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The Effects of Technology and Peer Collaboration on Children's Creativity

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Abstract

The aim of this research was to gain a more comprehensive understanding of 5- to 7-year-old children's creativity and discover what factors affect it. In particular, the focus of this research was to find out how and in which ways touchscreen device use and peer collaboration affect children's creativity. Two different creative domains were measured: storytelling and drawing. Storytelling was measured in two cultures: the UK and Turkey. A new way to measure children's creative storytelling was developed. Linguistic components of children's stories were evaluated to measure two divergent thinking skills (fluency and elaboration) in a more objective way. Children's stories were also measured by independent judges using the Consensual Assessment Technique. Touchscreen use did not affect children's creativity in either of the countries. Collaboration had a positive effect on the fluency of British children's stories, no effect on their overall creativity, and a negative effect on their elaboration. For Turkish children collaboration had a positive effect on the fluency and overall creativity of their stories, and no effect on the elaboration scores. Children's creative drawing was measured using the Torrance Tests of Creative Thinking (TTCT)-Figural. The effects of children's perceived peer acceptance were also measured. Collaboration had a positive effect on children's fluency, however it did not affect their originality or elaboration. Overall these results provide a holistic evaluation of the effects of collaboration on creativity across different domains and different cultures.

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CHAPTER ONE

Creativity as a Concept and Factors That Affect Children's Creativity

Creativity is an ability that allows people to cope with the challenges of life (Runco, 2004; Sternberg & Lubart, 1996). It enables people to solve problems (Guilford, 1966), create problems (Jaarsveld, Lachmann, & Leeuwen, 2012), make scientific discoveries (Simonton, 2004), and produce art (Guilford, 1957). It is a crucial skill to have to be successful in any occupation that involves thinking (Sternberg & Lubart, 1996). Creativity is also a highly valued ability for children both in school settings and at home (Runco, 1992). Children's curiosity and search for what is new and exciting motivates them to be creative from an early age (Leggett, 2017). An important question is which conditions allow children to be more creative? This thesis aimed to find out the factors that increase or inhibit children's creativity. In this thesis, creativity is conceptualised as an activity that results in a novel and appropriate outcome, and the novelty and appropriateness of this outcome is context- and domain-specific. This definition of creativity will become clearer once the concepts such as novelty, appropriateness, and context- and domain-specificity are defined later in this chapter. The two main questions of this thesis are: 1) What are the social and contextual factors that affect children's creativity? 2) Can the results that are gathered be generalised across domains and cultures?

Children's creativity can be explored in various activities they take part in. For instance, it can be viewed when they take part in pretend play, come up with innovative dance movements, or sing a made-up song. These activities and many others require children's imagination. In this thesis, children's creativity was measured in two domains: storytelling and drawing. The reason for choosing these two domains was to

examine two distinct creative abilities to get a broader picture of children's cognitive abilities. While measuring children's creativity in drawing and storytelling, the tools children used, and their social abilities were also considered. Specifically, children's use of technology and their collaboration with peers were analysed. In order to cover these topics and answer the questions mentioned above, this literature review is structured to follow these steps: 1) Discuss why creativity is important and the difficulty with defining and measuring creativity. 2) Specifically cover children's creativity as this is the scope of the thesis. 3) Discuss storytelling and drawing as creative activities. 4) Focus on technology, peer collaboration, and culture as factors that may impact children's creativity. 5) Introduce the aims of this thesis and the studies that are conducted within the scope of this thesis.

1.1 Why is Creativity Important?

As the world has progressed to be more complex and demanding, the need for creativity has risen (Runco, 2004). Runco suggested that in order to keep up with the more demanding nature of the modern world, individuals need to approach daily life problems in a more innovative way. People need creativity to solve problems (e.g., Guilford, 1967) and being able to solve daily life problems helps people manage their lives better. As such, Tanggaard (2012) suggested that creativity should not be regarded as a unique and rare ability, and that it is an everyday phenomenon. For instance, using the side of the fork in the absence of a knife is a creative idea, and it is far from being ground-breaking. However, it still helps people get on with their everyday lives and solve their problems. Sternberg and Lubart (1996) also suggested that regarding creativity as a mystical and otherworldly ability was one of the reasons for creativity to be a less studied area in psychology research. Creative thinking occurs in simple daily

life activities. Following this idea, this thesis aimed to evaluate children's regular activities for their creative value.

As much as being a daily life activity, creativity is also needed for scientific improvement. Although scientists are more restricted as their findings or discoveries need to be accurate, they still need ground-breaking ideas to make use of their knowledge (Simonton, 2004). For instance, Thomas Edison relied on his own and others' previous scientific knowledge before he designed his light bulb (Ward, 2007). However, this does not make his discovery any less creative. Additionally, creativity has an economic impact. New discoveries create new job opportunities and competition in work places (Sternberg & Lubart, 1996).

Creativity also has educational implications. The national primary school curriculum of the UK emphasises the importance of creativity and why children's creativity should be promoted (The National Archives, 2010). It is suggested that creativity supports children's self-esteem, it makes them open to new ideas, and improves their learning ability. A study looked at whether creativity and emotional intelligence were related to 9- to 12-year-old children's school performance (Hansenne & Legrand, 2012). They found that children's creativity was positively related to their school performance in maths and French classes, whereas emotional intelligence did not predict children's academic performance. Another study looked at the effects of a project called Creative Endeavours on children's learning (Cress & Holm, 2016). This project was conducted in a first-grade classroom and added creative activities such as sewing, drama, and photography into the classroom curriculum. As a result of this project, children's writing and drawing abilities improved. Sawyer (2006) also suggested that creativity was the key for better education. He proposed that techniques such as improvisation could be used as a way of teaching. By adding creativity into

teaching, it is possible to get children to generate more ideas and become more involved in the learning process.

