhance overall enjoyment (Koek et al., 2022). One game can evoke both emotions, sometimes after each other, but it can also happen simultaneously. For example, a child may feel excitement while actively playing a game and later experience a deeper sense of satisfaction when the child achieved a goal or completed a challenging task. The games designed by Tover likely elicit both hedonic and eudaimonic emotions. They are structured to minimize failure, which enhances enjoyment and encourages continued play, while the incorporation of goals may evoke eudaimonic feelings when achieved. However, players have the freedom to either engage with and reflect on the game's meaningful content or focus on its less cognitively demanding aspects (Koek et al., 2022). This raises the question whether players that engage only with the less cognitively demanding aspects, and are more likely to experience only hedonic feelings, might miss the deeper meaning of the games. If eudaimonic emotions are more closely tied to cognitive engagement, they may play a crucial role in how players interpret and internalize procedural rhetoric. Nevertheless, little research has explored how hedonic and eudaimonic emotions influence the understanding of the game's procedural rhetoric. Hence, the following sub question is proposed:

> ***Sub question 3:*** *Is there a relation between the understanding of procedural rhetoric and the feelings of hedonic and eudaimonic feelings amongst children with cognitive disabilities playing serious games?*

2.3.3 Reflection

Reflecting on learning goals can bridge the gap between unconscious learning experiences and conscious awareness of them (Shaheen et al., 2022), making it an important aspect of learning through

games. This study considers two forms of reflection: reflection-in-action, which is implemented in the game, and reflection-on-action, which takes place after gameplay (Villareale et al., 2020). In a few games of Tover, reflection-in-action is used, where reflection is added in the rules and mechanics of the game. In most games of Tover, reflection-on-action is used, where the supervisor can implement reflection by asking specific questions during and after the game.

Within games, reflection is important for learning outcomes. It fosters a deeper understanding of the topic at hand in a game (Vold et al., 2017) and debriefing after a game is seen as a crucial part of the learning experience (Feinberg, 2003), making it a relevant aspect for serious games. Next to that, adding reflection to gameplay may help children grasp procedural rhetoric by reinforcing cause-and-effect relationships and uncovering the game's underlying message. Ferrari (2010) even states that only when play becomes reflective, procedural rhetoric can possibly be understood. Similarly, Anderson et al. (2019) suggest that less reflective players are less likely to fully grasp a game's message, as they might just accept the message rather than think about a potentially deeper meaning. If possible, encouraging the children to reflect on their decision-making processes in the game might thus help them dedicate more attention to the structure of the game, which can help in understanding the procedural rhetoric. Nevertheless, little research is performed to empirically test this effect. Further, Williams (2019) found that reflection enhances the understanding of social skills as well as how these skills can be used in different contexts, while Cohen (2001) emphasized its role in effective social-emotional learning programs. Reflection may thus strengthen the connection between gameplay and real-world concepts, further supporting the understanding of procedural rhetoric. Since serious games often embed procedural rhetoric to teach social-emotional skills, reflection may be key in making these lessons meaningful.

For this study, it is important to note that children typically begin to engage in reflection between the ages of three to six, gradually improving over time through practice (Epstein, 2003). In early stages, children often need external cues for reflection, and as their cognitive abilities develop, they start to reflect more independently. For children with lower cognitive ages, it is likely that their ability to engage with reflection is limited, potentially resulting in challenges with reflecting on the learning goals and underlying message of the games. Hence, reflection likely has to be initiated when playing the games of Tover. Harle et al. (2006) mention that it is beneficial to adjust the reflection to the children and their experience when guiding reflection, where cognitive ages are important to take into account. The extent to which reflection can be initiated thus likely varies per child.

All in all, reflection appears to be beneficial for understanding procedural rhetoric and learning social emotional skills. However, for children with cognitive disabilities, reflection may present challenges, as they are unlikely to engage with reflection naturally. It is therefore important to determine

whether reflection is a crucial factor in understanding procedural rhetoric, or if it is mainly beneficial but not essential. Hence, the following sub question is proposed:

> ***Sub question 4:*** *Is reflection crucial for the understanding of procedural rhetoric for children with special needs?*

This theoretical framework outlined the key aspects of serious games and the role of procedural rhetoric within them. It also explored how social factors, such as multiplayer game types, emotions, and reflection, may influence how children engage with procedural rhetoric. While research suggests that procedural rhetoric can support learning, it remains unclear whether explicit understanding is necessary for children to benefit from serious games. Additionally, the impact of different types of gameplay, emotional experiences, and reflection on the learning process through procedural rhetoric requires further investigation. To build on these insights, the next section presents the research conducted in this study, examining the role of procedural rhetoric in serious games for children with cognitive disabilities and the influence of social factors on this understanding.

3. Methods

3.1 Research Design

To answer the research question, a qualitative approach combining participant observations and semi-structured interviews was chosen. The Ethics Committee of the University of Twente gave ethical approval for this study (request number 240691). Firstly, to assess whether children demonstrated an understanding of procedural rhetoric, they were observed while playing the games of Tover. Initially, observations took place in the children's usual settings. During the observations, prompts for concurrent think-aloud were given to the children to encourage them to explain what they were doing and why. The aim of this was to gain a deeper understanding of the actions and behaviours of the children playing the games. Examples of such prompts can be found in Appendix II. For some observations, the researcher participated in playing the games, adopting an insider perspective, to gain a deeper understanding of the thoughts and behaviours of the children when playing the games. After the observations, small semi-structured interviews were conducted with the children whenever possible (see Appendix II for the interview scheme). These interviews aimed to gain a deeper understanding of their thought processes, learning outcomes, feelings about the game, and attitudes towards other players. Lastly, semi-structured interviews were performed with the teachers to learn more about the teachers' perspective on how the

children learn from playing the games and how this possible learned behaviour is translated to real-life settings. Also, questions were asked about the feelings of the children while they play with the games. The exact interview scheme for these interviews can be found in Appendix III.

3.2 Research Sample

The network of Tover was used to recruit the research sample. Some locations in the Netherlands that use the *Tovertafel* were initially contacted by an employee of Tover to inquire if they wanted to participate in the research. Later, the researcher contacted the facilities herself, sending study details and setting arrangements with them. Restrictions for participation in the observations included that the location should use the *Tovertafel* at least once a week and the children using it had to be between 4 and 18 years old. To participate in the interviews, teachers or caretakers were required to work with the *Tovertafel* at least once a week at one of the locations already included in the observation sample.

The observation participants included children from special education or daycare programs at three different facilities across three cities in the Netherlands. In total, 27 children were included in the sample. The mean age of the observation sample was 10.3 years old, with an age range of 4 to 16 years old. Although the developmental or cognitive age was not available for all participants, it (likely) ranged from 9 months old to 5 years old within the sample. Nine participants were female, and eighteen participants were male. The cognitive disabilities included in the sample are: (characters of) Autism Spectrum Disorder (ASD), mild intellectual disabilities, disorder in language/speech development, learning disabilities, (strong) developmental delay, STXBP1 mutation (movement disorder), Down Syndrome, chromosomal aberration, congenital ataxia, tonus regulation disorder, ADHD, and variance of unknown significance in a gene. Notably, some children had multiple disabilities, and some cognitive disabilities (e.g., ASD or mild intellectual disabilities) were more often included in the sample than others (e.g., congenital ataxia or tonus regulation disorder). Further, five children from the observation sample also participated in interviews. They all attended the same school, and they were aged between 8 and 14 years old. In total, three interviews were conducted, for which three children participated in two interviews and two children participated in one interview. Additionally, eight interviews were performed with teachers, and the teachers were distributed (almost) equally over the three locations.

The three facilities included in the study varied in their use of the *Tovertafel.* The first facility is a school for children with learning difficulties (or in Dutch; Zeer Moeilijk Lerende Kinderen (ZMLK), and both primary and secondary special education are located within this school. At this school, the *Tovertafel* is not located within the classroom, but in a separate room. The second facility provides daycare for young children with intellectual disabilities or multiple disabilities. At this location, they can move the

Tovertafel around between different classrooms, and one classroom was used for the observations. As this facility is a daycare rather than a school, there are supervisors or caretakers present rather than teachers. However, throughout this report, the term *teachers* will be used, which also refers to the supervisors and/or caretakers of this second location. Lastly, the third facility is again a school for children who have difficulties learning, and the age range at this school is between 12 and 20 years old. This school also provides educational care groups for children aged 4 to 20 years old. At this school, the *Tovertafel* is located in the auditorium of the school. Other differences observed during the observations are presented in Table 3. Additionally, the setups used during the observations at the different locations are shown in Figures 3, 4, and 5.

Table 3

Differences between the three locations noticed during the observations

	Location 1	**Location 2**	**Location 3**
Projected on..	Table	Floor*	Table
Game selection	Mostly by teachers, often based on specific learning objectives.	Mostly by children	Mostly by children, based on what they recognized and preferred the most.
Ages of the children	Mid-range of this target group.	Relatively young.	On the older side of the target group.
Cognitive abilities	Relatively high.	Relatively low.	Varied quite much, but in general relatively low.
Verbal/non-verbal children	All children were verbal.	Some were verbal, some were non-verbal.	Almost all were non-verbal.

*This means that the children could choose whether they wanted to sit or stand while playing. Running around sometimes caused distractions as they found other toys to play with.

Figure 3

Set-up Location 1

Figure 4

Set-up Location 2

Figure 5

Set-up Location 3

3.3. Stimuli

Tover currently offers forty-two games for the target group of this study (see Appendix I for an overview), all of which were included in this research. During the observations, forty games were played, meaning that two games (*Seasonal Trios* and *Mindset*) were not played in any observation. Depending on the group of children and the observation location, the games were chosen either by the teachers or by the children themselves. Before the observations, the researcher selected eight games (see Table 4) that, based on the analysis of the game (Appendix I), showed clear and meaningful procedural rhetoric. If the researcher had the opportunity to choose which game was played, one of those games was selected.

During the observations, the researcher focused on children's interactions with the game and with one another. Specifically, attention was paid to their (in-game) choices, whether it seemed like they followed the rules of the games, their interaction with peers, and their emotions and feelings. To gain a better understanding of the behaviours and feelings of the children, an interview scheme was used which included prompts for think-aloud during the observations as well as additional questions that could be asked after the children finished playing with the games (Appendix II). Moreover, during the observations, a GoPro Hero 7, provided by Tover, was used to record the children playing. The children were recorded from above, so no faces were visible on the recordings. Those recordings were later reviewed to supplement the notes taken during the observations, as well as to transcribe the interviews with the children. Furthermore, another interview scheme (Appendix III) was used for the interviews with the teachers, and these were recorded with the researcher's phone or laptop.

Table 4

Highlighted games from Tover that show clear and meaningful procedural rhetoric

Game	Level	Procedural rhetoric
Pond	2	The rules of this game allow the children to learn about cause and effect, specifically that of playing at a pond, as the fishes will swim away when the water is moving or when they are touched (like in the real world).
Stardust	2	The rules of this game allow for exploration and allows the children to learn about cause and effect, as the different movements create different kinds of reactions of the stardust.
Sandy Beach	3	The rules of this game allow the children to learn about discovering, feelings of curiosity and models confidence building. Just like at a real beach, the objects can be found under the sand.
Sound Memo	3	The rules of this game allow the children to learn about sequential matching, with the use of positive feedback. The importance of memory and attention tasks is also simulated within this game.
Emotions	4	The rules of this game show that recognizing the emotions of children is rewarding, as it is a very useful skill in real life to be able to recognize emotions of others.
Frog King	4	The rules of this game allow the children to learn about competition, and dealing with winning and losing, as well as impulse control.
Time bomb	5	The rules of this game help the children with learning time recognition. The game thus simulates reading the time, and adds a stressful situation to it, mirroring certain situations in real life.
Animal letters	5	The rules of this game help the children in learning letter recognition and reading, which are important skills in real life. Additionally, the competition element in the game stresses the importance of being able to read or recognize words quickly in real life.

3.4 Procedure

First, participating locations were contacted to schedule a meeting to discuss several topics, including details about the way the *Tovertafel* is used at that location, the games that were mostly played, and details about the children. The study was also explained, and the teachers could ask questions. Additionally, the interview scheme was discussed with teachers familiar with the respondents to make sure no triggering or harmful questions were included. Following this meeting, the observations were scheduled with the locations. In the meantime, the researcher distributed informed consent forms to the three locations, and the schools shared them with parents or caretakers. Parents or caretakers were asked to give active consent for their children (see Appendix IV). Additionally, contact persons at the participating locations asked several teachers whether they were willing to participate in the interviews.

Once consent was obtained, the observations took place. In total, around 15 hours of observations were conducted, where the shortest observation lasted 14 minutes, and the longest observation 37 minutes. During the observations, the researcher introduced herself to the children where necessary, and if the children asked, a short explanation of the observations was given without revealing the exact aim of this research. The researcher let the process happen naturally, meaning that she would let the children and teacher follow the normal process of choosing and playing a game. Maintaining a natural observation setting aimed at uncovering the children's understanding of procedural rhetoric within their normal gameplay context, avoiding bias from an experimental setup as much as possible. Interference was kept to a minimum, and in case the researcher did interfere, it was to prompt the children to encourage them to tell why and what they did, to gain a better understanding of the behaviours and feelings of the children. In some cases, the researcher discussed with the teacher whether it was possible to observe specific groups of children or a child playing alone, in order to find out if changing the social context would influence the possible understanding of procedural rhetoric. During observations, the researcher took notes, which specifically focused on children's interactions with the game and with each other. To supplement these notes, the observations were recorded with a GoPro Hero 7, owned by Tover. As mentioned, the recordings were from above, so no faces were visible.

Additionally, whenever possible, one or more children were interviewed shortly after the observation was finished, to gain a deeper understanding of their thoughts on the game and their learning process. These interviews were recorded using both the researcher's phone and the GoPro. All recordings and the observation notes were immediately stored in Google Drive, where only the researcher had access to them. Before storage, all data was anonymized. Furthermore, the interviews with the teachers were conducted partly while the observations were still ongoing, and partly after all the observations and interviews with the children were completed. These interviews lasted between 19 and 37 minutes. At the start of each interview, an explanation of the research was given, including the aim of the research, so the

teachers could answer the questions with this aim in mind (see Appendix V). After this introduction, the informed consent form was given, and when this was signed, the questions were asked. The interviews were recorded with the researcher's phone or laptop, and these recordings were stored in Google Drive immediately after each session. If necessary, the data was anonymized before storage.

3.5 Data analysis

To analyse the data, a combination of inductive and deductive approaches was used. An inductive (conventional) qualitative content analysis (QCA) (Yuwono & Rachmawati, 2023) was applied to generate new insights into the possible use and understanding of procedural rhetoric for children with cognitive disabilities, as no previous research has been conducted on this topic. However, the analysis did not begin without any prior knowledge. Instead, the theoretical framework and research questions provided a foundation for the coding process, reflecting a deductive approach (Yuwono & Rachmawati, 2023). This prior knowledge mainly shaped the initial structure of the codebook. During the analysis, new themes and/or categories that emerged from the data were added to the codebook, reflecting an inductive approach. Hence, the data collection and analysis phases proceeded simultaneously. In general, QCA not only allows for the identification of new patterns or theories but also contributes to refining existing theoretical understandings (Zhang & Wildemuth, 2005).

The first step in the data analysis involved reviewing and extending the observation notes based on the recorded videos. Additionally, the interviews with the children were transcribed using verbatim transcription, meaning that all sounds and silences were included in the transcript, and it was transcribed as accurately as possible (Hill et al., 2022). This was chosen because, for the aim of this research, all sounds made by the children (for example laughter) can indicate something important. The interviews with the teachers were transcribed using intelligent transcription, meaning that laughter and pauses were excluded from the transcript. Apart from that, the transcription was done as accurately as possible.

The second step involved coding the data. This process began as soon as the first data emerged and proceeded simultaneously with gathering the data. Initially, deductive coding was used to develop a preliminary coding scheme based on concepts from the theoretical framework. As the analysis progressed, inductive coding was primarily used, which "allows research findings to emerge from the frequent, dominant or significant themes inherent in raw data, without the restraints imposed by structured methodologies" (Thomas, 2003, p. 2). In general, the coding process consisted of open coding, axial coding and selective coding (Vollstedt & Rezat, 2019). During open coding, themes and/or categories were identified by studying the observation notes, videos of the observations and transcripts of the interviews, which were added to the initial coding scheme. During axial coding, possible relationships

were investigated between the themes and categories found during the open coding phase (Corbin & Strauss, 1990). Lastly, during the selective coding phase, the core categories were chosen and linked to the categories identified during the axial coding phase (Vollstedt & Rezat, 2019).

Two coding schemes were created: one for the observations and interviews with the children, and one for the interviews with the teachers. Condensed versions of these coding schemes, which emerged from the different coding phases, are visible in Table 5 and Table 6. The coding schemes include main codes, sub codes, and additional codes. The additional codes are highlighted in Tables 5 and 6 by words in *italic.* The more detailed versions, which were used during the data analysis, are presented in Appendix VI.

3.5.1 Intercoder reliability test. After the coding schemes were completed using the three phases of coding, an intercoder reliability test was conducted for which the Cohen's Kappa was calculated. Cohen's Kappa coefficient (k) relates the number of congruent codes to the number of incongruent codes while also taking into account a factor for chance (Burla et al., 2008). To assess reliability, 10% of the observation notes and children's interviews, as well as 10% of the transcribed interviews of the teachers were cross-coded using ATLAS.ti. The second coder received the data with highlighted sections where the first coder had applied codes. Using the coding schemes, the second coder independently coded these highlighted sections. Next to the coding schemes, the document with the game analyses was also provided to clarify the rules and goals of the games. The overall Cohen's Kappa resulting from the intercoder reliability test of the children's observations and interviews codebook was 0.81, and the overall Cohen's Kappa resulting from the intercoder reliability test of the teacher's interviews codebook was 0.79. As both values are in between a moderate and a strong level of agreement (McHugh, 2012), the codebooks were deemed more than adequate. When reviewing the coding schemes, it was found that the subcodes *goal, interpretation* and *rules* were most often used interchangeably. This might be due to the subtle distinction between what can be seen as a goal or a rule within these games. To make the difference between these codes clearer, they were redefined. Hereafter, the remainder of the transcriptions were coded.

Table 5

Condensed version of the coding scheme for the observations and interviews with children

Main code	Sub code	Explanation
1.Procedural rhetoric	1.1.Rules	The *understanding* or *non-understanding* of the rules of the game, or the *creation of new rules*.
	1.2.Connection to real world	A possible connection made between the game and the real world (both verbal and physical).
	1.3.Goal	The *understanding* or *non-understanding* of the goal of a game, or *reaching* this goal.
	1.4.Learning (skills)	Learning skills such as *waiting for your turn*, *educational skills*, *social-emotional skills*. Also learning about *action-reaction* and *other learning aspects* are included.
	1.5.Interpretation	The way the children interpret the game, meaning the way they seem to want to play the games. Is it *similar to the rules*, do they *create gameplay/goals*, or do they do *something else?*
2.Playing together	2.1.Competitive	The *understanding* or *non-understanding* of competitive games.
	2.2.Collaborative	Whether children *worked together, worked individually at the same time, asked someone to join,* or *imitated others*.
	2.3.Helping	Whether children *helped others, asked for help,* or *explained rules* to others.
	2.4.Negative experience	A negative experience when children played together.
3.Emotions	3.1.Positive 3.2.Negative 3.3.Hedonic 3.4.Eudaimonic 3.5.Bored	The emotions the children experiences while, or after, playing the games, where *frustration* is also added.
4.Game preference	4.1.Strong preference 4.2.Just preference 4.3.Happy with the choice 4.4.Unhappy with the choice	Potential preference for playing a certain game, and their reaction when they could not choose themselves.
5.Distraction	5.1.Too difficult 5.2. Too boring 5.3.Reason unknown	The potential source of possible distraction of the children.
6.Guidance	6.1.Turn-taking 6.2.Explanation 6.3.Rule creating	Guidance from the teacher present.
7.Difficulty level	7.1.Easy 7.2.Difficult	Whether the children indicate they find a game (or an element thereof) difficult or easy.

Table 6

Condensed version of the coding scheme for the interviews with teachers

Main code	Sub code	Explanation
1.Use of TT	1.1.Learning 1.2.Relaxation 1.3.Other	The reason the Tovertafel is used.
2.Procedural rhetoric	2.1.Rules	The *understanding (or following)* or *non-understanding* of the rules of the game, or the *creation* of new rules.
	2.2.Real life	Whether a possible *connection to the real world* is made, or whether this *connection is not made*.
	2.3.Goal	The *understanding* or *non-understanding* of the goal of a game, or whether there is a goal *created*.
	2.4.Skills	Whether there is *improvement* or *no improvement* of certain social, emotional, motor, or cognitive skills, whether these are *translated to real life* or *not translated to real life*, and whether the *TT is seen as a tool* in learning these skills.
	2.5.Social emotional skills	Whether the children *understand* or *not understand* the social-emotional skills learned, whether those skills *improve* or *do not improve*, and whether there is a focus on *learning* these skills.
	2.6.Interpretation	Whether children came up with their *own interpretation*, an interpretation *similar to the rules/goals*, or one based on *action-reaction*.
3.Playing together	3.1.Competitive	The *understanding* or *non-understanding* of competitive games.
	3.2.Collaborative	Whether children *work together, work individual at the same time*, or indicate they *want to play together*.
	3.3.Helping	Whether the children *help others* or do *not help others*, whether they *ask for help*, and whether they *explain rules*. Also, whether specific *guidance from teachers* is mentioned.
4.Emotions	4.1.Positive 4.2.Negative 4.3.Hedonic 4.4.Eudaimonic 4.5.Bored	The emotions the children experiences while, or after, playing the games, where *frustration* is also added.
5.Reflecting	5.1.Yes 5.2.No 5.3.Useful 5.4.Non-useful	Is there reflection on the games and is the reflection useful for understanding the goal and/or improvement in skills?
6.Difficulty level	6.1.Easy 6.2.Difficult	Whether the games are difficult or easy for the children.
7.Game choosing		Anything related to the choosing of the games.

4. Results

This section presents the results of both the observations and interviews. First, observed differences in game preferences and guidance levels between the three locations will be elaborated upon. In the sections hereafter, the results from both the observations and interviews with teachers are combined to highlight similarities and differences between the observations and the perceptions of the teachers. Those results are split into several subsections, where the results regarding procedural rhetoric are discussed first, divided into several different aspects. After this, the results regarding the social aspects of playing games in relation to procedural rhetoric are discussed, starting with how the children played together, followed by the results about emotions. Lastly, a section on teacher observations is included, as not everything discussed within the interviews was also observed during the observations.

4.1 Observed variation in game preference and guidance levels

First, Table 3 in section 3.2 provides detailed information on differences in how the games were played and selected across locations, as well as variations in children's age and cognitive levels that may have influenced the results. Additional differences observed included the most frequently played games at each location and the level of guidance. Table 7 provides an overview of the number of times different games were played at each location. It is important to note that Location 2 used *Tovertafel* 1, which is the first version of the *Tovertafel*, while the other two locations used *Tovertafel* 2. Some games are only available for the second version of the *Tovertafel*, hence, Location 2 could not play all the games. These unavailable games are marked as *n/a* in Table 7.

During the observations, two games were never played. One of them, *Trios*, is similar to *Seasonal Trios*, differing only in theme, so this game will not be further discussed. The other game, *Mindset*, might not have been played because its picture was less visually appealing compared to other games, as some children seemed to choose Level 5 games based on the picture. Another reason might be that this game was perceived as too difficult based on previous experiences, as teachers also never selected it. Regarding gameplay frequency (see Table 7), Level 4 games were proportionally most played and most often picked by the children themselves, followed by Level 3 games, showing a preference for middle-level games among the children. At Location 2, Level 3 games were played the most, while at Location 1 and 3, Level 4 games were proportionally more often played. This aligns with the difference in ages and cognitive levels of the children at these locations. Level 2 and Level 5 games were played less often, with Level 5 games being the least played. These games were often perceived as too difficult by the children, and when they were played, it was mostly at Location 1 and Location 3. Again, this is likely due to the relatively older children present at these locations.

Table 7

Number of times the games were played during the observations per location

	Game	Location 1	Location 2 (TT 1*)	Location 3	Total
Level 2	Bubble bath	-	8	-	8
	Fairy-tale mist	-	n/a	1	1
	Flying Saucer	-	2	1	3
	Stardust	-	3	-	3
	Rainbow	2	2	1	5
	Paint splatters	2	2	4	8
	Pond	-	5	-	5
Level 3	Windmills	2	3	2	7
	Puppies	-	4	1	5
	Birthday cake	1	5	3	9
	Sandy Beach	1	5	2	8
	Steam Train	-	3	3	6
	Monster Pairs	1	1	1	3
	Farm Pairs	-	3	2	5
	Constellations	-	8	4	12
	Ducklings	2	n/a	2	4
	Unfold Photos	1	n/a	5	6
	Sound memo	-	n/a	6	6
	Fingerpaint	-	n/a	4	4
	Duo's	2	n/a	3	5
Level 4	Emotions	1	-	5	6
	Seasonal trio's	-	n/a	-	0
	Soccer Game	2	4	6	12
	Ball Toss	1	-	2	3
	Candy Fish	1	7	3	11
	Race Cars	2	4	-	6
	Minecarts	1	3	2	6
	Moles	4	1	2	7
	Frog King	-	-	9	9
	Trio's	1	-	3	4
Level 5	Emotion Words	-	n/a	3	3
	Word Treasure	1	-	1	2
	Rocket Sums	1	-	1	2
	Animal Letters	1	-	-	1
	Mindset	-	n/a	-	0
	Safe Cracker	1	-	1	2
	Baby Monsters	1	1	4	6
	Bookworm	2	-	1	3
	Time Bomb	-	n/a	3	3
	Marble Snake	-	2	3	5
	Hamster Maze	1	1	4	6
	Letter Board	-	n/a	2	2

*This location only had Tovertafel 1, which is the earlier version of the Tovertafel and has fewer games available.

In line with this, Level 2 games were most often played by children at Location 2. Additionally, certain games (e.g., *Bubble Bath, Constellations, Sound Memo, Frog King*), were played significantly more at specific locations, likely due to strong preferences from one or two children who repeatedly selected them. Not all children showed such strong preferences for games, rather, some children either followed the other children or chose different games every time they could choose.

Another important observed difference is the variation in levels of guidance at each location. All three locations showed a different type of guidance: Location 1 showed structured guidance, Location 2 showed minimal guidance, and Location 3 showed supportive guidance. Structured guidance involved the teacher actively directing game choices by explaining rules and interactions. At Location 1, the teacher was always present while the children played and often explained the games before turning them on. The teacher also guided turn-taking. For example, when the teacher selected the game *Soccer Game*, a game where two teams compete to score goals, the teacher first explained the aim, after which she assigned two children to play, also specifying which colour team each child would be on, making it explicit that this was a competitive game. Secondly, supportive guidance allows children more autonomy, with teacher providing support and clarification when needed. At Location 3, children started playing their chosen games without prior explanation, however, the teacher sometimes stepped in, for example to give turns to the children or by pausing the game to clarify rules. For instance, when playing *Sound Memo*, which is a memory game in which children have to match boxes based on sounds, the teacher announced whose turn it was to open a box. If a child opened a box out of turn, the teacher either mentioned something about this, or paused the game to explain they had to wait for their turn. Lastly, minimal guidance involved little teacher intervention. At Location 2, the teacher was present within the classroom but did not actively engage in the gameplay. They only intervened when a child wanted to switch games or when they became distracted by other toys for a rather long time.

At both Location 1 (structured guidance) and Location 3 (supportive guidance), teachers sometimes introduced new rules or goals when playing the games. This was mostly done to implement a more tailored learning goal in the game relevant for the children playing, or to make a game a bit more challenging. For example, at Location 1, the teacher introduced a new rule while playing *Paint Splatters*, a game where children pop paint bubbles to create a painting, by mentioning that only specific colours should be popped while avoiding popping the other colours. These additional created rules were considered alongside the original game rules when analysing the results in the following sections. Moreover, in the following sections, guidance levels will be referred to when they influenced differences in results or were relevant to specific findings.

4.2 Procedural rhetoric

The results regarding procedural rhetoric are split into different aspects, which will be discussed separately. First, the results regarding whether the children adhered to the rules and goals of the games are discussed, after which the children's interpretations of the games are elaborated upon. The different connections the children made to the real world are presented after, followed by the results regarding learning skills through the procedural rhetoric of the games.

4.2.1 Children's understanding of and (non-)adherence to game rules

When asked about the rules of the games, six teachers mentioned they thought the children did, at least sometimes, understand and adhere to the rules. Interviewee 8, for example, noted that many of the children playing with the Tovertafel have ASD and stated: "The children often want to play the game in the way the game is supposed to be played, so they will always follow the rules". The observations confirmed that children more often adhered to the rules than not, indicating that they more often showed an awareness of the rules of the games than they did not show this awareness. Children demonstrated adherence in three ways, namely by rule conforming play or behavioural expressions, by verbal recognition and by rule explaining.

Rule conforming play relates to observations where a child did not explicitly indicate their understanding of the rules but played the game in the same way as was intended. For example, in memory games such as *Sound Memo or Trios*, some children actively matched cards by remembering previously opened ones and by revealing new ones, while others repeatedly opened the same boxes and cards which were already known. Active matching behaviour thus likely indicates that the children knew what they had to do within the game without them mentioning this explicitly. Secondly, children sometimes showed verbal recognition, meaning they made certain comments related to the rules, indicating that they understood them. When playing *Sandy Beach*, in which the children have to search for a certain object under the sand, a child mentioned "I've got it!" and laughed after she found the correct object. She then stopped searching, indicating that she knew she had to find a specific object before the game would continue. Lastly, two children explicitly explained some rules, clearly demonstrating their understanding. For instance, one child mentioned specific aspects of the game *Time Bomb* to the teacher and the researcher, which is a game in which children must tell the correct time while playing against someone else. They mentioned that time would speed up if a wire had to be cut and repeatedly pointed out that the teacher was close to cutting a wire because the timer was almost over. Not surprisingly, verbal recognition and rule explaining were mostly observed in older, more cognitively developed children, as this behaviour might have been too advanced for younger, less cognitively developed children.

Furthermore, six teachers believed that there were games for which children did not understand the rules, with *Soccer Game* being mentioned most often. Observations aligned with this, as children were often seen scoring on both sides of the playing field instead of playing against each other. More broadly, children who did not adhere to the rules demonstrated this either verbally or through their behaviour. Verbal expression involved moments where children mentioned they did not understand the rules. For instance, two children asked what they had to do, and in both cases, they did not start trying something before the teacher explained what they had to do. More commonly, behavioural expressions were observed in which the children did not adhere to the rules. This includes instances where a child did not explicitly mention that they did not understand the rules, but their behaviour clearly indicated this. For example, a group of children played *Rocket Sums*, a game where numbered balls have to be pushed to the middle to match a target sum. The children did not know which number they had to reach, hence, started to push random balls to the middle until the teacher explained what they had to do. Not adhering to the rules was mostly due to a lack of understanding, however, children also sometimes deliberately did not adhere to the rules. As these moments tie in with the interpretation of the games by the children, they will be discussed in section 4.2.2.

The number of times it was observed that children did not understand the rules of the games increased the higher the level of the games became. This is not surprising, as the more difficult the rules become, the harder it gets to understand them. Interestingly, the two teachers interviewed from Location 2 both mentioned that they thought the children did not adhere to the rules, while for the other locations, there were differences in answers, or all teachers thought the children did sometimes adhere to the rules. Apart from the younger ages of the children at Location 2, another explanation would be that Location 2 provided minimal guidance. Hence, teacher guidance may play a role in children's ability to grasp and follow game rules. Interviewee 4 supported this notion, mentioning that when she explained the rules, children followed them. It is thus possible that rules were more often explained at Locations 1 and 3, also before the observations took place.

4.2.2 Children's understanding of game goals

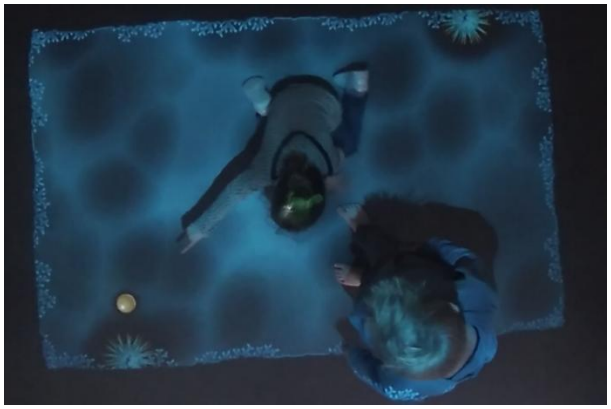
Beyond rule adherence, another important aspect of procedural rhetoric is whether children grasp the overall goal of the game, which may not always require strict rule adherence. The interviews provided mixed perspectives on children's goal understanding. Five interviewees believed that children, at least sometimes, understood the goal of the game, while it was also stated five times that some children did not. Interviewee 3 noted that understanding the goal of a game requires a relatively high cognitive level, which many of these children do not have. However, observational data suggest otherwise, as children

were often seen working toward and even achieving the intended goals. This discrepancy raises the question of whether teachers fully understand the goals of the games themselves, or if they might slightly underestimate the children's cognitive abilities in this regard. It is also possible that the teachers were thinking about relatively difficult goals purely based on social-emotional skills, while for the observations also broader goals for the games were taken into account, such as knowing that the goal of the game is matching or naming objects.

In general, it was observed that children more often understood the intended goal of the game than they did not understand it. Children demonstrated this either through behavioural or verbal expressions, similar to how they showed adherence to the rules. The goal was more often understood in higher-level games, while it was more often reached in lower-level games. This is likely due to the goals being easier to reach for the lower-level games (e.g. supporting physical movement or making the correct match) than for the higher-level games (e.g. correct counting or spelling). The goals tend to be more abstract for the lower-level games, which may explain why children showed less understanding of these rules. Notably, Level 4 game goals were almost always understood. One of the Level 4 games that stood out was *Candy Fish*, in which the children have to direct a fish to candy while dodging the spikes. Children could always tell that the fish was supposed to eat the candy, and some children showed this by pointing towards the candy (see Figure 6) or by mentioning something like "go eat fish". In contrast, the goal of Level 2 games was rarely understood, which might be because those games do not have clear initial goals for the children (e.g. the goal of *Flying Saucer* is to stimulate concentration and responsiveness, and the game helps with practising shared learning and interactions). Additionally, children often created their own gameplay for these games (see section 4.2.3), which makes it harder to observe whether they understood the initial goals of the game.

Figure 6

Snapshot of an observation showing a child pointing towards the candy while playing Candy Fish



4.2.3 Children's interpretation of the games

It was observed that children interpreted the games either in a similar way as the rules indicated, or they created their own gameplay. When they did the latter, the gameplay created could be categorized into three different categories: 1) creating goals, 2) playful disruption or deliberate rule-bending, and 3) competitive play. These categories will be discussed first, after which specific behaviour related to the interpretation of a game is discussed.

First of all, it was quite often observed that children created their own goals for the games, which were different from the intended goal of the game. This was most often seen in Level 2 or Level 3 games, which is expected to be because lower-level games allow for more creativity as the intended goals of the game are not that strict, whereas higher-level games often have quite set rules that have to be followed to reach the initial goal. Additionally, some children may have found the lower-level games too simple and thus created their own goals to make it more exciting. For example, during the game *Rainbow,* a game made to relax while exploring colours, several children created their own goal of trying to colour the whole playing field and leaving no place black (see Figure 7), which is not the initial goal of the game. Despite these observations, only two interviewees mentioned that they believed children created their own goals. A possible reason for this might be that the teachers normally guide the game sessions to a high extent, leaving little room for the children to create their own goals for the game.

Figure 7

Snapshot of an observation showing children trying to colour the playing field when playing Rainbow

The second category of created gameplay relates to deliberately bending the rules, also called playful disruption. In this form of gameplay, the children showed that they knew what they had to do within a game, however, deliberately decided to perform other behaviour. For example, when playing games such as *Monster Pairs* or *Farm Pairs*, some children chose the wrong options first and left the right option last. Most often, children showed that they knew which option was the right one but purposely chose the wrong options first. One reason for this behaviour might be that children found the

visuals funny when selecting a wrong option, which aligns with the observation that children were often more interested in the reactions their actions triggered than in following the exact rules. However, in some games, choosing the wrong option did not trigger any notable reaction, hence, the exact reason for this behaviour remains unknown. Interviewee 1 acknowledged that some children sometimes created this type of gameplay, as she mentioned: “Well, if the fish hits the spikes, then that is actually also fun” when she was talking about *Candy Fish*, a game where a fish has to be directed to candy, dodging the spikes. She indicated that children sometimes do not follow the rules within this game to get a certain reaction they want (in this case a fish that deflates).

It was furthermore observed that children created their own competitive gameplay, as children tried to add competition to games that did not have a competitive nature. For example, when playing *Birthday Cake*, in which several objects have to be brought to a cake to decorate it, some children tried to be the fastest to touch the objects. Similarly to creating their own rules, it might be that children engage with this type of gameplay to add a layer of excitement to the games. However, in some cases, the game’s mechanics may have unintentionally encouraged a competitive element, which the children incorporated in their play.

Apart from these gameplay categories, another observation related to the interpretation of the games by children was when one child always acted in the same way when playing the game *Constellations*. Within this game, stars must be touched to form lines, and it can be guessed what object becomes visible, after which it will be shown with a coloured picture. This child chose the game *Constellations* himself almost all the time and immediately started touching all the stars when it was turned on. He seemed very calm touching those stars, often standing in the playing field with his thumb in his mouth. When the last star was touched, the child always ran away, either to a place behind some tables or to a chair that he could close off. The game continued with tracking the lines of the object, and when the sound started indicating that the object became fully visible, the child came back. When another child sat in the chair he ran away to while they were playing this game, he did get her out of the chair before continuing with playing. The sounds playing when the lines were tracked is rather quiet compared to the other sounds of this game, hence, the reason for this behaviour is not thought to be overstimulation. It might be that the child was a bit scared of this particular part of the game, however, he did not look scared when he ran away, and when he stood behind the table, he still looked towards the playing field. Also, he always wanted to play the game repeatedly, suggesting he enjoyed the game. Thus, a more plausible explanation of this behaviour might be that he wanted to make the game more exciting for him, for example because he made it a challenge to run away on time and be back as soon as possible after the line is tracked.

4.2.4 Children's connections to the real-world during gameplay

Children made several connections to the real world while playing the games. The observed connections made to the real world can be divided into three categories: (1) real-life imitation, (2) real-life associations, and (3) applying real-world knowledge. The first category, real-life imitation, entails observations where children imitated certain behaviours from real life when playing the game, which occurred relatively often. For example, in *Constellations*, a game where stars must be connected to form the outline of an object, which then becomes visible with a picture, some children pretended to play musical instruments when they appeared after connecting all the stars. Children lay on the ground, pretending to blow into a trumpet or flute (see Figure 8) or pretended to touch the strings of a violin. By showing real-life imitation, children thus imitated behaviours they learned in real life. This behaviour was mostly observed in games with objects that were recognizable for the children (e.g. vehicles, animals, toys for on the beach), and with which they likely sometimes interact in the real world. In general, this behaviour was most often seen in Level 3 games as these games have the most recognizable objects in them. However, these objects most often did not have a link with the procedural rhetoric of the game; making this first category possibly less relevant for understanding the procedural rhetoric of a game.