In addition to the practical benefits, creativity was also found to be beneficial for emotional and social well-being. For instance, a study with older adults revealed that there was a positive correlation between individual's creative performance and their life satisfaction levels (Goff, 1993). Additionally, a study looking at the relationship between stress, suicide ideation and creative abilities revealed that college students who scored high on creativity measures scored lower on stress and suicide ideation measures (Mraz & Runco, 1994). It was suggested that creative people might be able to come up with alternative options to suicide when they faced stress or other problems in life.

Overall, creativity seems to help people in different areas of life and on different levels. While it is believed to be a crucial ability in many different areas, the creativity research is still sparse. Studying creativity is therefore valuable in terms of discovering how it improves people's everyday lives and how it leads to scientific breakthroughs.

1.2 Defining and Measuring Creativity

The term creativity has been used in the literature for a long time without having a specific definition (Hennessey & Amabile, 2010). Many researchers mentioned how hard it was to define creativity (e.g., Hennessey, Amabile, & Mueller, 2011; Kaufman & Beghetto, 2009). Throughout time, creativity was defined as producing novel and appropriate ideas (e.g., Runco & Charles, 1993), the ability to come up with lots of distinct ideas (e.g., Guilford, 1966), or the ability to combine different ideas to come up with the best idea (e.g., Mednick, 1962). The challenge of defining creativity brought with it another challenge - measuring creativity. There have been a number of studies that were published purely to review the existing measurement techniques and the

shortcomings of these techniques (e.g., Piffer, 2012; Yamamoto, 1966). Amabile (1982), and later Nusbaum and Silvia (2011), suggested that there were two major ways of measuring creativity: using standardised tests, or judges. This section of the literature review will cover the different definitions of creativity and different types of measurement.

1.2.1 Novelty and appropriateness

As a widely accepted description, creative products have been defined as being both novel and appropriate (e.g., Hennessey & Amabile, 2010; Kaufman & Sternberg, 2006; Runco & Charles, 1993). In this definition, novelty refers to the uniqueness of the product or idea while appropriateness refers to the usefulness or the practicality (Runco & Charles, 1993). It has been suggested that novelty and appropriateness complete each other to make a product or an idea creative (e.g., Piffer, 2012). However, a more recent study argued that it is novelty that is central to the creative value of an idea or a product, and that appropriateness matters only after the novelty criterion is met (Diedrich, Benedek, Jauk, & Neubauer, 2015). An earlier study (Runco & Charles, 1993) also suggested that when participants were asked to judge ideas in terms of their creative value, originality or novelty was a better predictor than appropriateness. Additionally, Houston and Mednick's (1963) study demonstrated that in a word association task, highly creative individuals preferred unusual word associations and therefore sought novelty more than individuals with lower levels of creativity. Thus, novelty appears to better determine the creative value of a product, and appropriateness is an add-on value once the novelty criterion was met. This is especially true when the end product is an art product.

The idea that novelty is the main determiner of a creative work can be challenged by taking a different approach to the definition of creativity. In scientific discoveries, the appropriateness or the usefulness of the idea becomes more important than its novelty. For instance, Einstein was more restricted in his scientific discoveries than Picasso was in his drawings (Simonton, 2004). The reason for that was argued to be the difference between science and art. Whilst science depends on previous knowledge and established facts, arts have a lot more room for novelty (Ward, 2007).

Together with the discussion of whether novelty or appropriateness makes an outcome more creative, another discussion has been around the generalisability or specificity of creative talent. While some researchers defined creativity as a domain-general ability (Plucker, 1998), others proposed that it was a domain-specific talent (Baer, 1998, 2012; Julmi & Scherm, 2015). Defining creativity as a domain-general ability assumes that if a person is creative in one domain (for instance linguistic) they would be more likely to be creative in other domains too (for instance musical) (Baer, 1998). However, the researchers who describe creativity as a domain specific ability suggest that a person's ability in one specific domain does not necessarily predict their creativity in other domains, and that each domain has different requirements (Baer, 2012). The domain-specific approach to creativity provides a clearer definition of the term. When approached as an umbrella term, it becomes harder to draw boundaries of creativity. Similar to the way in which a person's expertise in one area does not guarantee their expertise in other areas, being creative in one area also does not guarantee creativity in other areas. For instance, because somebody is a professor in physics, it is hardly plausible to expect them to be an expert in history too. Similarly, being creative in poetry, does not guarantee a person's creativity in sculpting.

Therefore, when judging the value of creative products, it is crucial to consider the domain.

The domain-specificity of creativity has also been challenged. In Ranjan, Gabora and O'Connor's (2013) study, two expert painters were asked to listen to four different pieces of music and reinterpret them in their paintings. Naïve undergraduate students were then asked to match the painting with the music piece that had inspired it. Participants managed to match the paintings with the correct piece at above chance levels for both artists. The idea from this study is that although painting and music are different domains, the way they are interpreted and the factors that impact the creation of art products in these two domains can be similar. Therefore, the authors suggest a possibility for cross-domain interpretation of creative outputs.

1.2.2 Divergent thinking

Guilford (1957) suggested that productive or creative thinking happens in two major ways: divergent and convergent thinking.