Figure 8

A snapshot of one of the observations, where a child pretends to play the trumpet that became visible

Children also related game elements to familiar real-world experiences or objects, also referred to as real-life associations. This type of connection included moments where a child recognized something in the game and linked this to an experience or object known from real life. This was also mostly observed in Level 3 games. For example, when playing *Paint Splatters* (a game in which balles can be splatted to create a painting), one child mentioned that she was glad it was not real paint, because

otherwise, she would get dirty. Teachers also noted that children recognized real-world elements in the games. For instance, when playing *Soccer Game,* the children connected it to playing soccer outside, and in other games, children identified objects like a train or aeroplane. Although the teachers mentioned that objects were recognized, they did not mention that the children made personal associations or told stories based on these associations. However, it was observed that children often talked about experiences they had in real life associated with the objects they saw, often related to animals. For example, stories were told about visits to the animal farm when seeing a goat, or someone started talking about their dog at home during the game *Puppies*. While not all connections were directly relevant to the procedural rhetoric of the game, these types of connections might deepen the engagement while playing, which might be useful for understanding the procedural rhetoric at a later point.

Children also applied real-world knowledge in the games, though less frequently. This category covers moments when children applied existing knowledge or logic from the real world to interpret or engage with the game, meaning that they used their real-world understanding to guide their behaviour within the game. For instance, one child made connections to Santa Claus when drawing a painting in the game *Paint Splatters*, as well as when she saw carrots in another game. Additionally, teachers sometimes tried to apply real-world knowledge to the game, by for example asking the children about emotions, such as when they feel happy or what they find disgusting, while playing the game *Emotions*, a game where emotions must be matched to facial expressions. Similarly to the second category, these types of connections to the real world might be relevant for understanding the procedural rhetoric, as they likely help in linking things that happen within the game to real-life situations.

Moreover, two teachers believed that the children did make real-world connections, while two others thought they did not. Four teachers mentioned that they think it depends on the specific child and game. Interviewee 8 for example mentioned: “Sometimes I have the feeling they understand it, but other games are maybe a bit too abstract, and then I think they do not make such a connection”. Contrary to this, real-life connections were rarely observed in Level 5 games, which might be due to the clear goal of those games (e.g. learning math skills), which allows for less exploration within the games. Hence, it is expected that games with some rules and a goal, that still allow for some freedom in interpretation, might enhance creativity, which may foster making connections to things children know from real life.

4.2.5 Learning skills through playing the games

It was observed that children engaged in learning several skills while playing the games, mostly involving social-emotional skills and educational skills, but also learning about action-reaction was observed. Moreover, almost all teachers mentioned that several skills (e.g. becoming better in playing the

game, motor skills or social-emotional skills) improved over time, and some skills were also transferred to real life. However, almost all teachers agreed that the *Tovertafel* serves as a tool for skill development and that children practice skills both while playing the *Tovertafel* games and in other activities outside of the game. The teachers thus suggested that skill improvement is not necessarily only attributable to playing the games but is instead reinforced through multiple contexts.

Looking at the specific skills learned, several social-emotional skills were practiced while playing the games, such as waiting for your turn, dealing with losing and/or learning about and dealing with emotions. Waiting for your turn was the most frequently observed skill that was practiced, likely because several teachers did support this by, for example, assigning turns to the children. As part of the learning process, teachers almost always addressed it when a child did not wait for their turn, hence, making consequences for this behaviour. This aligns with the results of the interviews, as waiting for their turn was one of the specific skills teachers mentioned they saw improving. Additionally, especially in Level 4 games, children were observed learning social-emotional skills such as handling losing and learning about and/or dealing with emotions. Again, these skills were mostly learned when the teacher focused on these skills. For example, teachers intentionally let a child win or lose to see how they would react, and, for example, praised the children for not getting angry when they lost. Overall, social-emotional skill learning was not much observed. However, it is possible that certain social-emotional skills are learned over time and are thus missed within the rather short time span of the observations. Adding to this, most interviewees noted that children may not always realize that they are learning social-emotional skills while playing. Interviewee 6 stated: "Some things they learn during the games, for example, that there are consequences related to certain things you do, are becoming part of their basic skills, and they likely will not know that themselves, but they will still use those skills in real life." However, while teachers saw skill improvement, they also noted that some children struggled to transfer them to real-life situations, especially for abstract games. It thus remains unknown whether the children transferred the learned social-emotional skills to real-life situations or not.

Learning educational skills was observed more frequently than learning social-emotional skills. What became apparent is that children, apart from the games designed for educational purposes, often started implementing skills such as counting, naming colours, objects, animals, foods or shapes or imitating sounds in games that did not necessarily have this implemented in the rules or initial goals of the game. Especially in Level 3 games, it was often observed that children started naming all the objects (e.g., shapes or animals) they saw without it being mentioned that they had to do this, for example with memory-like games such as *Duos*, *Farm Pairs* or *Monster Pairs*. Colour and/or object naming was also visible in Level 4 games, although to a lesser extent. In Level 5 games, on the other hand, the educational skills that were learned often corresponded with the goal of the game, for example when the children

learned about letter recognition during *Letter Board*. Further, during Level 2 games, it was not observed that the children learned educational skills, which was not surprising, as those games do not allow for learning such education skills as there are no objects that can be named or counted for example.

Additionally, apart from learning social-emotional and educational skills, children also learned to interact with the game. Teachers also recognized action-reaction as a skill that improved over time. Learning about action-reaction was mostly visible in Level 2 games, which are also the games that are mostly based on reactions of the children. It was, for example, several times observed that children walked through the bubbles in the game *Bubble Bath*, looked behind them to the ground to see what happened with the bubbles, and then started experimenting with walking faster or slower, to see how the bubbles reacted on these different movements. The higher the level of the games, the less frequent learning about action-reaction was observed, which seem logical as those games are generally not that much based on reactions of the children. Additionally, another possible explanation is that most children already had a higher cognitive level or age when they were playing the higher-level games, indicating that they might already be familiar with the concept of action-reaction.

The observations thus show that mainly learning social-emotional skills can greatly benefit from guidance while playing the games. Interview results align with this, as teachers stated that children need guidance to fully benefit from the games and to be able to apply the practised skills in real-life situations. However, it was also observed that children could play most games without guidance, which can even spark creativity. Without guidance, some children started to implement their own learning goals, which could also be educational ones. Although these self-created learning goals might differ from the game's intended learning goal, this suggests that guidance is not always necessary for skill development through the games of Tover.

4.3 Social aspects of playing games

The following section discusses the results regarding the social aspects of playing games and the potential influence of these aspects on the understanding of procedural rhetoric. First, the results about the type of multiplayer game, either competitive or collaborative, are presented, after which the results regarding the emotions of the children while playing are mentioned.

4.3.1 Children's understanding of competitive games

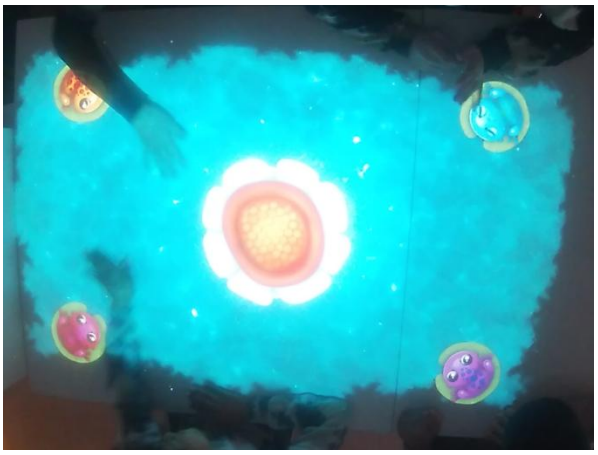
There were several games with a competitive nature included in this study. The observation showed that children more often adhered to the competitive nature of the game than they did not adhere to

it. Interview results support this, as six interviewees stated that they believed children understood the competitive nature of games. Interviewee 4 even mentioned: “The competitive nature is way more present in these children than their ability to work together”, indicating that the children are likely able to understand the competitive nature themselves. Interestingly, the three teachers who did not mention that the children understood the competitive nature were all from Location 2, which aligns with the finding that children at this location were less likely to understand the competitive nature. Besides the younger ages of these children, guidance may be an influence in this understanding. At Location 1 for example, teachers almost always explained the games beforehand, also elaborating upon the competitive nature, while at Location 3, children often recognized competition, which might be due to prior explanation of teachers, maybe even before the observations took place. At Location 2, in contrast, children likely had to figure out the competitive nature themselves due to the limited guidance. Beyond age and guidance, interviewees also highlighted that the way competition is presented might influence children’s understanding. They noted that when a game showed the winner with visuals, such as a frog jumping to the middle in *Frog King*, children were more likely to understand that the game was competitive compared to when a game displayed the score with numbers. This was also reflected in the observations.

Adhering to or not adhering to the competitive nature was mostly observed while playing Level 4 games, which was not surprising, as almost all Level 4 games have a competitive nature, while the other level games only have a few competitive games included. *Soccer Game*, a game in which a soccer match is simulated, did stand out as the game where competition was most understood or misunderstood. Some children recognized winning and losing which they expressed with emotions or by cheering when they won, and some children even tried to distract others to gain an advantage. Others, however, scored on both sides and cheered regardless of which side the goal was on. Hence, it seemed like they did not understand the competitive nature. Although less likely, some children might have purposely ignored the competitive side of this game. Further, *Frog King*, a game in which the children must catch flies with the tongue of their frog, was the only game for which it was observed that children always did understand the competitive nature of the game. Children often tried to shove their frog to the middle when they were waiting to see which frog won the game (see Figure 9), indicating that they did understand that one of them could win the game. For all other games, there were always children who did understand the competitive nature and children who did not understand it. A plausible reason for this might be the difference in cognitive levels. Overall, children seemed to like playing competitive games (see Table 7), and although the reason for this is unknown, this might be because of the excitement this competitive layer brings to the game. Children were often quite involved when playing a competitive game and were eager to find out whether they won or not when playing games such as *Minecarts* or *Frog King*.

Figure 9

Snapshot of one of the observations were the children tied to shove their frog to the middle at the end of the game



4.3.2 Individual and collaborative play in group settings

Within the context of this study, there were no games that required collaboration, nevertheless, several allowed cooperation to, for example, reach a goal easier. Regardless, it was most often observed that children played individually while playing in a group. In these cases, children rarely acknowledged the other children present or pushed them (or their hands) away when they wanted to play on their own. The interviewees also mentioned that children more often play individually while in a group than that they worked together. Interviewee 7, for example, mentioned that in her class, children simply do not know how to play together, as their cognitive levels are not developed enough to understand working together toward a goal. Nevertheless, there were also moments observed in which children did actively play together, which happened mostly when guided by teachers. Sometimes children engaged in collaborative play themselves, for example by asking the teacher, researcher or other children to join in playing the game, indicating that they would like to play together.

Aside from asking others to join, the children also showed other social behaviours related to playing collaboratively. For instance, it was several times observed that children imitated each other's behaviour, which was mostly seen in Level 3 games, and not at all in Level 5 games. This may be because Level 3 games allow for creativity while playing, leaving room for children to imitate others. An example of such behaviour was when two children were observed playing *Candy Fish*, where one of them was mostly directing the fish to the candy, and the other one was mainly watching. The child that was watching started to scream when the fish deflated for the first time. When the fish deflated again, the other child also started to scream. In response, the child playing started to purposely deflate the fish, and

the reaction of both children became more intense every time the fish deflated. At one point, one child started to run in circles while screaming when the fish deflated, which was again imitated by the other child. It seemed like the children were trying to outdo each other, so they screamed harder and harder and ran more and more circles the longer this was going on. When children showed such imitating behaviour, they thus acknowledged the other child(ren) present and possibly tried to create a way of playing together.

Moreover, helping behaviour was also observed, for which helping others was most often observed. Children helped others by pointing to a place or an object, indicating that the other child had to perform an action there. For example, when playing *Steam Train*, a game in which objects fall onto a train rail that have to be taken away, some children pointed to the object on the rails in front of another child, indicating that that child was supposed to get the object away. Moreover, a few children did sometimes ask for help, however, this was mostly because the teacher present prompted that the child could ask for help. As asking for help was rarely indicated by a child themselves, guidance seems crucial for such behaviour. Additionally, four of the teachers mentioned they do sometimes see the children explaining rules to others, either verbally or physically. Interviewee 7 for example mentioned that one of their children sometimes pushed a child away who does not play according to the rules, while they might not do this when the other child is playing according to the rules. During the observations, it was observed that some children indeed explained rules to others as a way of helping, though this happened less often than physically helping others. One child was almost half of the time involved when rule explaining was observed. When she was playing *Frog King*, a game in which flies have to be caught with the tongue of a frog, she made comments such as “Fast flies are harder to catch” or “You have to do it with your fist, that works better”. With those comments, she likely tried to help the teacher and researcher (with whom she was playing the game) to become better in the game, as she always won when playing this game. This child was one of the oldest children observed and had quite a high cognitive level compared to other children, which might be the reason this behaviour was not often observed in general.

Lastly, there were also several negative experiences observed when playing in groups. One child specifically mentioned he would rather play alone than together with other children. Additionally, children often did not want to share, which resulted in behaviour where children pushed away other’s hands or were telling others to leave. Comments were made like “No, this is mine!” or “No, this is my side!”. This behaviour shows that children do sometimes have difficulties with playing together, which is understandable due to their low cognitive abilities. Interestingly, when someone was commanded to, for example, leave, these children often accepted that they could not play for a while or went back to their side of the playing field without indicating that they did not like the way it was told to them.

4.3.3 Children's emotions while playing

While playing the games, the children expressed several different emotions, both positive and negative. Moreover, it was several times observed that children expressed eudaimonic emotions. Eudaimonic feelings were mostly observed when children reached a goal, which could either be the goal of the game or the goal the children made up for the game. For example, children were often happy when they made the right match in memory-like games such as *Farm Pairs* or *Sound Memo* and started cheering or saying "yeah" when this happened. Eudaimonic feelings were also evident in competitive games. For example, children were extremely happy when they won the game *Frog King* and started cheering or clapping their hands when their frog became the king. These emotions were observed across all game levels except Level 2. This might be because Level 2 games often do not have a clear initial goal for the children, hence, it is harder to either express eudaimonic feelings as mentioned above, or to observe these feelings. Although all teachers mentioned that the children only show basic, more hedonic emotions, they mentioned that they do sometimes see that the children are proud because they achieved something or are happy because of the reward they got when they were asked if the children might show some deeper emotions. Thus, teachers acknowledged some eudaimonic feelings in the children when playing games, similar to what was observed during the observations.

Further, positive emotions were more often observed than negative emotions when the children played the games. Positive emotions mostly involved children laughing during the game or physical expressions of joy, such as shaking, dancing, or clapping hands. This aligns with what all teachers mentioned in the interviews, as they observed that children were mostly happy, enthusiastic, or amazed when playing the games. On the other hand, teachers also mentioned that children do express negative emotions, such as disappointment, anger, or frustration, particularly when they lost a game, which was also noted during the observations. Frustration was the emotion most often observed, often triggered by a game that was turned off, not getting the right match in memory games, or a game that did not work in the way they wanted it to. Interestingly, frustration was most often observed in two competitive games. In *Soccer Game*, children got frustrated when they were not able to score or lost the game in general, and in *Frog King*, they got frustrated when they did not get the flies they wanted to catch, which resulted in hitting the frog more aggressively. Some teachers mentioned that children also became frustrated when they did not understand a game, however, this was not observed during the observations. Instead, children seemed to create their own gameplay when they did not understand a game. Interviewee 3 thought it depends on the motivation of the children whether they get frustrated or not when they do not understand a game, as some children just walk away when they do not understand it. Further, other negative emotions observed were disappointment or sadness, mostly when a game was turned off or when the game did not go as the child wanted it to go. Mainly during Level 2 and Level 3 games, boredom was another emotion

sometimes observed, which children showed by, for example, asking for another game. One child specifically mentioned he did not have fun when playing *Sandy Beach*, because it was not exciting enough, indicating he was bored. As being bored was rarely observed during Level 4 or Level 5 games, this emotion might have been caused by the games being too easy.

4.4 Insights from teacher observations

Apart from the results shared in previous sections, the interviews with teachers also highlighted additional aspects not noted during the observations. These aspects include reasons for using the *Tovertafel*, reflection, and the difficulty of the games. First of all, only five out of eight teachers mentioned they do use the *Tovertafel* to teach certain skills or behaviours which is the intended goal of these games. Most used it to learn social-emotional skills or educational skills, while one teacher mentioned they use it for the development of sensorimotor skills. Further, two teachers mentioned they used it for relaxation, and other reasons named for usage of the *Tovertafel* were activation, creating a contact moment, having some differentiation in the classroom or a nice addition to the lessons, or having something fun in between the classes. It can thus be seen that the *Tovertafel* is used for quite some different reasons.

Regarding reflection, three interviewees mentioned they do reflect on the games, while the other five mentioned they did not. During the observations, it was also rarely observed that teachers reflected on the game's goals or on the skills that could be learned. One teacher mentioned they reflect by asking what can be done differently the next time to prevent certain outcomes of a game, while another mentioned they pause the game and ask the children what they did or saw for example. The third teacher gave an example of how they reflect, and mentioned they might say "Good job, you found it!" when playing *Sandy Beach*. Moreover, two interviewees noted that reflecting likely aids in understanding the underlying message of the games. Interviewee 6 stated: "When you come back to something, the children can grow and learn from it, which is very crucial". However, two interviewees mentioned that reflection is not possible for the children in their class, as their cognitive levels are too low to be able to understand such reflection.

Lastly, another subject that came up during the interviews was the difficulty of the games. Several interviewees mentioned they thought some games were too difficult for the children, which was also observed. Interviewee 2, for example, mentioned that quite some games require high skill levels or intellectual thinking that the children in their class have not developed yet. Two interviewees mentioned that mainly educational skills, such as reading, spelling and mathematics are too difficult for the children, which might possibly be a reason why Level 5 games were played less often. Although teachers likely

know the children's capabilities, observations showed they sometimes underestimated the children's capabilities regarding educational skills. For instance, teachers sometimes mentioned that the child was likely not able to solve mathematical sums, while the child showed that they were able of solving simple sums with some guidance. This raises questions about whether all teachers challenge the children to practice certain skills.

5. Discussion

This study aimed to explore whether children with varying cognitive disabilities demonstrate an understanding of procedural rhetoric within serious games designed for social and emotional learning. The results suggest that these children can show signs of such an understanding, though the context is of importance for this demonstration. This section provides a thorough discussion on the results of this study, followed by theoretical implications. Limitations of this study and future research directions will be elaborated upon as well, and lastly, practical implications will be discussed.

5.1 Discussion of results

Within this section, the results of this study will be discussed based on existing literature. It starts with an analysis of game preferences, followed by a review of findings on procedural rhetoric. The social aspects of playing games with procedural rhetoric are explored after, including the role of different multiplayer gameplay types, emotions and reflection for understanding these games.

5.1.1 Preference for games

Several children showed strong preferences for specific games. Since all children had already played these games for at least one year before the observations took place, this preference is likely related to familiarity. Some children knew exactly where to find a game on the screen and immediately directed the teacher to their choice. Sweller (1994) suggests that familiarity reduces the attention required to focus on a task, as the task becomes more automated. From a cognitive resource perspective, this suggests that children had more cognitive resources available for other aspects of gameplay, such as enjoyment or striving to win. However, while it seems likely that children with cognitive disabilities choose games that minimize cognitive load, this assumption may be too complex for this target group. Instead, these children might just simply choose what they like the most based on previous experiences, which aligns with the mere exposure effect. This effect states that repeated exposure to a stimulus

increases the attitude towards it (Zajonc, 1968), and because these children already played these games often, they likely developed a preference for certain games.

In addition, children most often chose Level 3 or Level 4 games, which were middle-level games in terms of difficulty. According to the Self-Determination Theory, this choice may have been intrinsically motivated, as these middle-level games likely provided the right balance of challenge and enjoyment (Uysal & Yildirim, 2016). These games allowed the children to work towards a goal that levelled with their competence, making the challenge manageable and leaving room for enjoyment of the game. The observation that younger, less developed children favoured Level 3 games, while older, more cognitively developed children favoured Level 4 games supports this, as it indicates that they likely chose games related to their competencies. In line with Gee (2003), these results suggest that people like to play games that are adjusted to their abilities and preferred learning styles, hence, more cognitively developed children are more likely to choose higher-level games. Similarly to Plass et al. (2015), these findings thus emphasize the importance of designing serious games that consider the cognitive level of the players.

5.1.2 Procedural rhetoric

To this day, little research is performed on the topic of understanding procedural rhetoric as a player. In this research, procedural rhetoric is analysed through several different aspects, namely the rules and goals of a game, a connection made to real life, and learning skills through playing the games. These aspects will be discussed separately, after which the role of guidance in understanding procedural rhetoric is addressed. Lastly, all aspects are combined to be able to answer the first sub question of this study.

Regarding the rules and goals of a game, Bogost (2008) implies that, according to his definition, following the rules and striving to reach the goal when playing games is important for understanding its procedural rhetoric. However, this study shows that children can still learn from a game's procedural rhetoric even without strictly adhering to the rules or fully grasping the goal. Regardless, children who demonstrated an understanding of the rules and goals were more likely to understand the procedural rhetoric, aligning with Sicart's (2011) research. The results further suggest that older, more cognitively developed children demonstrated greater understanding by behaviours like verbally recognizing or explaining the rules/goals. This suggests that cognitive development plays a significant role in how well children with cognitive disabilities can grasp procedural rhetoric. While this is suggested in some research (de la Hera, 2013; Ypsilanti et al., 2014; Watanabe & Funahashi, 2018), it was not researched yet.

Moreover, as Sicart (2011) noted, players of a game can behave in ways not intended by the game, which indeed happened in this study as children created their own gameplay. Rather than engaging with the intended procedural rhetoric of a game, these children interpreted and interacted with game mechanics in their own way, suggesting that procedural rhetoric may not always function persuasively for

this target group. The Self-Determination Theory suggests that children may create their own goals to experience autonomy, which enhances intrinsic motivation (Ryan et al., 2006) and possibly makes playing the game more joyful (Ryan et al., 2006). Another, more likely, possibility is that young children, who often struggle with abstract thinking (Malik & Marwaha, 2023), might simplify some goals to make them more understandable. Moreover, some gameplay observed included bending rules, which might be explained by the fact that children with special needs often seek a sense of control (Overskeid, 2016). Some children got frustrated when they were not able to perform this playful disruptive behaviour, strengthening this point. Children further showed repetitive behaviour, which is not atypical for children with ASD (Militerni et al., 2002). Sometimes, this repetitive behaviour can become rather obsessive (Jiujias et al., 2017), which was indeed observed. However, as children were most likely playing for fun rather than to understand the procedural rhetoric, this behaviour might also be explained by stimming, as "stimming acts as a self-regulatory mechanism to help relieve anxiety, anger, fear and excitement" (Masiran, 2018, p.1). This type of behaviour can, nevertheless, get in the way of learning through procedural rhetoric, as the children then fixate on specific game elements that are not necessarily relevant to the intended message. In general, these findings support the research of Jacobs et al. (2020), who mentioned that procedural rhetoric is only convincing when the gameplay finds a balance between the user's cognitive limitations and the simulation's depth. This study adds that when this balance is not there for children with cognitive disabilities, they might create their own gameplay, through which they can still engage in learning, though not necessarily in line with the intended procedural rhetoric.

As for the connection to the real world, against expectations, children often made associations with real-life experiences while playing, connecting the game and the real world. Stevens et al. (2008) suggested that transfer between a video game and the real world could be better seen as an intentional action carried out by a child than an automatic process that occurs in the mind. Similarly to their research, this study found that children often imitated real-life actions within the game that they learned outside the game. According to the affordance theory (Cardona-Rivera & Young, 2013), it is likely that the objects' affordances of the objects visible within the games allowed the children to perform such real-life actions. By recognizing how these objects were typically used, the children might have been inclined to interact with them in familiar ways. In general, connecting the procedural rhetoric of a game to the real world is useful to be able to translate the learning to real life (Ypsilanti et al., 2014), however, the connections these children made did not always relate to the procedural rhetoric of the game and might thus not be that useful for translating learnings to real life. Nevertheless, some connections might deepen engagement or help in linking game aspects to real-life situations, which might be useful for understanding procedural rhetoric. Additionally, some children showed abilities to suspend disbelief, which means that these children were able to engage with the game as if it were real, while still understanding that the game

world differs from the real world (Muckler, 2017). Importantly, suspension of disbelief can enhance immersion in the game (Muckler, 2017), which in turn can enhance learning (Mikropoulos & Natsis, 2011), thus, might support understanding the procedural rhetoric of games.

Regarding learning skills, it was observed that certain social-emotional skills were learned by playing the games, which supports the research of Bellotti et al. (2010) by indicating that games can be good learning methods. As elaborated upon later, guidance played a crucial role in learning such skills. Further, the ability to learn certain skills is also highly related to age. For example, typical children start to recognize emotions around 12 to 18 months old, while it takes till 30 to 54 months to learn skills like impulse control (Malik & Marwaha, 2022). As there were multiple children with cognitive ages of 3 years or younger, whereas only a few had cognitive ages between 3 and 5 years old, this might explain the differences in the children's ability to engage with procedural rhetoric aiming at learning such skills. Further, as the children were not observed outside the context of playing with the games, it remains unknown whether the skills the children learned during playing also translate to real life. Teachers think that the skills do, in fact, translate to real life, supporting the research of Anderson (2019) and Ndulue and Orji (2022) by indicating that using procedural rhetoric in games can be beneficial for behaviour change. Apart from the social-emotional skills, it was also observed that children developed educational skills while playing, even when the game did not explicitly encourage them to do so. This aligns with previous research showing that children naturally engage in mathematical learning during free play (Dockett & Perry, 2010). The present study extends this understanding by demonstrating that children with cognitive disabilities are also capable of engaging in such spontaneous learning. This suggests that even when the main proposed procedural rhetoric is not related to educational skills, such games can still provide opportunities for skill development.

For children with cognitive disabilities, guidance seems to play a huge role in whether they are able to understand procedural rhetoric or not, supporting the research of Wendel & Konert (2016). For all different aspects of procedural rhetoric, guidance is shown to be of importance: children are better able to understand the rules and goals of the game when a teacher explains them, a teacher could help the children make meaningful connections to the real world based on the procedural rhetoric of the game, and teachers could help in learning social-emotional skills, as well as translating these skills to real life. Gekker (2012) mentioned that guidance in playing games with procedural rhetoric can result in learning the procedural rhetoric based on the interpretations of the guide, and this was indeed also observed in this study. Children mostly engaged with learning skills that the teachers wanted them to learn, although they sometimes engaged in learning skills independently. Generally, social-emotional skills are also learned through guidance in situations aside from these games, suggesting that children likely need support, either within the game or from an external source, to effectively learn these skills while playing. Moreover,

children generally not play such games on their own without a teacher present, which is also encouraged by Vandermaas-Peeler et al. (2018). Hence, this guidance can be beneficial for children to learn social-emotional skills through the procedural rhetoric of the games and should be recognized as such.

To conclude, the relationship between understanding procedural rhetoric and learning social-emotional skills for children with cognitive disabilities is a complex one. However, a connection between the two seems to exist, with guidance and cognitive levels of the children playing a crucial factor in the understanding. Some children were able to express the rules or goals of a game, could make certain connections to the real world, and learned skills from playing the game, indicating that they, although likely unconscious, were able to grasp the procedural rhetoric. To answer the first sub question: "*Is understanding the procedural rhetoric of games needed for learning and gaining social and emotional skills for children with special needs (specifically cognitive disabilities)?"*, the results of this study imply that understanding the procedural rhetoric of the games is not necessary to learn social and emotional skills from it. This is contrary to the findings of Anderson et al. (2019), who suggested that the players do understand the procedural rhetoric, which was likely the reason the players learned from the games. Additionally, this study found that serious games led to a better understanding of procedural rhetoric compared to games classified as serious play, likely due to their more structured nature. Thus, focusing on serious games may be more effective for studying procedural rhetoric.

5.1.3 Social aspect and procedural rhetoric

The relationship between social aspects of playing games and procedural rhetoric has not been explored until now. This study examined different types of multiplayer games that incorporate procedural rhetoric, the emotions children experience while playing, and the role of reflection in understanding procedural rhetoric. Those topics will be further discussed in this section.

Firstly, regarding types of multiplayer gameplay, children with cognitive disabilities were able to understand the competitive nature of a game, though only when the winner of the game was made visible with visuals rather than a score displayed in numbers. Likely, the score displayed in numbers was too difficult for these children to understand due to difficulties with reading. As previously suggested, these results indicate that procedural rhetoric should be adapted to the user's cognitive levels, as Jacobs et al. (2020) also proposed. Further, in line with Plass et al. (2013), who found that competitive play can enhance in-game learning, it seemed like the children were able to learn social-emotional skills from competitive games. A competitive layer might even enhance engagement and excitement, as children created competitive gameplay in games that did not have a competitive nature. Moving on to collaborative play, this was, against expectations, rarely observed. Most children were immersed in their own world, which might be due to autism-related tendencies (Brennan et al., n.d.). Some children did

engage with imitating behaviour, and a few showed helping behaviour, although the latter was mainly when there was structured guidance. This aligns with Parten's (1932) stages of play, which outline six different stages that children go through when playing in groups, with solitary play being most visible in children aged 2 to 3. When the children get older, they start to acknowledge others more and more, starting with watching others, imitating others and around age 4 to 6, they start interacting with others. Limited helping behaviour might, in turn, be due to autistic tendencies, as children with autism tend to lack social awareness (Brennan et al., n.d.).

Although there were aspects of collaborative play visible, the second sub question cannot be answered based on these results, as the question posed was: "*How does the type of multiplayer game (collaborative vs. competitive) relate to the understanding of and learning through procedural rhetoric within games for children with special needs?"*. However, what became visible is that, in the context of this study, children tend to be able to learn specific social-emotional skills when playing a competitive game, and when guidance was present, they likely understood that they could learn from these games. Additionally, these results support the suggestion of Gekker (2012), who mentioned that the meaning of the game in a multiplayer game is not only embedded in the rules and mechanics, but also in the way the players interact with each other. Player's interactions indeed did play a role in reinforcing the game's procedural rhetoric, as skills such as working together were not observed to be learned as the children did not engage in such interactions with one another.

Looking at emotions, the children expressed both hedonic and eudaimonic emotions while playing the games. Children often wanted to replay games in which they experienced positive hedonic emotions, and even negative hedonic emotions (e.g. frustration) sometimes led them to play again. As also suggested by Poels et al. (2012), hedonic emotions thus seem important for engagement when playing games, and in line with Hollebeek et al. (2022), the findings suggest that these emotions help with keeping players invested. Increased engagement likely leads to more exposure, giving children more opportunities to interact with the game's mechanics. Those repeated interactions can over time help in understanding the underlying message or skills. Furthermore, although initially uncertain, this study aligns with van Heerwaarden et al. (2022) in showing that individuals with cognitive limitations can indeed express deeper emotions. Those emotions were often related to the game's story or perceived cognitive challenges within this study, which is in line with the research of Tear and Nielsen (2013). Eudaimonic emotions thus tend to emerge when children achieve goals closely related to the game's intended message. To answer the third sub question "*Is there a relation between the understanding of procedural rhetoric and the feelings of hedonic and eudaimonic feelings amongst children with cognitive disabilities playing serious games?"*, it seems like both hedonic and eudaimonic feelings are related to the understanding of procedural rhetoric. Eudaimonic feelings are more directly related, as those feelings

are often evoked when the children engage with the game's deeper meaning, while hedonic feelings are more indirectly related, as they are important for engagement and motivation, helping to ensure that players are involved and want to keep playing, which is important for being able to understand the procedural rhetoric over time.

The fourth sub question of this study was "*Is reflection crucial for the understanding of procedural rhetoric for children with special needs?".* This question was included because previous research suggests that reflection can help players connect their game experiences to deeper meanings, including the procedural rhetoric embedded within the game (Anderson et al., 2019; Ferrari, 2010). Reflection has also been linked to improved social-emotional learning (Cohen, 2001; Williams, 2019), making it a relevant factor to explore in the context of this study. Nevertheless, the role of reflection on the understanding of procedural rhetoric could not be investigated based on the results of this study. Although the games of Tover allow for reflection, it is not an essential part of the game. Observations showed that teachers rarely engaged in explicit reflection with the children, such as discussing the goals of the game or the skills the children could learn. While the teachers did mention in the interviews that they sometimes reflect on these aspects, the context of the observations may not have allowed for this reflection. Time constraints and groups of children with different cognitive levels (which will be further discussed in section 5.3) might have left little room for reflection. In general, it was not expected that the children would show reflection without guidance, as this is a difficult process relying on metacognition (Goupil & Kouider, 2020). Given that guidance seems to play a huge role in understanding procedural rhetoric for these children, future research could explore how incorporating structured reflection within guidance influences children's learning outcomes when playing games with procedural rhetoric.

5.2 Theoretical implications

In general, procedural rhetoric is often looked at from a game mechanics perspective, focusing on how developers can design persuasive systems (Bogost, 2008; Custer, 2017; Maqsood et al., 2018; Matheson, 2015; Sicart, 2011). However, less attention has been given to how players interpret and engage with these mechanics, apart from studies of Anderson et al. (2019) and Ndulue and Orji (2022). This study contributes to ongoing research by shifting the focus from procedural rhetoric as a persuasive tool to procedural comprehension, a new term suggested to describe how players perceive and make sense of game mechanics. While procedural rhetoric is originally conceptualized as a means for games to persuade players through their rules and mechanics, this perspective assumes that players engage with these rules as intended. However, this study showed that children with cognitive disabilities often reinterpret or repurpose mechanics in ways that do not align with the game's original persuasive intent.

Rather than assuming that games "convince" players through procedural rhetoric, procedural comprehension captures the idea that players actively create own meaning from game mechanics and thus relates more to how they interpret and internalize the actions and messages conveyed by those mechanics. This reframes the discussion from the developer's intended design to the player's cognitive process.

This study further investigated a previously unexplored target group and examined whether procedural comprehension is necessary for learning social-emotional skills in children with cognitive disabilities. The findings suggest a relationship between understanding procedural rhetoric and learning social-emotional skills for these children, however, it seems to be a rather complex one, as guidance plays a crucial role, and the level of cognitive disabilities matters as well. There are thus signs that children with cognitive disabilities are able to learn via the procedural rhetoric of games, but likely in ways differing from prior assumptions when connecting procedural rhetoric with learning outcomes. The cognitive factor that is thought to be needed to connect the procedural rhetoric of a game to the real world might, for example, not be so critical. To add to this, procedural rhetoric research has mainly focused on adults until now, with only a few studies (e.g., Maqsood et al., 2018; Vermeulen et al., 2022) addressing the target group children. This study thus adds to the body of research looking at children and procedural rhetoric, thereby emphasizing the importance of considering different target groups when studying a concept. Children are less cognitively developed compared to adults, hence, in this case, procedural rhetoric might be differently received by both groups.

This study also contributes to the ongoing discussion on whether procedural rhetoric is useful for behaviour change. Adding to the research of Anderson et al. (2019) and Ndulue and Orji (2022), it is suggested that procedural rhetoric seems useful for behaviour change, as children were able to learn specific social-emotional skills due to the rules and mechanics of the games. However, guidance was crucial for this, and the games were seen as a tool to help with learning, as such skills were also practised at other moments apart from playing with the games. Hence, it remains unclear whether the games on their own can "teach" social-emotional skills to children with cognitive disabilities. Additionally, this study adds to the research investigating whether understanding procedural rhetoric is needed, which, to my knowledge, only Anderson et al. (2019) have done. Although this study does not have a clear answer, it brings new insights into this research field. For example, whereas Anderson et al. (2019) mention that within their study, the participants were likely to actively understand the procedural rhetoric, this study suggests that there might not be such a clear understanding, which is perhaps also not needed. Also, this study adds that guidance seems to play a crucial factor in the understanding of the procedural rhetoric, which is not investigated by Anderson et al. (2019), possibly due to their different target group.

Moreover, this study is one of the first to investigate the connection between social aspects of playing games and procedural rhetoric. The results imply that social aspects, such as the type of game or

different emotions evoked while playing the game, are important to take into account for future research about procedural rhetoric. It is suggested that playing competitive games might be beneficial for the understanding of procedural rhetoric, however, there are also other types of gameplay (e.g., collaborative play) that might be interesting to research as this was not possible within the current study. Regarding emotions, this study suggests that both hedonic and eudaimonic feelings are important to take into account when studying procedural rhetoric, although they are each important for different aspects related to procedural rhetoric. Eudaimonic feelings likely support the understanding of procedural rhetoric, while hedonic feelings are more important for engagement with the games, where the latter aligns with findings from Poels et al. (2012) and Hollebeek et al. (2022). Overall, this study can be seen as a motivation to explore procedural rhetoric in a more social context, as it suggests that social aspects may influence the understanding of and learning through procedural rhetoric.

5.3 Limitations and suggestions for future research

As with most research, some limitations can be noted, and several of those related to the games used in this study. First of all, as there were forty-two different games included, it was challenging to analyse patterns across gameplay. The variety in game mechanics, objectives, and required skills made it harder to isolate the effects of procedural rhetoric. It is suggested to include a smaller sample of games in future research to be able to analyse the games in more detail. Moreover, procedural rhetoric was not always very strong within the games that were used for this study. This may have caused difficulties in determining whether children understood the procedural rhetoric, as weaker procedural rhetoric is generally harder to grasp than stronger procedural rhetoric. Generally, the higher-level games most often had stronger procedural rhetoric, however, not all children included in this study were cognitively developed in such a way that they could play those higher-level games, making it not possible to focus solely on the games with strong procedural rhetoric. For future research, it might be useful to either design games for the purpose of the study so the procedural rhetoric can be adjusted to the target group, or to use games that already have strong procedural rhetoric. Further, another limitation related to the use of these games was that during the observations, collaborative play was not observed. All the games could be played alone as well, hence, no games “forced” the children to play together. Also, some children in the target group were likely not able to actively engage in cooperative play with others due to their low cognitive ages. However, collaboration might influence whether and how the procedural rhetoric is understood, and it is thus important to also focus on this type of multiplayer gameplay in future research.

Further, although efforts were made to keep the play environment in which the children used the *Tovertafel* as close as possible to their natural playing environments, some minor adjustments were made

that may have influenced their behaviour. For example, some children were distracted by the camera or had difficulties with the presence of the researcher. Some even asked if they were being assessed on their skills, and although it was explained that this was not the case and it did not matter whether the children did something right or wrong, it might have still influenced their behaviour. This increased awareness of being observed, also referred to as the Hawthorne effect (Oswald et al., 2014), might have led them to focus more on performing well or improving their skills. Nevertheless, such behaviour changes were likely minimal and mitigated by observing the children multiple times. Moreover, direct observations helped to gain insights into the children's emotions and behaviours that might not have been captured through recorded play sessions alone. Thus, the benefits of this method likely outweigh the potential influence of the Hawthorne effect.

Another limitation is that some children played in groups that would normally not play together. Due to time constraints, it was sometimes decided to group children with permission together rather than observing them individually, however, for some children, it was difficult to work with others they barely knew or with whom they were not used to play with. This regrouping also sometimes resulted in great differences in capabilities between children playing together, which might have influenced the results as well. In future research, it is recommended to allocate more time for observations and allow children to play in their natural context without adjustments. Minimizing external influences, such as altered group dynamics, is important to ensure that the children's behaviour reflects their typical play patterns as accurately as possible. Moreover, there were also time constraints on the individual observations, as they took place in between classes or other activities. This is also how the locations normally use the *Tovertafel,* however, for this research, sometimes multiple groups of children were fitted into one time frame. Those time constraints made it impossible for the researcher to try to reflect on the game with the children when teachers did not do this, and very few interviews could be conducted with the children due to these time constraints, as the children often had to go back to their usual program after an observation. It is thus advised to schedule more time for observations in the future. Related to this, due to overall time constraints of this study, it was not possible to assess whether the children's social-emotional skills improved through playing the games. Teachers indicated that, over time, most children show improvement in these skills, hence, future research could explore whether and how procedural rhetoric contributes to this process, potentially through longer-term studies whereas possible.