Divergent thinking was described as the ability to come up with multiple, and loosely related ideas to solve a problem (Guilford, 1959). Guilford argued that there were four components of divergent idea production: fluency, flexibility, originality and elaboration. Fluency is used to describe the ready flow of ideas. Flexibility is the ability to switch between different ideas. Originality is the ability to come up with ideas that are distinctive from existing ideas. Finally, elaboration is the amount of detail a piece of creative product has (Guilford, 1967). For instance, if a story was to be investigated in terms of its divergent thinking components, fluency would refer to the flow of the ideas throughout. Flexibility would refer to the storyteller's ability to include several ideas and switch between these ideas while telling the story. Originality would refer to the

features of the story that distinguish it from other stories and make it unique. Elaboration would manifest itself in the level of details that the story has, such as a detailed description of the setting and the characters.

There have been plenty of divergent thinking measures that were created in an attempt to capture creative ideation in a standardised way (Runco & Okuda, 1991). Among these measures, Guilford's Alternate Uses Test (AUT) (Guilford, 1967), Wallach and Kogan's Creativity Battery (Wallach & Kogan, 1965) and Torrance's Tests of Creative Thinking (TTCT) (Torrance, 1966) appear to be the most widely used ones. In the AUT (Guilford, 1967), participants are given three minutes to come up with alternative uses for an item (e.g. a paperclip). They are expected to list as many diverse ideas as they can think of, such as using a paperclip for lock picking, or keeping a plastic bag closed. Therefore, this task measures the individuals' ability to come up with loosely related ideas.

Wallach and Kogan's Creativity Battery (Wallach & Kogan, 1965) consists of five tests: Instances, Alternate Uses, Similarities, Pattern Meanings and Line Meanings. While the first three tests involve verbal stimuli, the last two involve visual materials. The Instances test requires participants to find as many examples as they can for four categories, such as listing all the square things that they can think of. The Similarities test asks to find similarities between object pairs, such as listing all the ways in which a violin and a piano are alike. The Pattern Meanings test requires participants to look at a list of pattern combinations (for instance, four circles on top of two parallel landscape lines and one horizontal line) drawn on a piece of paper and interpret them. The participants are asked to describe what the whole pattern looks like. Finally, in the Line Meanings test participants are asked to interpret the meanings of a list of single lines

which are shaped differently. For instance, some of the lines are curvy, while some of them have sharp edges. (Wallach & Kogan, 1965).

The TTCT has been the most widely used divergent thinking measure (e.g., Baer, 1993; Lissitz & Willhoft, 1985). There are two versions of the TTCT: verbal and figural. Both verbal and figural versions have two parallel forms (Form A and Form B). The TTCT-Verbal consists of six activities: Asking, Guessing Causes, Guessing Consequences, Product Improvement (based on a toy elephant for Form A and based on a toy monkey on Form B), Unusual Uses (of cardboard boxes for Form A and of tin cans for Form B), and Just Suppose (Kim, 2006; Krumm, Aranguren, Filippetti, & Lemos, 2016; Torrance, 1966). The Asking task requires participants to ask questions regarding a picture that is shown to them. The Guessing Causes task asks participants to guess the reasons for the scene they see in a picture. In the Guessing Consequences task, participants come up with ideas for the outcomes that would occur as a result of a scene shown in a picture. For the Product Improvement task, participants are asked to make changes to an existing product to make it different from other existing products. In order to complete the Unusual Uses task, participants are asked to come up with many different and unique uses for an object. Finally for the Just Suppose task participants are given an unrealistic situation and they are asked to think of events that would occur as a result of this situation (Torrance, 1966).

The TTCT-Figural consists of three activities: Picture Construction (an egg-like shape for Form A and a bean-like shape for Form B), Picture Completion (different sets of 10 incomplete pictures in each form) and Lines (for Form A and Circles for Form B) (Torrance, 2017a). The TTCT-Verbal measures fluency, originality, and flexibility of the responses (Krumm et al., 2016; Torrance, 1966), while the TTCT-Figural measures fluency, originality and elaboration (Torrance, 2017a). Participants are given 10 minutes

to complete each of these tasks. In the Picture Construction task, participants are presented with a shape on the paper and are asked to work on this pre-existing shape to make it into an unusual drawing and give this drawing a title. In the Picture Completion task, participants are provided with 10 incomplete picture stimuli and they are asked to turn these stimuli into complete drawings and give each drawing a title. Finally, in the Lines (or Circles) task, participants are given 20 pairs of parallel lines (or 20 circles) to turn into different drawings. For each of the tasks, participants are asked to come up with ideas that no one else would think of (Torrance, 2017a).

1.2.3 Convergent thinking

Convergent thinking is the ability to come up with the best idea to solve a problem by making connections between different ideas (Guilford, 1967). Mednick (1962) emphasised that an original idea could only be called creative when it was also useful. The most commonly used test to measure convergent thinking is the Remote Associations Test (RAT) (Mednick, 1962). The idea behind this test is that each test item consists of three words that all have association to only one word. For instance, the words *rat, blue* and *cottage* have an association to one word, which is *cheese.* Although, this type of creativity requires coming up with a correct answer, the procedure that brings the person to the correct answer is creative, as it requires making connection between words that are somewhat distinct from each other at first glance. Houston and Mednick's (1963) study demonstrated that college students who scored high on the RAT tended to have a need for novelty. In this study, participants were categorised as high creativity (HC) and low creativity (LC) groups based on their scores on RAT. Afterwards, they were shown a list of word pairs. This word pairs consisted of one noun and one non-noun, and the participants were asked to choose one of the two words in each pair. Nouns were then matched with unusual words and non-nouns were matched

with ordinary words. The results revealed that HC participants chose the nouns more frequently as they sought for novelty more than LC participants who chose non-nouns more frequently.