Based on the results of this study, several other recommendations for future research can be made. To begin, more research is needed on children and procedural rhetoric, as the cognitive levels of children and adults differ, and it seems like these cognitive levels play a role in how procedural rhetoric can be understood by the players. A direct comparison between these two groups might be useful to delve deeper into the relationship between cognitive levels and procedural rhetoric. Additionally, further

investigation into the role of guidance in relation to procedural rhetoric is needed, as this study suggests that there is a crucial role of guidance in the understanding of procedural rhetoric for children with cognitive disabilities. This role of guidance may also influence how procedural rhetoric is conveyed, so further research is necessary. Further, future studies should also focus on the social aspects of playing games in relation to procedural rhetoric. It is for example interesting to investigate whether the persistence of certain emotions might influence the understanding of procedural rhetoric, as it is already known that eudaimonic feelings tend to stay longer than hedonic feelings. Future research could also explore whether eudaimonic feelings are necessary for understanding procedural rhetoric by comparing games designed to (likely) evoke eudaimonic feelings with games that are less likely to evoke these feelings. However, designing games that incorporate procedural rhetoric without evoking eudaimonic feelings may be challenging, so it is essential to first determine whether this is feasible.

Additionally, it would be useful to investigate how games with procedural rhetoric specifically influence the development of social-emotional skills, as these skills are also practiced in other aspects of real life. Almost all teachers mentioned that they use the *Tovertafel* as a tool to help in learning these skills, hence, future research can focus on the role of serious games with procedural rhetoric in learning social-emotional skills for children with cognitive disabilities. Related to this, it remains unclear whether procedural rhetoric is the cause for behaviour change within these children, or whether there might be something else about the games that causes this change in behaviour. Future research could specifically examine whether procedural rhetoric can directly cause behaviour change or if it primarily supports behaviour change without being sufficient on its own.

Moreover, specifically for research including children with cognitive disabilities, several suggestions for future research can be given. The target group of this study consisted of children with several different cognitive disabilities, however, it might be interesting to look into differences between certain cognitive disabilities. Certain behaviour was observed within this study that is very typical for ASD, while this behaviour might be less typical for other cognitive disabilities, making it interesting for future research to look into the differences between these disabilities for the understanding of procedural rhetoric. Additionally, it is suggested to perform future research into certain behaviours that might undermine learning through procedural rhetoric. Repetitive behaviour is an example of such behaviour observed in this study which might take the focus away from the procedural rhetoric in the game, especially when it is obsessive. This might result in the children not grasping the procedural rhetoric or not learning the social-emotional skills conveyed through the procedural rhetoric.

5.4 Practical implications

This study provides several insights into how serious games with procedural rhetoric can be used for children with cognitive disabilities. One key finding is that children sometimes come up with their own gameplay that might be distinct from the original learning goal or message, highlighting the importance of considering how procedural rhetoric is understood. Especially because there is a great variety of ways in which the *Tovertafel* can be used, it might be beneficial to allow more flexibility, like the lower-level games in this study do. This acknowledges that children may understand and experience the gameplay in different ways, rather than enforcing a strict interpretation of the game's procedural message. When designing games, it is thus important to decide whether the procedural rhetoric needs to be interpreted in a specific manner or whether there is room for more flexibility, allowing for personal interpretation of the learning objective. Children will likely grasp and/or learn different social-emotional skills through play, and these skills may vary according to how each child comprehends the procedural elements. Allowing flexibility can still result in valuable learning, even if it does not align exactly with the intended outcomes.

However, without guidance, this approach may overlap more with regular play. For this, it is important to acknowledge that the strength of such games lies in their potential to guide players toward the desired learning goals, especially with the support of an adult. Since the learning goal is already embedded in the rules and mechanics, teachers and other facilitators can more easily guide the learning process, ensuring that the learning goals are met. It is thus recommended to make sure that the individuals who are guiding are aware of the underlying messages of these games. Needless to say, the facilities using the *Tovertafel* can decide themselves whether they will include this guidance or not, however, briefing the individuals who are guiding the children while playing the games enhances the chance that they will use the *Tovertafel* as a tool to empower learning in their classroom. Making the guides aware can be done by hosting an (optional) workshop when a *Tovertafel* is sold or by adding a folder with a clear guideline on how to best use the *Tovertafel* to optimize the learning outcome. The online environment Tover provides can also be used to bring across the importance of guidance on grasping the procedural rhetoric of the game, as well as sending out emails. Moreover, it would be beneficial to have regular check-ins, whether initiated by Tover or the facility, to ensure that both new and existing guides remain well-informed. Once aware, teachers can encourage children to reflect on the gameplay and connect their actions to real-world scenarios, fostering deeper comprehension of the procedural rhetoric. Teachers can also help the children with understanding how the game stimulates learning a certain skill through conversations around the gameplay, and can guide the children back to the intended learning goal when necessary.

In addition to guidance, the design of the games themselves is also important to ensure that children can connect with the procedural rhetoric of a game. Intuitive gameplay is especially important to

achieve previous mentioned goals, as this study found that intuitive gameplay that aligns with real-world experiences can help children make real-life connections. Those connections, in turn, are important for grasping the procedural rhetoric within a game and seem to help the children with learning. Design ideas such as object affordances and using recognizable objects worked best for making such connections with real life. Another design suggestion is to include real-life habits into the game, such as brushing your teeth or getting dressed, as already done for other target groups of Tover. Such behaviour is also recognizable for the children, possibly helping them in making a connection with the real world. Additionally, it is important to consider the varying cognitive levels of children playing these games. This is particularly crucial because younger, less cognitively developed children may struggle to grasp the procedural rhetoric and are often less likely to engage in social behaviours. When designing games, it is thus suggested that the difficulty of social-emotional skills increases with each level, ensuring that learning goals are achievable across different developmental stages. Although the games themselves were already structured with levels of increasing difficulty, and the corresponding social-emotional skills learned through the procedural rhetoric also progress with each level, it is suggested to create different levels within a game to ensure that all games can be levelled to the cognitive abilities of the children playing at that point.

Additionally, visuals and sounds seem to play a crucial role in conveying messages as well as in enhancing learning, as children tend to favour games with appealing visuals and/or sounds. These games were more often played, which might be beneficial for comprehension of the procedural rhetoric as well as for learning social-emotional skills. However, if children focus too much on the visuals and sounds, they may lose sight of the game's rules. Therefore, a balance is needed between engaging elements and the ability to focus on procedural rhetoric, for which the game *Constellations* is a good example, as the visuals prompt anticipation, keeping the children focused. Specifically for competitive games, children understood the procedural rhetoric better when the winner was shown visually, rather than with a score. For collaborative games that use scores, it is also recommended to explore visual methods to show team progress and improvements rather than using numbers.

Considering both the role of guidance and the importance of game design, it is valuable to incorporate serious games like those offered by Tover into classroom settings. These games provide an engaging and enjoyable way to help children with cognitive disabilities learn social-emotional skills by embedding these learning processes in the game's rules and mechanics. Hence, given that teachers are properly briefed, and the games are designed to be intuitive and adaptable to different cognitive levels, it is highly recommended to use such games in the classroom, as they offer fun playing experiences on the one hand and allow for various learning opportunities on the other hand.

6. Conclusion

This study investigated the role of procedural rhetoric within serious games for children with cognitive disabilities. While procedural rhetoric assumes that players internalize the messages embedded in the game's rules and mechanics as intended by the designer, this study shifts the focus toward procedural comprehension, a term coined to capture the ways in which players engage with, interpret, and sometimes repurpose game mechanics based on their own cognitive abilities and experiences. By shifting the focus more towards the player's perspective rather than seeing it purely as a persuasive tool, this study contributes to the limited body of research on how players interact with and make sense of game mechanics. The findings suggest that while some children demonstrate an understanding of procedural rhetoric, cognitive levels and guidance play a crucial role for this. Interestingly, children do not necessarily need to comprehend procedural rhetoric to learn from a game, rather, learning can also emerge through unintended forms of gameplay. The findings indicate that children were often not aware of the intended gameplay and sometimes deviated from it, either intentionally or unintentionally. This suggests that game designers should consider the ways in which players might repurpose rules and mechanics, apart from the intended procedural message. Balancing structured learning with flexible gameplay allows room for children's own interpretations while still guiding them towards meaningful outcomes.

The role of teachers and facilitators is highlighted as a key factor in ensuring that children engage with intended learning opportunities embedded in the games. Teachers can actively support gameplay by explaining rules, reinforcing learning objects, and facilitating discussions to help the children connect in-game experiences to real-life situations to enhance learning social-emotional skills through the games. This underscores the need to train teachers on how to most effectively use serious games in the classroom to optimize the potential of them as learning tools. Where the game mechanics ensure the learning goal is embedded in the game, adults can guide the learning process, ensuring that the learning goals are met. Apart from supporting the guiders, practical implications can be to focus on intuitive gameplay with recognizable objects and real-world affordances to support procedural comprehension when designing serious games. Incorporating adaptive difficulty levels can also help in ensuring that children with different cognitive abilities can engage in meaningful ways with the game.

Overall, this study calls for an expanded understanding of procedural rhetoric, recognizing that comprehension of game mechanics is a process driven by the player rather than something solely determined by the game's designer. Generally, incorporating serious games like those offered by Tover into the classroom can provide an engaging and adaptable way for children with cognitive disabilities to develop social-emotional skills, offering both enjoyable experiences and valuable learning opportunities.

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Appendices

During the preparation of this work the author used ChatGPT in order to assess the written text in terms of readability and structure. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.

Appendix I

Games of Tover (for special education)

There are quite some games available for the target group inclusive education. They are divided into levels, each level adding to the difficulty and challenge of the games. Below, a short explanation is given of every game, including an evaluation of whether the game is serious play or a serious game, and whether there is procedural rhetoric within the game or not. Additionally, it is indicated whether the game is available for Tovertafel 2 only, or also for Tovertafel 1.

1. Level 2 games

In addition to perception, those games aim for players to pay attention to sensory stimuli. Children can both get moving to release energy and explore the concept of action-reaction a bit. Developmental age 0-4.

1.1 Bubble bath (Available for ToverTafel (TT) 1&2)

Bubble bath is a game with a physical and sensory effect. Children can "sit" in a little pool with (duck) toys and bubbles. The bubbles will pop when you "touch" them. Also, when children touch the toys, they will disappear under water and pop up somewhere else. The game can help children with the introduction of wet or sticky sensations for example.

- **Serious play**
    - This game is categorized as serious play because it focuses on physical and sensory interaction and the goal is quite open ended, namely to explore and relax.
- **Procedural rhetoric**
    - There is not one main goal for this game, as the goal is rather to explore taking a bath in a safe environment, and there are no grade or goal rules within this game. Hence, the procedural rhetoric is immersed through the experience created by the social play (e.g. taking a bath). It does simulate a highly simplified version of real life, since the model rules of the game allow for bubbles to keep coming, the toys pop up rather late again and the water cannot really splash (unless you decide to project it on a real pool with water).

1.2 Fairy-tale mist (Available for TT 2)

Fairy-tale mist is a game with physical and sensory effects. Children can move their hands over the table, leaving a trail of colored "dust" behind. Different movements create different kinds of dust. Sometimes, white sparkles show up to indicate that something is hidden there. By moving over that spot multiple times, a fairytale character is revealed which will stay visible for a while and then disappear. The different colours and the calming music help children to relax and explore.

- **Serious play**
    - This game is categorized as serious play as it focuses on exploratory play and physical activity. It provides a sensory-rich environment for which the goal is to relax and explore.
- **Procedural rhetoric**
    - There is not one main goal for this game, as the goal is rather to explore and relax. Hence, there are no grade and goal rules. Revealing a fairy tale character is not necessarily the main goal as nothing happens when you do not find the character. The stimulation of imitation might be embedded in the rules and mechanisms of the game, however, that is not the main goal of this game. Cause and effect relationships can be seen as the procedural rhetoric, and are stimulated by the model rules of this game. Different movements show different kinds of dust and when moving on the right spot, a fairytale character can be revealed.

1.3 Flying saucer (Available for TT 1&2)

Flying saucer is a game with physical and social effects. UFOs appear one by one on the table, accompanied by a sound. When you "touch" a UFO, it will explode in a colorful cloud. Children can learn taking their turn in this game, or they can play it competitive against each other (who is the fastest to pop the UFO). In both ways, it stimulates concentration and responsiveness, and helps with practicing shared learning and interactions. It is also possible to throw a ball or a toy at the UFOs instead of using your hands.

- **Serious play (but straddle the line between them)**
    - This game is seen as serious play, however, it does straddle the line between serious play and a serious game. In general, physical interaction is promoted and children can explore action-reaction. On the other hand, although not necessary, this game can promote learning to collaborate, competition, or taking turns in a rather structured setting. However, the game is not structured in a way that this is always promoted.
- **Procedural rhetoric**
    - This game does not have a clear procedural rhetoric. The game does support elements such as turn-taking or impulse control, and it also promotes physical movement, however, this is not necessarily embedded in the model, grade or goal rules, mechanisms or design/experience of the game.

1.4 Stardust (Available for TT 1&2)

Stardust is a game with physical and sensory effects. There is stardust visible, which moves when a child moves their hand over it. It reacts differently to different movements, and players can learn about action-reaction and imitate each other, while it is also relaxing due to the colors and visuals.

- **Serious play**
    - This game is categorized as serious play, as it focuses on physical and sensory interaction with the goal to explore and relax. Although children can learn about action-reaction, imitation and social interaction, these are not the main goals of the game and are not learned through structured play.
- **Procedural rhetoric**
    - There is not one main goal for this game, as the goal is rather to explore and relax. The stimulation of imitation and physical movement might be embedded in the rules and mechanisms of the game, however, that is not the main goal of this game. Cause and effect

relationships can be seen as the procedural rhetoric as it is embedded in the game's rules and mechanics. Different movements show different kinds of reactions of the stardust.

1.5 Rainbow (Available for TT 1&2)

Rainbow is a game with physical and sensory effects. The edges of the table have all different rainbow colors, and by moving your hand over them, you can move the rainbow over the table and reveal different colors, sounds (music) and stars. It does not matter how big the movement is, there is always a reaction visible. The game is relaxing and good for the confidence of the children because they get autonomy over their environment in this game.

- **Serious play**
    - Because this game focuses on physical interaction and sensory-rich experiences through exploratory play with the goal of relaxing, it can be seen as serious play.
- **Procedural rhetoric**
    - There is not one main goal for this game, as the goal is rather to explore and relax. The stimulation of imitation and physical movement might be embedded in the (model) rules and mechanisms of the game, however, that is not the main goal of this game, and there are no grade or goal rules in this game. Cause and effect relationships might be seen as the procedural rhetoric as it is embedded in the game's model rules and mechanics, although it is less clear than it is for some other games. Regardless, different movements show different kinds of colors, sounds and stars.

1.6 Paint splatters (Available for TT 1&2)

Paint splatters is a game with physical and sensory effects. Colorful balls are rolling on the table and children can splash those balls which will create a direct reaction of colors and sound. This leads to more movement of the children, and a colorful artwork is created in the end. This artwork is shown at the end of the game. Additions to the game include that color names can for example be practiced with this game, as well as learning to count.

- **Serious play (with elements of serious game possible)**
    - In general, this game is categorized as serious play, however, elements of a serious game can be added to it. It supports exploratory play to enhance creativity, physical activity and sensory engagement. However, educational additions can be added, and when this is done, the game shows elements of a serious game as well by supporting structured learning.
- **Procedural rhetoric**
    - This game does not have a clear procedural rhetoric. The game does support elements such as imitation and impulse control, and it also promotes physical movement, however, this is not necessarily embedded in the model rules, mechanisms or design/experience of the game, and there are no clear grade or goal rules within this game.

1.7 Pond (Available for TT 1&2)

Pond is a game with physical and sensory effects. There is a pond with colorful fishes and seaweed. Children can move the water, which causes little waves and ripples in the water. The fishes will shoot away when they are close to the moving water. There is also a rippling sound, which gives peace, and it is

also possible to play the game with real water underneath or with fish nets to catch the fish (it is not possible to really catch the fish), which makes it therapeutic for tactile defensive children.

- **Serious play**
    - As this game supports exploratory play through sensory experiences and physical activity, it is categorized as serious play. Children can mainly relax and explore by playing this game.
- **Procedural rhetoric**
    - This game simulates playing with water in a pond in real life to a certain extent, which can be seen as the procedural rhetoric of this game. Realistic features embedded in the model rules are that the water riffles and waves when you move it and that the fishes shoot away when they are close to the moving water. However, in the game it is also possible to put your hand fully on a fish, which is harder in real life. Nevertheless, this game can be seen as a simplified version of playing at a real pond. Further, there are no grade or goal rules within this game.

2. Level 3 games

The players have to use their memory in those games. They work towards a certain goal, and therefore need a small concentration arc to oversee the game. But nothing can go wrong, every action a player takes is rewarded.

2.1 Windmills (Available for TT 1&2)

The Windmills game has physical and social effects. There are several windmills visible, which will start spinning when children hover over them. The longer the movement takes, the more colorful the windmills will get. This is for example possible by moving over them yourself, but it is also possible to ask for help and switch turns, or you can play a game to see who can spin the windmill the fastest. If you spin the windmill long enough, it will “explode” into colors and disappear

- **Serious play**
    - Windmills can be seen as serious play as physical activity is stimulated and gross motor skills and social play are encouraged through exploratory play.
- **Procedural rhetoric**
    - The model rules of the game allow for competition by letting the windmills explode after turning them for a certain amount of times, and showing multiple windmills together on the screen. It might thus be that the procedural rhetoric is to stimulate competition, however, only if the goal of the game is said to be being the first one to have “exploded” the windmill. Otherwise, there is no main goal in this game, hence no goal and grade rules, and although turn taking and learning cause and effect relations are supported, they are not embedded in the games rules and mechanics.

2.2 Puppies (Available for TT 1&2)

The Puppies game has sensory and social effects. There are puppies which all have a different color collar and a ball in the same color. Children can pet the puppy, throw away the ball (the puppy will get it and bring it back to you). The puppies do not react on hitting or not throwing the ball away. Puppies themselves already enhance positive feelings, and puppies will stay still if they are petted.

- **Serious play**
    - This game is categorized as serious play as social engagement (e.g. sharing and cooperative play) are promoted in a positive emotional environment, supporting comfort and joy. Caring interactions can be learned, however, this is not the focus of this game.
- **Procedural rhetoric**
    - Although the game does simulate playing with dogs, the procedural rhetoric is rather weak. Having a dog or playing with a dog is namely more than only playing, as the dogs also need care, and the dogs do not give much feedback on how you treat them (other than coming back with the ball and waggling their tale). Other effects, such as supporting social engagement, comfort and joy, are not embedded in the games' model rules and mechanics, and there are no grade or goal rules, hence, this cannot be seen as the procedural rhetoric.

2.3 Birthday cake (Available for TT 1&2)

The Birthday cake has sensory and social effects. To celebrate a birthday, there is a cake in the middle which needs to be decorated with fruit, whipped cream and candles. This can be done by touching the decorations, so they move (automatically) to the cake. When it is done, a birthday song is played and confetti is shown. The birthday kid can make a wish and blow out the candles with their hands.

- **Serious play**
    - This game can be seen as serious play as the focus is on sensory interaction, social play, creativity and personal expression. There is no structured learning involved, rather, a joyful experience is created.
- **Procedural rhetoric**
    - This game does simulate part of the process of a birthday, for example with decorating a cake, blowing out the candles and singing a birthday song. However, it is not possible to choose the decorations or to mess up the cake due to the model rules, hence, it is not a very strong procedural rhetoric, and additionally, the way the candles have to be "blown" out within the game is not similar to how it is done in real life. The goal is to celebrate someone's birthday, which the model rules and mechanics do support by the cake, the birthday song and the candles.