Hudson (1966) suggested that young students could be divided into two groups: convergers, who are more capable of performing well in objective tests, and divergers, who are more successful at essay type tests. He therefore suggested a distinction between convergent and divergent thinking and related convergent thinking to analytical and objective thinking, and divergent thinking to subjective and more creative thinking. Later, Lloyd-Bostock's (1979) study also suggested that divergent thinking was more related to arts while convergent thinking ability was not found to be correlated with arts in 13- to 14-year-olds.

1.2.4 The criticism towards standardised measurement techniques

Measuring creativity with standardised pen and paper tests has been criticised for several reasons (Sternberg & Lubart, 1996). For instance, Amabile (1982) suggested that most of the creativity research focused on individual abilities and ignored the social psychological importance of creativity. She suggested that while the cognitive determinants of creativity were important to focus on, the effects of the social environment also needed to be considered. She believed that the creative value of an idea or a product could be decided by others' judgement rather than by standardised tests. Amabile's approach can be considered as the pioneer movement towards a more ecologically valid measurement of creativity. Rather than generalising the results of a standardised test to an individual's overall creative ability, this approach suggested that there were different types of creative abilities, and each could be measured by people who are knowledgeable in these specific areas. Baer (1993) also suggested that

standardised measures of creativity were far from covering different types of creative abilities. He suggested that these tasks were still in use because, from a practical perspective, having a standard test to measure an "overall creativity" was useful for researchers. However, he suggested that listing alternate uses for a brick was far from adequate for measuring an individual's creative ability. Baer also emphasised the domain-specificity of creativity and that a one-fits-for-all type of creativity measurement was underestimating individuals' creative performance (Baer, 1994a, 1998, 2012).

Another criticism about the standardised tests has been about the problem with their definition in the literature. Often times divergent thinking has been regarded singlehandedly as creativity, and therefore divergent thinking tests as purely creativity tests. For instance, although it only measures divergent thinking, Torrance's divergent thinking measure is called Torrance Test of Creative Thinking (Piffer, 2012). Piffer argued that, while it is not entirely inaccurate to call a divergent thinking test a creativity test, this approach undermines the ability of, for instance, convergent thinking measures as creativity measures. This approach to divergent thinking measures exhibits the problematic evaluation of divergent thinking to be the sole determiner of a person's "creativity". This approach is problematic both because the notion of an overall "creativity" is not accurate, and a divergent thinking measure that focuses on one domain (e.g. verbal ability) cannot be generalised to a person's creativity in other areas.

Before moving on to a more subjective way of creativity measurement, another debate about the general understanding and definition of creativity needs to be addressed. In the earlier days of creativity research, one of the biggest debates was the creativity-intelligence distinction. Some researchers explained creativity as a subtype of, or synonyms with, intelligence (for a review see Runco, 1992). Also suffering from the

hardship of having clear boundaries, intelligence was defined by Wechsler as "the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment" (Wechsler, 1958, p. 7, as cited in Guilford, 1967). The idea of classifying creativity as a subtype of intelligence faced opposition by many researchers. Guilford (1950) stated that the abilities that were used to measure intelligence, such as maths and reading abilities, did not require creative talent, and therefore were not measuring creative abilities. Ward also emphasised the importance of making the distinction between creativity and intelligence: "… it must be shown that creativity tests are something other than unusual and relatively unreliable measures of IQ." (Ward, 1968, p. 738). Similarly, Wallach and Wing (1969) proposed that while intelligence scores could give information about somebody's academic achievements, they could not provide information about this individual's success in areas that required talent such as arts, music or creative writing.

Wallach and Kogan (1965) argued that there were two paths to follow when thinking about the intelligence-creativity distinction. They proposed that researchers either needed to accept that there was no difference between creativity and intelligence, which would have been the end of creativity research. The other option was to investigate the creativity measurement in more depth and find out the shortcomings and misrepresentations within the definitions. The fact that creativity research still exists to this date suggests that the creativity researchers followed the second path. As such, Runco (2004) argued that towards the end of 1980s researchers mostly agreed that creativity and intelligence were different concepts.

1.2.5 A consensual definition and measurement of creativity

Although standard measures are widely used in psychology research, it is often not possible to fully rely on standard measurements especially for measuring creativity (Nusbaum & Silvia, 2011; Silvia, Martin, & Nusbaum, 2009). Thus, alternative ways of measuring creativity have been suggested, one of which was to get judges to decide the creativity of a product (Amabile, 1982).

Creativity has widely been evaluated with divergent and convergent thinking measures. However, when the ecological validity of these measurements are concerned, it brings up the question of whether, for instance, listing different uses for an object could explain the actual creative potential of individuals (Cohen-Shalev, 1986). It was argued that creativity in art could be different from what standardised measures identified as creative. This concern led to another way of measuring creativity.

The Consensual Assessment Technique (CAT) was an alternative way of measuring creativity which was proposed by Amabile (1982). She aimed to measure creativity in a way that was more subjective, yet reliable. CAT has a more naturalistic approach to measuring the creative value of a product. This technique suggests that everyone knows whether a product is creative or not; however, when it comes to describing what is creative, people often struggle with the correct description. Thus, this technique relies on people's intuitive knowledge of creativity, and it has been suggested that if researchers ask enough people to rate a product's creative value, people will manage to agree on the items they rate as creative. This way, the creative product will be evaluated in a more ecologically valid way.

Amabile (1982) suggested that in order for the CAT measurement to be trustworthy, there are some requirements about the creative product and also about the measurement

style. For instance, she declared that the task or the product that is being evaluated for creative properties should be an open-ended one that requires flexibility and novelty. Another important point is that the judges of the creative product should have a certain level of experience and knowledge in the area of the creative product (Amabile, 1982). This does not mean that the judges should be an expert in the area, although that could also be desirable in certain situations. However, they should at least have basic knowledge about the area. For instance, Ward (2007) suggested that if the creative product is a tool, or an animal with unusual features, anyone with a knowledge of this tool or animal should be able to judge the creativity of the ideas that the participants come up with. Similarly, Amabile's (1982) study also revealed that, when judging the creativity of collages made by children, artists' and non-artists' judgements showed a high agreement. However, when the end product requires expert knowledge, such as an architectural design, the judges were frequently chosen among the experts in the area (Amabile, 1982; Kaufman & Baer, 2012).

Additionally, judges should give their ratings independently and most importantly without being given a definition of creativity. The idea behind the CAT is that people do know what is creative, and the CAT should be measuring this rather than the judges' ability to follow instructions given by the researcher. Only in this way can the CAT reach an ecologically valid measurement of creativity.

The CAT has been used widely among researchers (e.g., Caroff & Besançon, 2008; Kaufman & Baer, 2012; Kaufman, Baer, Agars, & Loomis, 2010; Kaufman, Lee, Baer, & Lee, 2007; Mouchiroud & Bernoussi, 2008; Stefanic & Randles, 2014) and was found to reach a high inter-rater reliability level. Inter-rater reliability, in other words the agreement between independent judges, is an important indicator that this measurement can be trusted (Hennessey & Amabile, 2010). Additionally, Baer's (1994)

study revealed that CAT measurement has long term stability. Five independent judges measured the creative value of fourth grade children's story- and poem-writing abilities in two timepoints which were 11 months apart. The results revealed that there was considerable stability of the results (.44 correlation for the poem-writing and .58 correlation for the story-writing). Therefore, Baer suggested that researchers should consider using consensual assessment as either the main or a complementary measurement of creativity together with the standardised tests. Similarly, Lubart and colleagues (2010) suggested that, to measure creativity, standardised measures and independent judges should not be thought of exclusively. They suggested that to achieve a better understanding of creativity, combining different types of measurement should be considered.

1.2.6 Innovation

Another term that has been linked with creativity is innovation. In different studies innovation has been either used interchangeably with creativity or as an end product which is succeeded as a result of creative thought (Westwood & Low, 2003). Innovation can be observed in animals as well as humans. Innovation is defined as the ability to come up with a unique solution to a problem, or to use a previously known solution for a new problem (Boesch, 1995; Kummer & Goodall, 1985). In this sense, creativity and innovation indeed seem very similar. However, a study suggested that children's innovation abilities were not related to their divergent thinking abilities (Beck, Williams, Cutting, Apperly, & Chappell, 2016). In this study five- to seven-year-old children completed two divergent thinking tasks. The first one was a drawing task, similar to the Circles test in the TTCT-Figural (Torrance, 1966). The participants were then asked to complete the hook-innovation task. The hook-innovation task requires participants to think up the idea to create a hook from a straight pipe cleaner to collect a

sticker in a bucket that is located inside a clear tube (Beck, Apperly, Chappell, Guthrie, & Cutting, 2011). The final task was an alternate uses task that asked participants to come up with alternative uses for a given object. The results revealed that children's success in the divergent thinking tasks did not predict their tool-innovation performance.

Barron and Harrington (1981) made two somewhat distinct descriptions of creativity: 1) The ability to create novel products and receive public interest and recognition; and 2) The ability to perform well at tests where a person's creativity can be measured and compared with someone else's. These definitions suggest that creativity can either refer to the end product or to the person who performed well at a creative task. In this sense, it can be argued that having the ability to think divergently might not always lead to innovating a product. As such, the ability to think divergently and the ability to use these thoughts to innovate a tool could be separate. While both divergent thinking and innovation require thinking up a new idea, innovating a tool additionally requires the idea to be appropriate.

Overall, the literature seems to suggest that there are different definitions of creativity, and different ways of measuring creative abilities. While some overlap with each other, others refer to different components.

1.3 Children's Creativity

Children's creativity had been a neglected area in psychology research until the 1950s when Guilford drew researchers' attention to this topic (Guilford, 1950). He mentioned how important it was to examine children's creativity and yet how very few studies had been done in the area. This endeavour created such an increase in children's creativity research that in the 1980s research on adult creativity seemed to go into

decline (Cohen-Shalev, 1986). Cohen-Shalev argued that the reason for the emphasis on children's creativity was the researchers' interest in capturing the development of this phenomenon as early as possible.

Young children are in the process of discovering and learning about their surroundings which makes them creative individuals (Urban, 1991). Most of the things around children are new and exciting for them which makes them more appreciative of novelty. The novelty aspect ranges from discovering their own physical abilities to the way things around them work. For instance, young children discover how to use different parts of their bodies, how different body movements result in different actions and how they can manipulate these to achieve appropriate actions such as throwing or grabbing. In addition, they are frequently faced with new tools, objects, and environments to which they need to adapt appropriately (Torrance, 1964). While a big part of their adaptation occurs through imitating other people around them, children also come up with their own creative solutions through trial and error (Urban, 1991).

Children's creative abilities can also be observed through pretend games (Vygotsky, 2004). Vygotsky proposed that children pretending to ride a horse when mounting on a stick, or be a pirate or a sailor in a game, shows their ability to imagine a world that deviates from reality. Moreover, children's creative abilities have been found to develop as they grow older. For instance, abstract thinking and creativity in children's drawings were found to develop as they get older (Lambert, 2005). In this longitudinal study, 4- to 5-year-old children's drawings were observed throughout 12 months to discover the development from preschool into primary school. The results revealed that children developed towards a more abstract drawing style which related to their symbolic understanding. Additionally, children's ability to accurately judge originality and appropriateness of ideas was found to improve with age, which suggests

cognitive development in terms of understanding and appreciating creative ideas (Charles & Runco, 2001).