2.4 Sandy Beach (Available for TT 1&2)

Sandy Beach has physical and sensory effects. A beach is visible with corresponding sounds. Under the sand, a lot is hidden. A wooden board is washed ashore with an outline of an object on it. By making small or big movements, the children can try to find the hidden treasure as with those movements, the sand goes away. There is always something to be found, which enhances the confidence and it helps children how to recognize and match similar shapes. The object that needs to be found is always already a bit shown, while this is not the case for the other objects that are hidden. When the correct object is found, the object flies to the wooden board and a sound is played, after which a wave comes and takes the object with it.

- **Serious play (with elements of serious game)**
    - Sandy Beach can be categorized as serious play, however, also shows elements of a serious game. Physical activity and sensory play are promoted through exploratory

learning. Recognizing and matching shapes can be added to this game, which shows signs of structured learning. Nevertheless, this is not the main goal of this game.

- **Procedural rhetoric**
    - This game simulates digging in sand on for example a beach or in the sand pit through the model and goal rules of the game, hence, it shows procedural rhetoric. Exploring and discovering are simulated as well within the game. By moving sand, different objects become visible, which can be seen as positive feedback (digging is rewarding), and the objects are collected which can also be seen as rewarding. Lastly, confidence, pattern recognition and feelings of curiosity are also modelled in this game.

2.5 Steam Train (Available for TT 1&2)

Steam Train has cognitive and social effects. A toy train is driving circles on the table. Sometimes, a cow walks on the trail or a tree falls on the trail. Players have to work together to be there in time with removing the obstacles from the trail. When the object is not removed on time, the train stops and "honks". A winning sound is played when an object is removed (this sound does not differ between when you do remove it on time and when you do not). It are repetitive tasks, and can be useful when having difficult conversations with kids as it takes the focus somewhere else than at the conversation. It also helps with impulse control.

- **Serious play (with elements of serious game)**
    - This game is categorized as serious play, however, also shows elements of a serious game. This game supports learning about impulse control and cooperative problem-solving, with a focus on engagement and collaboration rather than on achieving specific educational outcomes. Emotional and social development are thus supported in a playful context.
- **Procedural rhetoric**
    - There is no main goal in this game other than making sure the train keeps driving, however, even when the train stops driving, nothing really happens. This game thus does not have a clear procedural rhetoric. The game does support elements such as problem solving, working together and to a certain extent impulse control, nevertheless, this is not necessarily embedded in the model rules, mechanisms or design/experience of the game.

2.6 Monster Pairs (Available for TT 1&2)

Monster Pairs has cognitive and social effects. There are cards with (basic) shapes and different colors. One of the cards is in the middle, and four of them are distributed around this middle card. Children have to pick the one that is the same as the one in the middle, so children can learn about shapes, colors, looking closely and matching. When they found the right shape, the shape will change in a playful monster that makes funny noises. When the wrong shape is chosen, this card will just disappear. This game is also good for practicing taking turns.

- **Serious game**
    - Monster Pairs is a serious game that focuses on matching and visual discrimination. There are clear, structured goals, which additionally foster turn-taking and collaboration. Feedback is included to support the goal.
- **Procedural rhetoric**
    - Shape and color matching is learned within this game through the model and goal rules and mechanics support this. Hence, this can be seen as the procedural rhetoric of this

game, together with learning visual discrimination and observation skills. There is positive feedback when the matching is correct (as a monster appears then).

2.7 Farm Pairs (Available for TT 1&2)

Same game as 2.6, only now farm animals are on the cards and the animals make noises when the right match is found. Kids can also name the animals for example.

2.8 Constellations (Available for TT 1&2)

Constellations has cognitive and social effects. A sparkling starry sky is projected. Children can either watch, play with the little stars or touch the big stars that appear. When touching the big star, a piece of a drawing is made, and with every touch, the drawing gets more finished. When the drawing is finished, the object drawn will be shown in a picture, and when touching it, it makes the sound of that object. Children can discuss what they think the drawing will be in the end. They can also identify shapes and colors on the table, and practice taking turns.

- **Serious play**
    - Constellations is categorized as serious play, focused on understanding shapes, colors and patterns through exploratory play. Creativity and imagination are fostered, as well as social interaction and turn-taking. This game supports open-ended play with no clear goal.
- **Procedural rhetoric**
    - The design of this game does slightly stimulate the process of recognizing shapes and patterns and also stimulates creativity and imagination. Since the outline of the drawing is only partly shown every time the big star is touched, the design (through the model rules) does support this goal of triggering imagination and recognizing shapes and patterns, and this can thus be seen as the procedural rhetoric of the game. However, not being able to guess the correct shape does not have consequences, only finishing the shape gives positive feedback by colouring in the drawing, and there are no goal or grade rules. This makes the procedural rhetoric not that strong.

2.9 Ducklings (Available for TT 2)

Ducklings is a cognitive and social effect game. There is one big duck, and smaller ducks appear one by one. The little ducks have to be guided to the big duck, which can be done by using hand movements. This game practices hand eye coordination and shared attention by guiding the little ducks with hand movements to the swimming mother duck. When stopping too early with the hand movement for example, the little duck will not swim behind the mother duck, but will go its own way again. Children can play the game together or alone. In the end, the ducks that are “rescued” are counted, and the group or the child can for example count the ducklings aloud at the end.

- **Serious play (with elements of serious games)**
    - Ducklings is categorized as serious play that also shows elements of a serious game. Cognitive skills such as hand eye coordination and shared attention are learned, while it also fosters problem-solving and social engagement. The focus is on slow and gentle hand movement, which can be learned through exploration.

- **Procedural rhetoric**
    - To a certain extent, this game simulates a mother duck with baby ducklings in real life, as they always belong together and will remain together as much as possible. As the goal is to get as many baby ducklings to the mother duckling, and this is embedded in the model and grade rules, this can be seen as the procedural rhetoric of the game. Nevertheless, certain parts of reality are not simulated, as a mother duck can get angry when touching her baby's aggressively for example, while making aggressive hand movements is not "punished" in this game. The movements support coordination and goal-directed action.

2.10 Unfold Photos (Available for TT 2)

This game has cognitive and social effects. In the beginning, a book opens and you can click on one of the four wrinkled sheets. The paper will then be folded into a wad, which can be unfolded by moving over it. By using your hand to smoothen the paper, you can reveal a colorful picture (although the picture is already quite visible when it is wrinkled), and when it is completely revealed, it will be shown for a while in the middle of the table. You can complete a book by unwrinkling all the pictures in the book. It is possible to ask the children if they have a story to accompany the photo, or make up a new part of a story with each new image.

- **Serious play (with elements of serious game possible)**
    - Unfold Photos can be seen as serious play, however, elements of a serious game can be added. Visual exploration and imagination, as well as social interaction are encouraged in this game through an open-ended nature. Exploration and discovery, supporting creativity and imagination are central in this game. Visual recognition can be added to this game, however, this is not necessarily embedded within the open-ended nature.
- **Procedural rhetoric**
    - The main goal in this game is to unwrinkle the pictures. The stimulation of imagination and exploration are embedded in the model rules and mechanisms of the game, however, that is not necessarily the main goal of this game, and there are no grade rules. Additionally, visual recognition and social interaction are supported, however, this is not done through specific rules or mechanics in the game. Hence, no procedural rhetoric is visible in this game.

2.11 Sound Memo (Available for TT 2)

This is a cognitive and social effect game. A box is shown, in which 3 (or more, based on what level you chose) pictures go in. Then, six boxes appear, and you can open a box with your hand, after which a sound is played. You then open a new one, and if the sound matches, the boxes disappear (like normal memory). The game goes on till everything is matched perfectly. The kids can help each other remember where they last heard the sound or take turns guessing what the sounds are. In the end, having it right is celebrated by showing all the objects again and hearing the sounds one more time.

- **Serious game**
    - Sound Memo is a serious game in which the focus is on cognitive skills and educational content such as training memory and sound recognition. There is feedback present and the game is structured with the goal to find and match sounds.
- **Procedural rhetoric**
    - Sequential matching is learned within this game, as well as memory is trained. The model and goal rules support this by only being able to win when all the matches are made

correctly, and by giving feedback on whether the match is correct or not. Hence, this can be seen as the procedural rhetoric of this game, together with learning sound discrimination and listening skills.

2.12 Fingerpaint (Available for TT 2)

Fingerpaint is a physical and social effect game. By moving your hand over the table, you can reveal an image. For this, the place that you move your hand over has to touch the already visible "paint", otherwise it will not reveal anything. The full image will be revealed when a big part of the image is covered with "paint". There are sometimes balls coming, and if you splash the ball, the ball will reveal a piece of the picture at the place you splash it. The picture can be discussed when it is finished.

- **Serious play**
    - Physical engagement is a key goal in this game, and exploration and creativity are also encouraged, hence, it is categorized as serious play. There is no clear predefined (educational) goal present in this game.
- **Procedural rhetoric**
    - There is not one main goal for this game, as the goal is rather to explore and be moving. The stimulation of physical movement might be embedded in the model rules and mechanisms of the game, however, that is not the main goal of this game, and there are no goal and grade rules. Hence, no procedural rhetoric can be found.

2.13 Duo's (Available for TT 2)

Same game as 2.6, only now it is possible to add your own pictures to the cards.

3. Level 4 games

Those games aim to make the players think and reason, which means they can also make mistakes in those games. Players have quite a lot of influence on whether or not they reach the final goal.

3.1 Emotions (TT 1&2)

This is a cognitive and social effect game. Children can learn emotions based on facial expressions. A question is asked like "who feels sad?" (in both text and sound) and three faces are shown. The players have to point to a face and when it is the right face, the visuals and a sound ("I feel sad") will reveal it is the right answer. When it is the wrong answer, a sound indicating it is wrong is played. The game can be played in 1 or 2 player mode. It is also possible to mimic the emotions to practice expressing and seeing expressions on others, or to discuss when they feel those emotions.

- **Serious game**
    - Emotions is a serious game that focuses on learning emotions. There is structured feedback present and additionally, social and emotional learning are encouraged.
- **Procedural rhetoric**
    - Emotions are learned in this game, and the rules and mechanics of the game support that recognizing others' emotions is rewarding. Hence, this can be seen as the procedural rhetoric of this game. The model rules and goal rules support the learning by giving

feedback through sound and visuals, and only allowing to continue when the right option is chosen.

3.2 Seasonal Trios (TT 2)

This is a cognitive and social game. Children have to find three of the same pictures during memory. You can choose between 9, 12, 15, or 18 cards. The cards will turn when you "touch" them. When the first two cards that are selected are not the same, they will turn back so you cannot see the image anymore, and you need to start again. When a match of three cards is found, the cards will disappear. When all the matches are found, the cards will reappear in a circle and a sound is played. After two games, the season on the cards switches, and working together is beneficial for memorizing the cards.

- **Serious game**
    - This game is categorized as a serious game that focuses on cognitive skills such as memory skills and pattern recognition through structured play. There are specific rules that have to be followed. Additionally, collaboration and communication are also supported.
- **Procedural rhetoric**
    - Matching and pattern recognition are learned in this game by the rules and mechanics of the game, so this can be seen as the procedural rhetoric of the game. The goal and model rules support perfect matching, otherwise you cannot finish the current game, hence, observations skills and pattern recognition can be learned through this. Additionally, learning patience and turn-taking are also supported in this game, however, this is not the main goal of this game.

3.3 Soccer Game (TT 1&2)

This is a physical and social game. You can play a game of soccer together. The ball can be moved by moving your hands in such a way that it seems like you are kicking the ball (with your hands). The score is shown as well on both sides with boxes that are filled when you make a goal. 5 goals on one side means that you win, and after every goal a sound is played. Reaching the 5 goals on one side will start a new game, so it is not celebrated extensively when someone wins. Children can either play together and learn to share the ball, or they can compete against each other and learn to deal with winning and losing.

- **Serious game (but straddles the line between them)**
    - Soccer Game can be categorized as a serious game, however, straddles the line between a serious game and serious play. The game has a structured aspect, namely scoring and competition, through which skills such as dealing with winning and losing and sportsmanship can be learned. However, physical activity, social interaction and sharing are also encouraged in this game, which relate more to serious play as it is not embedded in the structure of the game.
- **Procedural rhetoric**
    - This game does support dealing with winning and losing through its rules and mechanics. By celebrating each goal slightly, and having two goals and two opposite sides with different colors, children can learn how to deal with winning a game and losing a game through the model, grade and goal rules. Since those skills are useful in the real world, this can be seen as the procedural rhetoric of the game. Additionally, children will be physical active and can also learn to share and work together, however, those are not the main goals and are not necessarily embedded in the rules and mechanics of the game.

3.4 Ball Toss (TT 1&2)

This is a physical and social game. In the middle, there is a circle that is rotating with holes in them. Every hole is a certain amount of points; the lower the amount of points, the bigger the hole. When you touch the ball, the ball will always go to the middle, so all children can score points, which can be beneficial for their confidence. Scoring a ball gives a sound, and scoring the highest amount of points (50), a victory sound is played. By aiming right, and using hand eye coordination, more points can be scored. In the end, a ticking timer sound is played so it is known that the end is coming, and when finished, there is one score, although there are different color balls.

- **Serious play (with elements of serious game)**
    - Ball Toss can be categorized as serious play, but also shows elements of a serious game. The focus in this game is on playful interaction, social engagement and improvement. Cognitive aspects can be added, such as learning about hand eye coordination and strategy, however, this is not the primary goal.
- **Procedural rhetoric**
    - The goal of this game is to gain as many points as possible, together with everyone playing. Model rules of this game support this goal by, amongst other things, always allowing the ball to go to the middle of the table, and grade rules by providing different size holes with different points related to them. However, it is not possible to win anything (other than getting a higher score than previous games maybe), the procedural rhetoric is not that clear. Additionally, hand-eye coordination and spatial awareness can be learned through the rules of the game, for example by making it more difficult to reach a hole with a higher number of points. Again, this procedural rhetoric is not necessarily that clear.

3.5 Candy Fish (TT 1&2)

This is a physical and social game. Being careful and hand-eye coordination are important in this game. There is a fish, which you have to direct to candy with hand movements (children can also work together to do this). When it eats the candy, it gets bigger and changes to the color of the candy it just ate. There are also sharp spines on the edges of the table, and the fish deflates when it touches those spines (like a balloon). The spines also get bigger when the fish eats more candy. When the fish is deflated, the game starts again. This shows a cause and effect relationship with no negative effects (the fish doesn't die). It is also possible to add an element where the children predict what color the fish will turn next.

- **Serious play (with elements of serious game)**
    - Candy Fish is a game that can be categorized as serious play, but does show some elements of a serious game. There is emphasis on physical interactions, social collaboration and open-ended exploration. Cause-and effect relationships can also be learned, however, this can be done in a playful way with no big consequences.
- **Procedural rhetoric**
    - Within this game, the goal is to let the fish eat as many candies as possible and let it grow, without letting it deflate. The procedural rhetoric might be learning about cause and effect relationships, as the model and grade rules of this game do support those relationships by changing colors, getting bigger and deflating when the spike is touched. Additionally, it is possible to learn about colors in this game, however, this is not the main goal of this game, and hand-eye coordination is also supported.

3.6 Race Cars (TT 1&2)

This is a physical and social effect game. Children can play a competition on the race track, where two cars can race against each other. Children have to move a lot to make sure they keep touching the car so it keeps moving (so, the car is moving when you are "touching" it. Everytime the finish line is reached, a sound is played and one of the five lights displayed in the middle for both cars is going on. The first car that made 5 rounds wins, so children can also learn how to deal with winning and losing. This game can be played one to one or with teams.

- **Serious play (with elements of serious game)**
    - Race Cars is categorized as serious play, but also shows elements of a serious game. The primary focus is on physical movement and it fosters social engagement while supporting learning social-emotional skills. Learning about strategy can be added, however, this is not the primary goal.
- **Procedural rhetoric**
    - This game does support dealing with winning and losing through its rules and mechanics. By celebrating each round that is finished slightly, and having two different cars racing against each other, children can learn how to deal with winning a game and losing a game through the model, grade and goal rules. Since those skills are useful in the real world, this can be seen as the procedural rhetoric of the game. Additionally, children will be physical active and can also learn to work together, however, those are not the main goals and are not necessarily embedded in the rules and mechanics of the game.

3.7 Minecarts (TT 1&2)

This is a physical and social effect game. In the beginning, one by one, three mine carts and a rail to gems becomes visible. Additionally, a timer becomes visible. Children can (in teams) "find" the gems in the mine by moving over the mine, and they can move the mine cart by moving over the cart so it can collect gems. However, the rails are all overlapping, so not all carts can go together. This game can either be played as a whole group, or in teams to see who can collect the most gems. When the timer is over, the gems that are collected become visible out of the cart, and the children can see who collected the most gems (there is no count or anything here).

- **Serious play (with little elements of serious game)**
    - Minecarts is a game that can be categorized as serious play, which also shows elements of a serious game. Physical interaction is emphasized in this game, and social collaboration and teamwork are promoted. The competition aspect is there for engagement, and there is not so much a focus on cognitive challenges.
- **Procedural rhetoric**
    - The main goal of this game is to support physical activity amongst the children, and it also supports dealing with winning and losing through its model, grade, and goal rules and mechanics, as in the end the gems are shown and with sounds it becomes known who was the winner. Since knowing how to deal with winning and losing is useful in the real world, this can be seen as the procedural rhetoric of the game, although it is less strong in this game. Additionally, children can also learn to work together, which is also supported in the model and goal rules, as teamwork is needed to be able to collect the most gems. This might thus also be seen as the procedural rhetoric of this game.

3.8 Moles (TT 1&2)

This is a physical and social effect game. Out of holes in the table, molls appear sometimes. The moles have to be hit on the head, which will give points when done on time. All the moles are 1 point, except for "king" moles, those are more points. There is one score in the end, so team work and helping each other is beneficial.

- **Serious play (with elements of serious game)**
    - This game can be categorized as serious play, but has elements of a serious game as well. The focus is on physical engagement, and a bit on cognitive or educational learning goals through the implementation of a score. Teamwork is promoted, and there is feedback via points, however, this is not necessarily the main focus.
- **Procedural rhetoric**
    - The main goal of this game is to support physical activity amongst the children, as well as learning how to work together. The grade, model and goal rules support this, as in the end a total score is coming up, and different moles are worth different number of points. Working together is a skill that this game learns that is supported by procedural rhetoric.
    -

3.9 Frog Kings (TT 1&2)

This is a cognitive and social effect game. In every corner, there is a hungry frog. In the middle, there is a plant that releases flies once in a while. The flies fly around the table, and when you touch the frog, a sticky tongue appears that can catch the flies. Sometimes you have to wait for the tongue (to be back for example), which helps in practicing self-control. The best fly catcher is the winner in the end, which helps children play together and deal with losses and winning. The winner is announced by that frog jumping to the middle of the screen and getting a crown when the game is finished. Also, it is good for impulse control, as you have to time the hits instead of just hitting the frog. Children can work together to help with the timing.

- **Serious game (but straddles the line with serious play)**
    - Frog Kings can be seen as a serious game, nevertheless, straddles the line with serious play. There is a clear goal in this game, as it focuses on learning skills such as impulse control, timing, patience and self-control. The element of competition is structured, and a feedback mechanism is included.
- **Procedural rhetoric**
    - This game supports competition, dealing with winning and losing and impulse control all through the model, grade and goal rules. Since the frog that catches the most flies wins and gets a crown, competition and dealing with winning and losing is supported, while having to wait till the tongue is completely back in the frogs mouth to stick it out again supports in learning about impulse control, hence, those skills can be achieved through the procedural rhetoric of the game.

3.10 Trio's (TT 2)

Similar to game 3.2, however, now it is possible to add your own pictures to the cards.

4. Level 5 games

The executive part of the brain is emphasized in those games. Planning and decision making, for example, fall into this area of the brain.
Developmental age 7-10.