From an educational perspective, schools have been criticised for "killing children's creativity" (Kaila, 2005, p.6). For instance, Robinson (2011) argued that education makes children less creative because schools start standard education too early instead of allowing children to explore their creative potential more. Schools follow a fixed curriculum and it was argued that they fail to support the individuality of each child (Runco, 2004). It was suggested that schools need to be more democratic and open to children's ideas in order to allow them to express their ideas and enhance their creative thinking (Kaila, 2005). In educational settings, creativity has been approached with caution as the results of creativity studies have not been very clear compared to other areas such as maths or literacy (Runco, 2004). Therefore, schools preferred to invest time and money in these areas instead. However, it was stated that creativity should be made a part of education both in socioeconomically high and low countries (Shaheen, 2010). Shaheen suggested that more emphasis has been given to creativity in education in developed countries compared to the developing ones. Introducing creativity into the curriculum has been found to have positive impacts. For instance, arts based education and the inclusion of a short improvisation intervention into the school curriculum was suggested to support children's divergent thinking abilities in a primary school (Sowden, Clements, Redlich, & Lewis, 2015). Additionally, as mentioned earlier, children's creativity scores correlate with their success in school subjects such as maths, which suggests that there might be a relation between children's creativity and other cognitive abilities(Hansenne & Legrand, 2012).

1.3.1 Measuring children's creativity

Standardised measures have been used to measure children's creativity. For instance, the TTCT-Figural can be used to measure divergent thinking abilities of individuals from kindergarten to adulthood (Torrance, 2017b). Torrance Test of Creative Thinking Norms and Technical Manual (Torrance, 2017b) was created based on the results from a representative sample of 60,917 students in the US who completed the TTCT-Figural. This manual provides standard scores for different age groups. Additionally, Wallach and Kogan's (1965) creativity battery was first tested with children whose average age was 10 years. They suggested that working with children rather than adults to measure creativity would control for the different levels of cognitive abilities that come with age which could be confounding.

Another standard measurement that was used with kindergarten children was Original Problem Solving task which was adopted from Wallach and Kogan's (1965) study (Hong & Milgram, 1991). There were two versions: Lenient Solution Standard and Stringent Solution Standard. In the Lenient Solution tasks, children needed to complete Instances and Pattern Meanings subtests similar the ones in Wallach and Kogan's creativity battery and their answers were evaluated based on originality. For the Stringent Solution tasks, there were multiple correct solutions to choose from for stories that were told to children that included a problem such as how to sit on a chair with three legs. Therefore, these two versions of the test followed a similar logic to divergent and convergent thinking measurements. While the former asked for as many answers as possible, the latter asked for choosing the original and appropriate solution among the given options. The researchers found that the Lenient Solution task which measured children's verbal fluency related to original thinking more than the Stringent Solution task.

The CAT has also been used to judge children's creativity. Amabile's (1982) study included children at the ages of 7- to 11 who created collages using colourful papers in different sizes and shapes, glue and a white board. Children's collages were then rated by independent judges. The judges were a diverse group consisting of psychologists, art teachers and artists. The results revealed that CAT was a reliable technique to measure children's creativity. Different types of judges were also found to rate the collages similarly.

Children were found to be surprisingly poor at tool innovation. Repeated studies on the hook innovation task (Beck, Apperly, Chappell, Guthrie, & Cutting, 2011) revealed that until the age of 8 years, children performed poorly in altering an existing tool (a pipe cleaner) to make it useful (Beck, Apperly, Chappell, Guthrie, & Cutting, 2011; Beck, Williams, Cutting, Apperly, & Chappell, 2016; Cutting, Apperly, & Beck, 2011; Cutting, Apperly, Chappell, & Beck, 2014). Another study looked at children's ability to use an existing object innovatively for a different aim (Nielsen, 2013). Children at the age of four years were shown a plastic toy that was at the bottom of a tube and out of reach. They had access to a jug of water to pour it inside the tube to float the toy and access it. However, the majority of children failed to think of using water for this purpose, unlike adults who all managed to think of pouring the water down the tube.

While some standardised measures have been used extensively, some of these measures of creativity fall short of usefulness for younger children. For instance the standardised tests that require verbal abilities such as RAT and TTCT-Verbal (e.g., Mednick, 1962; Torrance, 1966), or fine motor abilities such as TTCT-Figural (Torrance, 2017a), are not appropriate measurement techniques for younger children. Bijvoet-van den Berg and Hoicka (2014) developed a standardised tool to measure the

divergent thinking abilities of children as young as one year old (Hoicka et al., 2016). The Unusual Box is a colourful, open-top wooden box with different compartments. It has ledges, strings and rings attached outside it. Children are presented with this box and are given five unusual items to use while playing with the box. The aim is to record children's actions while using the box and code all different types of actions they come up with. The divergent thinking ability is measured by the number of different actions that were produced by the participants. Unusual Box test was found to correlate with other measures of divergent thinking, such as the Instances and Pattern Meaning subtests of the Wallach-Kogan creativity test.

Although children's creativity can and has been measured using various techniques, it is important to use the measurement technique that is suitable both for the children and for the creative outcome. As discussed earlier, researchers suggested that creativity is a domain-specific ability (Baer, 1994a, 2012; Huang, Peng, Chen, & Tseng, 2017). Therefore, different domains require different measurement techniques. In this part of the literature review, two distinct domains of creativity will be discussed: storytelling and drawing. Vygotsky (2004) suggested that children's willingness to draw pictures of and tell stories about non-existing places, objects, or people show their creative ability.