4.1 Emotion words (TT 2)

Emotion words is a game with cognitive and social effects. There is a monkey who wants to understand what emotions are and needs the players for this. The players play with players tiles, which show which players' turn it is. An emotion word appears with an explanation *(e.g., nervous - something is going to happen that you're anxious about. You feel uncomfortable and shaky)*. The player whose turn it is (which is decided by the game) has to give answer to the subsequent question that pops up *(e.g., when do you feel this way? Or; Act out this feeling without making any sound. Or; What are you thinking when you feel this way? Or; How many letters does this word have?)*. After the answer is given (which has to be done within a certain time limit shown with a timer), the monkey opens the pot and the player puts its tile in the pot. After five questions about a certain emotion, the monkey drinks the drink and can feel the emotion (this is shown with a picture of the monkey saying "This drink allows me to FEEL this emotion too. Thank you!"). The progress per emotion is shown with a line around the table indicating how far the drink already is. When one emotion is done, the next one is shown.

- **Serious game**
    - Emotion Words is a serious game with a clear goal of understanding and articulating emotions. Cognitive skill development is promoted, as well as social interactions. There is structured gameplay through the use of a timer and specific questions.
- **Procedural rhetoric**
    - The goal of this game is understanding, recognizing and expressing emotions, which is embedded in the model rules of this game, and this can also be seen as the procedural rhetoric of this game. Model rules support this by presenting the emotion, asking questions about it and by forcing the children to take turns. Additionally, the time limit supports learning, thinking and recognizing the emotions quickly. Seeing the process of the monkey learning as well as the interactions with the other children can give the children a feeling of accomplishment and can encourage empathy and social learning (for example, it helps in understanding others in social settings).

4.2 Word Treasure (TT 1&2)

Word Treasure is a game with a cognitive and social effect. There are some treasure chests in the middle of the screen, all with a picture in them. On both sides of the table, three words appear, and on each side of the table, one of the three words corresponds with the pictures. If the player chooses the right word, a key will go to the treasure chest and they earn gold pieces. The goal is to earn the most gold pieces. The quicker you react, the more gold pieces you can get. There are different difficulty levels in the game that can be chosen. At the end of the game, the winner is shown by quickly highlighting the points that are shown by the player that has the highest score.

- **Serious game**
    - Word Treasure is a serious game with a clear goal, namely practicing word recognition and vocabulary in a structured approach. Competition is also added to enhance social engagement, and a feedback mechanism is included for structured learning.

- **Procedural rhetoric**
    - The procedural rhetoric in this game is word recognition, as this is the main goal of this game. Apart from word recognition, quick thinking, gradual learning and skill improvement are also embedded in this game through goal, grade and model rules. Model rules allow for learning about word recognition and vocabulary skills by for example giving a choice and giving feedback on what is right and wrong. Grade and goal rules support this by providing a score in the form of gold pieces (scoring system), giving different points depending on how fast you are to recognize a word (speed incentive), and by letting the one with the most gold pieces win. Additionally, the element of competition is thus also embedded in this game through the rules and mechanics, and the children can learn how to deal with winning and losing with this.

4.3 Rocket Sums (TT 1&2)

Rocket Sums is a game with cognitive and social effects. In the middle of the table, a number is shown on a planet, and around the planet another number is shown. This second number is the number that has to be reached, and the middle number is how high the current number is. There are also several balls shown on the table with numbers on them. Players have to play the right balls to the planet in the middle to form the number that is shown around the planet. The number in the middle changes based on the balls that the children play to the middle. After three good calculations, the rocket is full and takes off. There are different levels, each level with different forms of calculations (e.g.addition, subtraction, multiplications, or fractions), and the game can be played with multiple players.

- **Serious game**
    - Rocket Sums is a serious game with a clear goal, namely practicing mathematical skills. There is a feedback mechanism included to provide structure, and apart from mathematical skills, teamwork, communication and critical thinking can also be learned.
- **Procedural rhetoric**
    - The goal of this game is to practice mathematical skills, and this can also be seen as the procedural rhetoric of this game. The practicing of mathematical skills is namely embedded in the model, grade and goal rules. The goal rules for example show clearly whether you did it right or wrong, by making different sounds and visuals when you either reached the number or when the number is too high, and the rocket takes off after three good answers. The number of good answers is also shown with green bars. Additionally, the model and grade rules help in practicing mathematical skills as there are multiple options given that can be added or subtracted to the number in the middle, and the progress is shown (immediate feedback). Moreover, problem solving can also be learned in this game, although this is not the main goal.

4.4 Animal Letters (TT 1&2)

Animal letters is a cognitive and social effect game, where the aim is to practice reading by starting with recognizing letters. On both sides of the table, an animal name is shown missing one letter. The word is spoken, and then the children have to finish the name of the animal by clicking on the right letter (out of the five letters that are shown). When they choose the right letter, the animal will be shown in a picture and it will make a noise. When the wrong letter is chosen, this is shown by visuals, and a new letter can

be picked. The children can play on two sides against each other, or together on one side. An addition might be to imitate the sounds or to let the children name all the letters that you can choose.

- **Serious game**
    - This game is categorized as a serious game as it provides a clear goal, namely practicing reading and recognizing letters. It works structured to this goal with the use of a feedback mechanism.
- **Procedural rhetoric**
    - Recognizing letters and practicing reading is learned in this game, which is supported by the rules and mechanics, hence, can be seen as the procedural rhetoric of this game. Model rules make it possible to choose out of 5 letters, which helps for the main goal, and showing the picture of the animal when the right letter is chosen is also helpful. Goal rules are helpful as they can be seen as the feedback mechanism; choosing the wrong letter is shown by visuals and choosing the right letters shows the animal in a picture and with sounds.

4.5 Mindset (TT 2)

Mindset is a game with cognitive and social effects. This game is with a play tile, and every child has one. A question about feelings or a social situation pops up (e.g. Your parents give you a hug, how do you feel? Or; You receive a gift, how do you feel? Or You really have to use the bathroom, what do you do?). Answers are provided as well around the question. All the children have to place their tile on an answer within the time limit, and then a "why" question is asked to let the children explain why they gave a certain answer (e.g. "why do you feel this way?). This question disappears when all the playing tiles are taken off the table. In this way, personal stories come up, players have to listen to each other, and they can reflect on their answers. There are different levels, showing complexer emotions as answers for example (e.g. "There's a red traffic light. You're in a hurry. What do you do?").

- **Serious game (on the line between serious game and serious play)**
    - Mindset is a serious game, however, straddles the line between a serious game and serious play. There is a clear goal, namely understanding and discussing emotions and social situations. There is structured gameplay (e.g., placing a tile and feedback), however, there are no real consequences and the correctness cannot be checked.
- **Procedural rhetoric**
    - This game shows procedural rhetoric through the rules and mechanics, as it supports learning about social situations and emotions, which is useful in real life. The model rules of this game allow for a Q&A, which is helpful in understanding the situations and learning how to best deal with them. Additionally, the model rules help in understanding those situations by asking a reflective question about the situation. Also, a timer is added which reflects that is important to make those decisions as quick as possible, as that is necessary in the real world. However, it has to be noted that the rules of this game do not show a right or a wrong answer (which is also difficult because not all situations have one right answer), which can mean that without a teacher playing this game along, there might not be a big learning effect for example.

4.6 Safe Cracker (TT 1&2)

Safe Cracker is a game with cognitive and social effects. The children can open a safe by solving sums as quick as possible. This game helps automating math skills like addition and subtraction to 10, to 100 and multiplications (different levels are included). A sum is shown, and five answers are given. The right answer has to be chosen, but when the wrong answer is chosen, this answer option disappears and visuals indicate that it is the wrong option. There are two sides this game can be played on, and there is only one team that can open the safe first. Hence, it also helps in practicing competition and dealing with losses and winning. The winner gets the gold in the safe, and the progress per side is shown by five gold metal bars that disappear after a good answer. The first with five good answers wins. It is also an option to play it individually to practice math.

- **Serious game**
    - Safe Cracker is a serious game that has a clear goal, namely automating math skills. Problem solving, teamwork, and learning about competition are also embedded in this game, and a clear feedback mechanism is included for structure.
- **Procedural rhetoric**
    - This game has a clear goal, namely learning and automating math skills, and this can also be seen as the procedural rhetoric of this game. Model, grade and goal rules support this goal by providing five options to choose from as the answer to the sum, giving feedback on whether it is the right or wrong answer, showing progress by retracting gold metal bars, and by winning the gold when you are the first one to solve five sums. Having to be the fastest to solve the sums to win the gold helps especially in automating the math skills. Additionally, this game also supports learning about winning and losing, as it can be played on two sides as a competition. However, that is not the main goal of this game.

4.7 Baby Monsters (TT 1&2)

Baby Monsters is a game with cognitive and social effects. In the middle of the table, an egg is shown, and a few thought clouds appear with certain foods in there. When the thought clouds disappear, there is a little break in the game, and after the break, a few foods appear in bubbles. The children have to give the right food to the egg, and if it is the wrong food, the little monster in the egg will spit it out (but only after all options are given to it (2 for the simple levels, 6 for the more difficult levels), so not immediately). When food is spit out, the monster will show again what the right food was and the children can try again. Good answers on the other hand, make the egg bigger and bigger, until it cracks and a baby monster appears. Incorrect foods move more slowly to prevent accidental incorrect answers. Children can work together to remember everything the baby monster wants to eat. When playing the game, an addition is that a teacher for example can ask questions about the food, for example whether the children do like it themselves or not.

- **Serious game**
    - This game is categorized as a serious game that supports educational goals such as recognizing and remembering food. Memory, attention and categorization are also trained through this game, for which a feedback mechanism is included to support structured learning.
- **Procedural rhetoric**
    - This game's goal is to train memory and learn to recognize foods, which can also be seen as the procedural rhetoric of this game. The model and goal rules support this goal by leaving a pause between showing which foods need to be chosen and the moment the

food options become visible, giving multiple options to choose from, allowing for multiple levels of difficulty, letting the monster come out of the egg when it has eaten enough of the right foods, and having a feedback mechanisms that also makes it visible when a wrong choice is made. Next to the main goal, keeping attention is also a skill that can be trained with this game, and when played together, teamwork and working together can also be trained.

4.8 Bookworm (TT 1&2)

Bookworm is a game with cognitive and social effects. In this game, different levels with different lengths of words can be chosen. Children can work together to spell a word that is visible in a picture. They have to rub over the letters in the right order to form the word (all letters visible have to be used). A bookworm will crawl to the letters that are rubbed and eat them. If the letter is right, the letter appears on its body, but when it is wrong, he will spit it out, so the children will always spell the word right in the end. In more difficult levels, sometimes two letters are shown together, and one of them will go separate after the combination is chosen (so, when you have the options “b”, “ie”, and “k”, children have to select “b”, “ie” (after which the e goes separate), “k”, “e”). To practice writing as well, it is possible to add that the children can write the letters and the word themselves. The letters are grouped by sound and change to reflect how kids learn to read.

- **Serious game (on the line between serious game and serious play)**
    - Bookworm is a serious game that straddles the line between a serious game and serious play. Educational goals are practiced, such as spelling words and letter recognition. Feedback mechanisms help in supporting this learning.
- **Procedural rhetoric**
    - This games’ procedural rhetoric is word spelling, and is shown through the model and goal rules of this game. The model rules support word spelling by showing a picture and letters, out of which the children have to spell the word that is shown in the picture, by having a feedback mechanism on whether the chosen letter is right or wrong, and by including difficulty levels. The goal rules support this slightly by only continuing when the right word is spelled. Additionally, problem solving is also slightly embedded in this game.

4.9 Time Bomb (TT 2)

Time Bomb is a game with cognitive and social effects. A ticking time bomb appears, and the children have to say which time is visible on the clock. This can be a normal clock with pointers or a digital clock. The children can one by one choose the right time that is show out of the multiple options that are given, which is either depicted in words or like a digital clock (at least different from the clock that is shown). One by one means that the times become visible first on one side of the table and then the next time becomes visible on the other side of the table. There is also a timer ticking (in the middle it is green, the further it comes to a side, the colors become yellow, orange and red). This timer stops when the right answer is given, and for the next player, the timer goes from the place it is stopped by the previous player. (the timer goes from one side to the other back and forth). When the time is not chosen correctly in time, that player has to cut one of the cords of the bomb, risking that the bomb explodes. If the right cord is cut, the timer just resets to the green one in the middle and a new game can be played.

- **Serious game**
    - Time Bomb is a serious game with the primary goal of correctly identifying the time. Cognitive skills such as time-telling, decision-making and quick thinking are supported through structured mechanisms. Time pressure and feedback help in learning such skills.
- **Procedural rhetoric**
    - The goal of this game is to learn reading the clock and indicating the time, which is also the procedural rhetoric of this game as this goal is supported by the rules and mechanics of the game. The model rules of this game namely support learning to read the time by providing a digital or a normal clock, and several options to choose from that show the time in letters or numbers. Additionally, including a timer simulates reading the time in stressful situations. The goal indicate that you lose when the wrong cord is cut. Winning and losing, and dealing with stressful situations are skills that are also embedded in this game through the rules, however, those are not the main goals of this game.

4.10 Marble Snake (TT 1&2)

Marble Snake is a game with cognitive and social effects. A snake will keep moving, and the players have to tick the right button on time to make sure the snake goes to the marbles shown. The buttons have arrows on them, and only the ones that are possible show up. Not everyone can easily reach all the buttons across the table, so working together and communicating is essential. Thinking ahead is also important because when the snake touches its own tail, the children have to start again. Some marbles are worth more points than others. Likely, a plan has to be made on how to work together efficiently. In the end, the score is shown, which is calculated by the marbles collected. Touching the tale ends the game, however, touching the "wall" is possible. The game is also finished when all marbles are collected.

- **Serious game**
    - Marble Snake is categorized as a serious game because it has a clear goal. Timing, planning, spatial awareness and teamwork can be learned through playing this game. A point system is added to give it a structured nature.
- **Procedural rhetoric**
    - This game supports learning about timing, planning and spatial awareness, which is embedded in the rules of the game, hence, can be seen as the procedural rhetoric. The model, grade and goal rules of this game ensure that clicking the buttons with directions has to be done with the right timing to be able to get the highest score, and not lose the game because the snake touches its own tail. Additionally, teamwork and working together are skills that are also modelled in this game, as the buttons appear on all the sides of the playing field, making some hard to reach for one player (nevertheless, it is possible to walk around the table). In the end, other games from this level show better procedural rhetoric in my opinion.

4.11 Hamster Maze (TT 1&2)

Hamster Maze is a game with cognitive and social effects. A hamster is walking through pipes, and the players have to make sure the hamster can get to the carrot by changing some small parts of the pipes (indicated by a colour) to change the direction of the hamsters. Not all children can reach all the coloured pipes that can be moved, so teamwork is needed. The children have to look closely and think ahead, because the hamster does not quit moving, only when the hamster cannot continue because the pipes end. There are different difficulty levels, and there is also an option to first get all the broccoli before the

hamster gets the carrot. Another option is to find the shortest and longest route possible, however those extra options have to be included by for example a teacher, as it is for example not necessary to get all the broccoli before getting the carrot.

- **Serious game**
    - Hamster Maze is a serious game that has a structured task of guiding the hamster through the maze. It involves skills such as problem-solving and strategy, as well as critical thinking and planning. This can be learned through structured gameplay, with a clear goal.
- **Procedural rhetoric**
    - The goal of this game is to learn about problem solving and strategy, which is supported by the rules of the game, hence is the procedural rhetoric of this game. The model and goal rules support this as it is only possible to pass a level when the hamster gets to the carrot, and making the wrong choices in adjusting the pipes can result in not passing a level. However, it has to be mentioned that there are no real consequences of choosing the wrong direction, as the hamster only stops moving until the right choice is made.

4.12 Letter Board (TT 2)

Letter Board is a game with cognitive and social effects. When the playing tiles are placed on the playing field, a letter appears by each playing tile. It is thus possible to choose the number of letters you want to play with. You can change the order of the letters by moving the playing tiles, with the goal to make words. The longer the word is, the more points you get. Children can help each other to think about new words and have to make as many words as possible before the bar indicating the time you have left is completely filled. Every word is worth points, and the longer the word, the more points are given. When the timer is over, the letters change and a new game can be started. As an addition, it is possible to pause the game and ask the children about the meaning of the words for example.

- **Serious game**
    - Letter Board is categorized as a serious game, that has a defined goal, namely forming words. Spelling and vocabulary are also practiced. There is structured gameplay with a scoring system.
- **Procedural rhetoric**
    - This game simulates vocabulary building and when played with multiple children also teamwork and working together. This is done by model and grade rules such as being able to choose how many letters to include, assigning points to the words and assigning more points for longer words, and having a time limit within which as many words as possible have to be found. Hence, vocabulary building can be seen as the procedural rhetoric of this game.

Appendix II

Interview scheme for the children

The questions displayed below are pure guidelines. Depending on the game, the situation and the cognitive age of the children, the questions were adapted or left out, and other questions or prompts were added during the observations as well.

<u>Prompts for think-aloud during observations</u>

- Wat ben je aan het doen/Wat doe je? *(What are you doing?)*
    - Wat heb je net gedaan? *(What did you just do?)*
- Waarom doe je dit? *(Why are you doing this?)*
    - Waarom koos je die? *(Why did you pick that one?)*
- Waarom hielp je [naam]? *(Why did you help [name]?)*
- Hoe voel je je hierdoor? *(How does this make you feel?)*
    - Waarom voel je je [emotie]? (*Why are you feeling [emotion]?)*
- Waar kijk je naar nu? *(What are you looking at now?)*

Only if I participate in playing the game:

- Wat gebeurt er als ik dit doe? *(What happens if I do this?)*

<u>Interview questions children</u>

- Heb je weleens zoiets gedaan buiten het spelletje om? *(Do you ever do something similar to what you did in the game in real life?)*
    - *(Make this more specific for each game, so for a game where they play with ducks in a pond, for example ask; do you ever go to the pond with your parents?)*
- Wat was jouw favoriete gedeelte van het spelletje? *(What was your favorite part of the game?)*
- Vond je het spelletje makkelijk of moeilijk? *(Did you find the game easy or difficult?)*
    - Wat vond je het moeilijkste aan het spelletje? *(What was the hardest thing for you in this game?)*
- Vond je het spelletje leuk? *(Did you find the game fun?)*
    - Was er ook iets wat je minder leuk vond? *(Was there something you didn't like?)*
- Hoe voel je je nu na het spelen van het spelletje? *(How did the game make you feel?)*
- Heb je iets geleerd door het spelen van dit spelletje? *(Did you learn something from playing this game?)*
- Heb jij iemand geholpen? *(Did you help anyone?)*
    - Heeft iemand jou geholpen? *(Or did someone help you?)*

Appendix III

Interview scheme for the teachers

Introduction

Allereerst wil ik u bedanken voor uw deelname aan dit onderzoek. Dit onderzoek richt zich op de vraag of kinderen met ondersteuningsbehoeften in staat zijn om de procedurele retoriek van serious games te begrijpen. Om dit uit te leggen: procedurele retoriek is een manier om de regels in een spel te gebruiken om een punt te maken of de spelers iets te laten leren over de echte wereld. Bijvoorbeeld, in een spel over het bouwen van een stad laten de beslissingen die je moet nemen al snel zien dat je niet iedereen tevreden kunt houden in het proces, wat deze situatie in de echte wereld weerspiegelt. Dus wat je wel en niet kunt doen in het spel communiceert in principe een boodschap. Bovendien zijn deze interviews gepland zodat ik meer te weten kan komen over de manier waarop de kinderen leren van het spelen van de games en hoe het mogelijk aangeleerde gedrag tijdens de spellen wordt vertaald naar situaties in het echte leven, en als laatste ook over de gevoelens van de kinderen tijdens het spelen van de games.