1.3.2 Storytelling

Storytelling has been embedded in human history long before the advent of writing (Ransome, 1978). People told tales of their heroic achievements or used stories as a way of sharing experience. Storytelling is the ability to narrate fictional or imaginary events and characters (Bruner, 1987). Etymologically, the word "narrate" comes from the Latin words *narrare* which means telling, and *gnarus* which means knowing in particular way (Bruner, 2002). Ransome (1978) argued that while sharing

their achievements with others, people gradually deviated from reality in their narratives to impress the listeners. It can be argued that the fictitious elements in stories stemmed from these deviances in the early days of storytelling.

Telling and listening to stories is a very important and natural ingredient of children's lives. Children's first encounter with this narrative structure is by listening to the stories that are told to them by their caregivers or other people around them (Sherman, 1979). At the age of 18 months onwards, children start composing short sentences and as soon as they learn to make up sentences, they start telling their own stories (Marjanovič-Umek, Fekonja-Peklaj, & Podlesek, 2012). It is not until the age of 5 to 6 years when children can tell well-structured stories with a beginning, chain of events and a conclusion (Broström, 2002).

While retelling previously heard stories cannot be labelled as creative, children's ability to tell new stories is considered as creative whether they depict real or fictional events (e.g. Engel, 1995). Daniels (1996) argued that children use both their language abilities and imagination to create stories. Together with being well-structured, a good story also needs to capture the readers or listeners' attention. One way of managing this is by telling artful stories (Glenn-Applegate, Breit-Smith, Justice, & Piasta, 2010). Artfulness refers to the creative and surprising elements of a story that makes it more interesting above and beyond the basic requirements of a story (Peterson & McCabe, 1983). A study looked at 5- to 12-year-old children's storytelling abilities in terms of their ability to include expressive elements such as emotions and enhanced details about the events (Ukrainetz et al., 2005). Children were given a picture sequence of events that were likely to happen in real life and were asked to narrate the story in the pictures. The researchers examined participants' ability to tell a well-structured story with expressive elements such as adding personality traits, dialogues between characters, and

a detailed setting. The results revealed that the inclusion of expressive elements significantly developed with age and children told more elaborate stories as they got older.

1.3.2 Drawing

Humans have always been interested in making marks on surfaces (Matthews, 2003). Although it is hard to specifically pinpoint where and at what time in history drawing actually started,research suggested that humans were producing art by carving rocks as early as 40 thousand years ago (Aubert et al., 2014). In his efforts to create a taxonomy of drawing, Farthing (2013) described drawing in two distinct classes: conceptual and pictorial drawing. He argued that while pictorial drawing relied on the ability to copy things people see in real life, conceptual drawings depended more on the understanding of the abstractions. He also described that, when looking at a drawing, one seeks for a narrative. If the narrative is directly embedded in the image, then this drawing can be considered as pictorial. Whereas, if the narrative is beyond the drawing, this means that the drawing involves abstraction and is therefore conceptual. Children start drawing at the age of two years onwards (Strauss, 1978). However, a lot earlier than that their premature attempts in making marks start as early as six to eight months of age (Matthews, 2003). Matthews (1984) suggested in an earlier study that children's drawings when they are younger than two years of age were actually more meaningful than just scribbles based on his observations in a longitudinal small sample study.

Children's drawings provide invaluable insight into their worlds. Children at kindergarten age are known to be highly creative at their drawings (Gardner, 1982; Lambert, 2005). They use abstract themes and show symbolic understanding. While this is the case for kindergarten children, Parker (1925) suggested that the education system

values intellect more than arts ability, and as a result, children's creative tendency starts decreasing as they get higher in their education. Parker argued that the preschool environment is a lot less critical of children's artwork, but at around sixth grade, the pressure from the teachers mean that children may stop being creative in their art work and follow certain rules. Later, Kaila (2005) also suggested that strict school rules were limiting children's creative potential.

Drawing is a creative activity (Coates & Coates, 2006), specifically when the drawing is conceptual, hence includes abstraction (Farthing, 2013). Coates and Coates found that kindergarten children produced creative drawings, and talking improved children's creative levels. The researchers observed three types of talk: "talk related to the subject matter", "social talk" and "interaction with an adult" (p.227). Among these types of talk, talk related to the subject matter was often done with a classmate. Talking about and sharing ideas about the drawing may help children come up with more ideas and this could improve their drawings. If children perform better when they talk to others about their drawing, this might then mean that children can draw better collaboratively. But as it will be discussed in the collaboration section, better performance on collaboration can depend on various factors. There is no known study to look at children's collaborative drawing that factors in children's social abilities. This is therefore one of the aims of this thesis.

1.4 The Link Between Different Types of Media and Creativity

Technological devices have become a part of children's daily lives (Marsh et al., 2015). Children use technological devices for educational and leisure time purposes. A recent census that was done in the US (Rideout, 2017) revealed that children at the age of 0 to 8 years spend over two hours per day using various screen media, such as TV, computers, video game consoles and mobile devices. While children spend most of this

time watching TV (i.e., around one hour), their mobile device usage considerably increased compared to previous years.

Children's interaction with technological devices affect their interaction with their family members. Keeping up or dealing with technological devices in the household is challenging for some caregivers. A study on children's attitudes when they played with technological toys revealed that children tended to interact with their mothers less compared to when they played with a non-technological toy (Wooldridge & Shapka, 2012). It was suggested that this could be due to the mothers' lack of knowledge about the technological toys and the fact that they felt intimidated to interrupt the kids while they were playing with the toy. Plowman, McPake and Stephen's (2008) study also suggested that many parents believe that they do not contribute to their children's competency in technology and kids somehow educate themselves. However, the same study also demonstrated that having different technological devices at home helps children learn how to use them in different ways. Children imitate other members of the family, they learn by their family members' active help or they learn by trial and error. Another study by Plowman and McPake (2013) revealed that parents are worried about their children's technology use as that might affect their social interactions.