> *First of all, thank you for participating in this research. This research will focus on whether children with special needs are able to understand the procedural rhetoric of serious games. To explain this, procedural rhetoric is a way of using the rules in a game to make a point or learn something about the real world. For example, in a game about building a city, the decisions you have to make soon show that you cannot keep everyone happy in the process, which reflects this situation in the real world. So, what you can and cannot do in the game communicates a message. Moreover, those interviews are scheduled so I can learn more about the way the children learn from playing the games and how the possible learned behaviour is translated to real-life settings, as well as about the feelings of the children while playing the games.*

Tijdens het interview mag je de vragen zo gedetailleerd beantwoorden als je zelf wilt, maar ik wil wel benadrukken dat gedetailleerde antwoorden het meest nuttig zijn voor mijn onderzoek. Houd in gedachten dat er geen goede of foute antwoorden zijn, want ik ben echt nieuwsgierig naar alle verschillende ervaringen, gedragingen en gevoelens van de kinderen die u hebt ervaren terwijl ze met de Tovertafel speelden. Houdt u er rekening mee dat u het recht heeft om het interview op elk moment te stoppen of om te weigeren een vraag te beantwoorden. Bovendien zal alles wat u zegt tijdens het interview anoniem blijven en ik zal ervoor zorgen dat de kinderen niet kunnen worden herkend in de gegevens van dit onderzoek. U kunt zich op elk moment terugtrekken uit het interview. Als dit allemaal duidelijk is zou ik graag uw toestemming vragen om dit interview op te nemen, en ik wil nogmaals vermelden dat ik deze gegevens alleen voor onderzoeksdoeleinden zal gebruiken. **Informed consent form geven**

*During the interview, you are free to answer the questions as detailed as you would like, however, I would like to express the value of detailed answers for my research. Keep in mind, there are no right or wrong answers, as I am truly curious about all the different experiences, behaviours and feelings of the children you have experienced while they played with the Tovertafel. Please note that you have the right to stop the interview at any time or to refuse to answer any question. Moreover, everything you say during the interview will be kept anonymous, and I will ensure that the children cannot be recognized in the data of this study. You are able to withdraw from the interview at any time. When this is all clear, I would now like to ask for your consent that I will record this interview, and I want to mention again that I will use this data for research purposes only. *Gives informed consent form**

<u>Interview questions teachers</u>

- Denk je dat de kinderen vooral de regels volgens tijdens het spelen of maken ze misschien hun eigen regels om te zorgen dat ze het spel kunnen spelen? *(Do you think the children play according to the rules of the game or do they make up their own rules?)*
- Heb je het gevoel dat de kinderen een connectie maken met wat er in het spel gebeurt en wat er in het echt leven gebeurd? (*Do you notice any students to make connections between what happens in the game and what happens in real life?)*
- Heb je het gevoel dat de kinderen doorhebben waarom een spel wel of niet gelukt is? *(Do you feel like the children understand why they failed or succeeded in playing the games?)*
    - Hebben de kinderen door wat de gevolgen van hun acties in een spel zijn? *(Do you think the children know what the consequences of their actions are in the game?*)
- Zie je vooruitgang in vaardigheden na het spelen van de spellen? *(Do you see improvement in skills conveyed in the game?)*
    - Heb je het idee dat de kinderen bepaalde skills or kennis die ze geleerd hebben in de spellen toepassen in het echte leven? *(Do you think that the children show certain skills or knowledge they learned in the games in real life?*)
- Zie je dat de kinderen de onderliggende gedachte achter een spel vaak doorhebben en veranderd dit na het vaker spelen? *(Do you see improvement in understanding of underlying messages conveyed in the game?)*
- Heb je het gevoel dat de kinderen het weleens hebben over de regels van het spel als ze het in een groepje spelen? *(Do you feel like the children talk about the rules of the games when they are playing it together?*)
- Zijn de kinderen vaak gefrustreerd als ze de regels van een spel niet snappen? *(Are the children often frustrated when they do not understand the rules of a game?)*

Appendix IV

Informed consent for parents or guardians of the children

Mail to parents
Sent by the school

Dear parent/guardian,

My name is Britt van de Ven and I am currently graduating for my degree in Communication Science at the University of Twente. I am doing this together with the company Tover; they have developed the Tover table that is used at your child's school. More information about the Tover table can be found on this website: https://www.tover.care/nl/

For my research, I look at how children interact with the games of the Tover table. For this, I would like to conduct observations at your child's school. This means that I will be there when your child is alone, or in a group with other children, playing with the Tover table. The children will just play in the same way as they would normally do. In between, I might ask the children some short questions like ‘what are you doing?’ or ‘why are you doing this?’. After playing a game, I might also possibly ask your child some additional questions such as ‘Did you like the game?’ or ‘Did you learn anything while playing the game?’. As soon as I, or the teacher, notice that your child does not feel like answering these questions, I immediately stop asking them. So, your child is not obliged to answer the questions.

If you would like to read more about the study, you can read the attached information document. This document also states that I will ensure that your child's personal information will not be shared with anyone, and I will put everything in my research report anonymously. I will thus make sure that it is not possible to recognize your child in the documents that others can read. I will also film the observations, which I will do from above, so the face of your child will not be visible.

I would like to ask you if you give permission for your child to participate in this research. If you consent to this, would you please return the attached consent form signed. Thank you in advance!

Please note! During this study, we only look at the technology of the Tovertafel and <u>not</u> your child’s performance (i.e. how well he/she does). Therefore, if your child participates in this study, there are no positive <u>and/or</u> negative effects or consequences for your child. I, Tover, and the school would be delighted if you consent to your child’s participation!

For questions, you may always send an e-mail to b.a.a.vandeven@student.utwente.nl or britt.vandeven@tover.care

Kind regards,
Britt van de Ven

INFORMATION SHEET

Master Thesis - Communication Science - In collaboration with Tover
Britt van de Ven – S2154757

This document contains all the information you need to consent to your child's participation in the study. It is helpful to also discuss this information with your child so that he or she knows what will happen. I (the researcher), and the teachers, will also explain this information to the children on the days the study takes place.

Purpose of this study
With this study, I would like to understand exactly how the children interact with the Tover Tafel games, and what they learn from the games. I would like to know if the children understand the message of the games, and how they experience the games.

What happens during the study?
During this study, your child will play with the Tover Tafel as normal. The researcher will be present near the Tover Tafel and observe the children playing (i.e. watching them play with the games), and take notes of what she sees. While observing, the researcher might ask your child some questions, such as 'what are you doing?' or 'why are you doing this?'.

After the children have played with a game, the researcher might ask your child some additional questions, such as 'how did you like the game?' and 'did you learn anything from this game?'. As soon as the researcher, or a teacher, notices that your child prefers not to answer questions, they will stop asking those questions. So your child is not obliged to answer questions.

In addition, the researcher will sometimes play along with your child and the other children.

Potential Risks and Discomforts
There are no risks or inconveniences to participating. Your child does not have to answer any questions if he or she does not want to, and your child does not have to participate if he or she does not want to.

Confidentiality
Your child's privacy is protected as far as possible by law. No personal details of your child will be mentioned in the study. However, the researcher will talk to the teacher about your child, for example to find out at what level your child is approximately in terms of learning and what the reason is your child attends Mattheus School. This information will only be used by the researcher herself, and will not be disclosed anywhere else. Your child's name will not be mentioned in any documents that others may read.

You can request the results of the study if you would like to see them.

Video and audio
The observations will be filmed. This will only be done from above, so your child's face will not be visible on these videos. If your child does look up, I will delete the video.

If your child answers the questions, this will also be recorded. I use the recordings only for this study, keep them safe so no one can access them, and delete them after ten years.

Right to Withdraw and Questions

Your child's participation is completely voluntary. You can choose not to allow your child to participate. If you decide to let your child participate in this study, you can indicate at any time that your child should not participate in the study after all, and your child may also indicate this himself/herself during the study. You, or your child, will not be punished for this. If you want your child to stop participating in the study, you can do so up to three days after the study. After stopping the participation, your child's results will no longer be used.

If you decide to have your child stop participating in the study, if you have any questions, concerns or complaints, please contact Britt van de Ven. This can be done via this e-mail address: b.a.a.vandeven@student.utwente.nl (or britt.vandeven@tover.care).

Statement of Consent

This research has been approved by the University of Twente's ethics committee.

For problems with the study or other questions about the research project, please contact the secretary of the University of Twente Ethics Committee at ethicscommittee-bms@utwente.nl.

Your signature indicates that you are at least 18 years old; that you have read the consent form and this information document; that your questions have been answered and that you voluntarily consent with your child's participation in this study. You may obtain a copy of the consent form if you would like one.

Consent Form for Research on Procedural Rhetoric, Serious Games and Children with Special Needs.
YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM IF REQUESTED

By signing this form, you agree to the following:

- I have read and understood the information about the study. I have been able to ask questions about the study and my questions have been answered.
- I voluntarily consent that my child may participate in this study. I know that my child is not obliged to answer questions and that I (or my child himself/herself) can decide to stop the study at any time, without having to give a reason.
- I understand that a video recording will be made. I also know that the data will be destroyed within 10 years of the completion of this study. A document explaining this research will be made public, but in it your child will not be recognisable.
- I understand that an audio recording will also be made. I also know that the data will be destroyed within 10 years of the completion of this investigation. A document explaining this research will be made public, but in it your child will not be recognisable.
- I understand that the information collected from my child will only be used for the study, and will be made anonymous. The report written about this study will be available to Tover and made public.
- I understand that personal information, such as my child's name or age, will not be shared outside the research team.
- I agree that statements made by my child may be quoted in the report of this study.

Check the box below if your child may participate in the study.

Name child: …….

☐ Yes, my child can participate in this study.

Signatures

_____	_____	_____
Name:	Signature	Date

I have carefully compiled the information sheet and given it to the participant's parent(s) or guardian(s). I have ensured that the parent(s) or guardian(s) clearly understand what they are voluntarily agreeing to.

_____	_____	_____
Britt van de Ven	Signature	Date

Study contact details for further information:
Britt van de Ven
b.a.a.vandeven@student.utwente.nl / britt.vandeven@tover.care

Contact Information for Questions about Your Rights as a Research Participant
If you have any questions about your rights as a participant, or the rights as a parent/guardian of the participant, or would like to request information or discuss concerns with someone other than the researcher(s), please contact the secretary of the University of Twente Ethics Committee. This can be done via ethicscommittee-hss@utwente.nl

Appendix V

Informed consent for teachers

INFORMATION SHEET

Master Thesis - Communication Science - In collaboration with Tover
Britt van de Ven – S2154757

Thank you for agreeing to participate in this study for a Master thesis, conducted by Britt van de Ven, in collaboration with Tover.

Purpose of the research
The purpose of this research is to gain insight in whether children with special needs (or children attending inclusive education) are able to understand the procedural rhetoric of serious games. To explain this, procedural rhetoric is a way of using the rules in a game to make a point or learn something about the real world. For example, in a game about building a city, the decisions you have to make soon show that you cannot keep everyone happy in the process, which reflects this situation in the real world. So, what you can and cannot do in the game communicates a message.

The aim of the scheduled interviews is to learn more about the way the children learn from playing the games and how the possible learned behaviour is translated to real-life settings, as well as about the feelings of the children while playing the games.

Procedures
By participating in this research, you will answer several questions the researcher asks. Feel free to do this as detailed as you prefer. If you think of something that you might think is important, feel free to mention this, even when it is not asked about.

Potential Risks and Discomforts
There are no physical, legal or economic risks associated participating in this study. You do not have to answer any questions you do not wish to answer.

Confidentiality
Your privacy will be protected to the maximum extent allowable by law. No personally identifiable information will be reported in any document related to this research. Within these restrictions, results of this study will be made available to you upon request. In the report, your name will not be mentioned.

Similarly, the privacy of the children will be protected, meaning that no names or other identifiable information about the children will be mentioned in the report or transcribed texts.

Audio
This research project involves making an audio recording of the interview. This audio recordings will not be used for other purposes than this research. The audio recordings, forms, and other documents created or collected as part of this study will be stored in a secure location and will be destroyed within ten years of the initiation of the study.

Right to Withdraw and Questions
Your participation in this research is completely voluntary. You may choose not to take part. If you decide to participate in this research, you may stop participating at any time. There will be no consequences for you when you decide to stop participating . If you want to withdraw from the study, you can do this till three days after the interview. The result will not be used anymore after withdrawing from the study.

If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact Britt van de Ven. This can be done by this email: b.a.a.vandeven@student.utwente.nl (or britt.vandeven@tover.care)

Statement of Consent
I have been given the guarantee that this research project has been reviewed and approved by the BMS Ethics Committee. For research problems or any other questions regarding the research project, the Secretary of the Ethics Commission of the faculty Behavioural, Management and Social Sciences at University Twente may be contacted through ethicscommittee-bms@utwente.nl.

Your signature indicates that you are at least 18 years of age; you have read this consent form; your questions have been answered to your satisfaction and you voluntarily agree that you will participate in this research study. You will receive a copy of this signed consent form if requested.

Consent Form for Research on Procedural Rhetoric, Serious Games and Children with Special Needs.

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM IF REQUESTED

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	□	□
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	□	□
I understand that taking part in the study involves an audio-recorded interview, that will be transcribed as text. I am also aware that the data will be destroyed within 10 years after completing this research, however, the transcribed text will be made public (fully anonymized)	□	□
Use of the information in the study		
I understand that information I provide will be used for research purposes only, and will be mentioned in the report belonging to this study that will be openly published, and available to Tover.	□	□
I understand that personal information collected about me (or the children) that can identify me (or the children), such as names or age, will not be shared beyond the study team.	□	□
I agree that my information can be quoted in research outputs	□	□
Consent to be Audio Recording		
I agree to be audio recorded.	□	□
Future use and reuse of the information by others		
I give permission for the audio recording that I provide to be archived in safe possession of the researcher so it can be used for future research and learning.	□	□

Signatures

_____	_____	_____
Name:	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____	_____	_____
Britt van de Ven	Signature	Date

Study contact details for further information:

Britt van de Ven

b.a.a.vandeven@student.utwente.nl / britt.vandeven@tover.care

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 Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl

Appendix VI

Coding schemes

Table 8

Coding scheme observations and interviews children

Main code	Sub code	Additional code	Explanation
1. Procedural rhetoric	1.1 Rules	1.1.1 Understanding 1.1.2 Creating 1.1.3 Not-understanding	The understanding or non-understanding of the rules of the game, or the creation of new rules. Rules refer to the rules explained in the game analysis performed.
	1.2 Connection to real world		A possible connection made between the game and the real world (both verbal and physical).
	1.3 Goal	1.3.1 Understanding 1.3.2 Not-understanding 1.3.3 Goal reached	The understanding or non-understanding of the goal of a game, or reaching the goal of the game. Goals refer to the goals explained in the game analysis performed.
	1.4 Learning (skills)	1.4.1 Waiting for your turn 1.4.2 Not waiting for your turn 1.4.3 Educational skills 1.4.4 Social-emotional skills 1.4.5 Action-reaction 1.4.6 Other learning aspects	Learning skills such as waiting for your turn, educational skills (e.g. naming colors, mathematics, letter recognition etc.), social-emotional skills. Also learning about action-reaction (one of the goals of the games) and other (remaining) learning aspects are included.
	1.5 Interpretation	1.5.1 Creating gameplay / goals 1.5.2 Similar to rules 1.5.3 Other	The way the children interpret the game, meaning the way they seem to want to play the games. Is the interpretation similar to the rules or do they create gameplay/goals?
2. Playing together	2.1 Competitive	2.1.1 Understanding 2.1.2 Not-understanding	The understanding or non-understanding of competitive games, and the behaviour or

				comments made when they won or lost.
		2.2 Collaborative	2.2.1 Working together 2.2.2 Working individual at the same time 2.2.3 Asking someone to join 2.2.4 Imitating	The way in which the children participate in collaborative play when a group of children plays with the games.
		2.3 Helping	2.3.1 Helping others 2.3.2 Asking for help 2.3.3 Rule explaining	The helping behaviour or the ability to ask for help of the children while playing together.
		2.4 Negative experience	2.4.1 Not wanting to share	A negative experience when 2 or more children are playing together.
3.	Emotions	3.1 Positive 3.2 Negative 3.3 Hedonic 3.4 Eudaimonic 3.5 Bored	3.2.1 Frustration	The emotions the children experience while, or after, playing the games, and whether they are basic emotions (hedonic) or deeper emotions (eudaimonic; e.g. coming from reaching a goal).
4.	Game preference	4.1 Strong preference 4.2 Just preference 4.3 Happy with the choice 4.4 Unhappy with the choice		Potential preference for playing a certain game amongst the children, and their reactions when they could not choose themselves.
5.	Distraction	5.1 Too difficult 5.2 Too boring 5.3 Reason unknown		Possible distraction of the children while playing a game and the potential source of distraction.
6.	Guidance	6.1 Turn-taking 6.2 Explanation 6.3 Rule creating		Guidance from the teacher in any form.
7.	Difficulty level	7.1 Easy 7.2 Difficult		Whether the children indicate they find a game (or an element of the game) difficult or easy.

Table 9

Coding scheme interviews teachers

Main code	Sub code	Additional code	Explanation
1. Use of TT	1.1 Learning 1.2 Relaxation 1.3 Other		The reason the TT is used; as a tool to learn or for mere entertainment and relaxation.
2. Procedural rhetoric	2.1 Rules	2.1.1 Following/understanding 2.1.2 Creating 2.1.3 Not-understanding	The understanding or non-understanding of the rules of the game, or the creation of new rules. Rules refer to the rules explained in the game analysis performed.
	2.2 Real life	2.2.1 Connection to real world 2.2.2 No connection to real world	A possible connection made between the game and the real world.
	2.3 Goal	2.3.1 Understanding 2.3.2 Not-understanding 2.3.3 Creating	The understanding or non-understanding of the goal of a game. Goals refer to the goals explained in the game analysis performed.
	2.4 Skills	2.4.1 Improvement 2.4.2 No improvement 2.4.3 Translation to real life 2.4.4 No translation to real life 2.4.5 TT is seen as a tool	The improvement or no improvement of certain social, emotional, motor, or cognitive skills related to playing the games, the possible translation of those skills to real life situations, and whether the TT is seen as a tool in learning skills.
	2.5 Social emotional skills	2.5.1 Understanding 2.5.2 Not understanding 2.5.3 Improvement 2.5.4 No-improvement 2.5.5 Learning	Whether the children understand the social-emotional skills learned with the games or not, whether those skills improve or not and whether there is a focus on learning those skills.
	2.6 Interpretation	2.6.1 Own interpretation 2.6.2 Similar to rules/goals 2.6.3 Based on action-reaction	The interpretation of the games by the children while they play the games, meaning the way they seem to want to play the games. They can create an own interpretation (different from the rules), it can be similar to the rules

				and the goals of the game or they can be driven by the action-reaction they see and interpret it based on those reactions visible in the game.
	3. Playing together	3.1 Competitive	3.1.1 Understanding 3.1.2 Not-understanding	The understanding or non-understanding of competitive games, including the scores.
		3.2 Collaborative	3.2.1 Working together 3.2.2 Working individual at the same time 3.2.3 Wanting to play together	The form of collaborative play when a group of children plays with the games together.
		3.3 Helping	3.3.1 Helping others 3.3.2 Asking for help 3.3.3 Rule explaining 3.3.4 Not helping 3.3.5 Guidance from teacher	The helping behaviour (or not) or the ability to ask for help of the children while playing together, and whether the teachers give guidance.
4	Emotions	4.1 Positive 4.2 Negative 4.3 Hedonic 4.4 Eudaimonic 4.5 Bored	4.2.1 Frustration	The emotions the children experience while, or after, playing the games, and whether they are basic emotions (hedonic) or deeper emotions (eudaimonic; e.g. coming from reaching a goal).
5	Reflecting	5.1 Yes 5.2 No 5.3 Useful 5.4 Non-useful		Is there reflection on the games and is the reflection useful for understanding the goal and/or improvement in skills?
6	Difficulty level	6.1 Easy 6.2 Difficult		Whether the games are difficult or easy for the children.
7	Game choosing			Anything related to the choosing of the games.