Children use various technological devices, such as televisions, desktop computers, laptop computers and touchscreen devices such as smartphones and tablet computers. In a study that was done with children under five years of age from four European countries (England, Luxemburg, Greece and Malta), 92% of the children reported that they used technological devices to play with, while 65% mentioned learning with these devices (Palaiologou, 2014). As technology becomes more integrated in children's lives, the research on children gradually focuses on technology.

In order to understand the role of various technological devices in children's lives and how one is different from the other, a short review of these different types of technological devices is presented.

1.4.1. Television

Television is a fairly core element for many households and it can even be forgotten to be mentioned as a technological device. However, television plays a crucial role in children's social and cognitive development (for a review see Courage & Setliff, 2010). It is a social device as much as a technological one and parents' attitudes towards TV directly affect children's habits (Wartella, Richert, & Robb, 2010). A comprehensive review on infants' and toddlers' TV watching habits suggested that very young infants are not properly capable of understanding the content of TV, however they still pay attention to it (Courage & Howe, 2010). By the end of their second year, they start to comprehend what TV offers, especially if the content matches their cognitive level; however, they tend to prefer human interaction over TV.

A review study evaluated the research on TV and creative imagination (Valkenburg & van der Voort, 1994). The authors reviewed studies on the relationship between TV watching habits and daydreaming and creative imagination. This review demonstrated that while a small number of researchers argued that TV could stimulate creativity, more others proposed that watching TV diminishes children's creativity. Among the reasons for reduced creativity were the excessive and rapid visual stimuli that does not leave room for creativity, and the passivity that is created as a result of watching TV. They have also suggested that TV reduces creativity as it takes up children's time which could otherwise be spent on more creative activities. The studies that were reviewed in this article were mainly quasi-experimental and correlational, and

therefore they were not fully sufficient in terms of obtaining causality. However, as it was shown repeatedly, there was a trend towards a negative correlation between TV watching habit and creative imagination, and conversely a more positive correlation between TV watching and off-task daydreaming. It can be derived from this article that no studies that were reviewed demonstrated evidence of a positive relation between watching TV and creativity.

1.4.2 Computers

Computers also play a fairly crucial role in young children's lives as they are accessible both in households and during their time in school. Young children's skills in using computers depend highly on having access to a computer at home and in kindergarten (Saçkes, Trundle, & Bell, 2011). A study on children's perception of their own computer use (McKenney & Voogt, 2010) revealed that 4-7 year old children in general have a positive attitude towards computers. Although boys were found to have a more positive attitude, no competency difference was found between boys and girls.

The effects of computers on children's creativity is twofold. A study compared the effects of using no tool, a picture that was drawn on a paper and a dynamic picture on a computer on children's storytelling abilities (Riding & Tite, 2006). The results revealed that using a dynamic picture resulted in more words produced by children. Another study looked at the effects of using computer software on 6-years-old children's dyadic creative storytelling (Åberg, Lantz-Andersson, & Pramling, 2014). They found that using a computer created distraction caused by deciding who will control the computer and children lost focus on the actual task of creating stories.

1.4.3 Touchscreen devices

Together with TVs and computers, children are also introduced to some more portable and interactive technological devices like smartphones and tablets. Touchscreen devices have been found to appeal to young children due to their easy-to-control interface and their portability (Beschorner & Hutchison, 2013; Marsh et al., 2015). The portability of these devices gives the users the advantage of using them without having to socially isolate themselves and be immobile (Traxler, 2010). Touchscreen devices can be categorised differently from TV and computers as they are more interactive and responsive to children's actions such as touch and body movement (Troseth, Russo, & Strouse, 2016).

Touchscreen devices have become more widespread and therefore cheaper, which make them a very plausible purchase for families (Plowman, 2014). A large sample survey study of 2000 parents of 0-5 year-olds in the UK revealed that 25% of children under the age of 3 years, and 37% of 3-5 year olds had their own tablets (Marsh et al., 2015). Moreover, 75% of children used tablets for fun, such as playing games or watching videos. A census that was done in the US revealed that the amount of time children spent using touchscreen devices between the ages of zero to eight tripled between 2013 and 2017 (Rideout, 2017).

Tablets, specifically iPads, have become a part of educational settings, and an increasing number of schools invest in these technologies (Falloon, 2013). A study looking at iPad usage in different levels of education revealed that although educators have some concern about the potential adverse effects of them, they agree on the necessity to get engaged in technological education as it became an inevitable part of education (Flewitt, Messer, & Kucirkova, 2014). The study also suggested that as some

kids were better at using iPads than the educators, the power balance between the receiver and producer of education has changed.

There is controversy over the effects of touchscreen devices on children's social abilities (Plowman & McPake, 2013). While some affordances of touchscreen devices are found to support children's socialisation, some others were found to deteriorate it. For instance, a dual tablet, which allows two users to manipulate an activity on separate tablets simultaneously, was found to help children with autism to communicate better (Holt & Yuill, 2017). In this study, 5- to-12-year-old children with autism who had learning disabilities used dual tablets which were connected to each other via Wi-Fi. Children completed picture-sequencing activities with a partner using either dual tablets or single tablets. Dyads who used the dual tablets showed more other-awareness and communicated with each other more compared to the ones using single tablets. However, touchscreen devices do not always lead to positive social outcomes. Introducing touchscreen devices into the classroom was found to affect children's social interactions negatively (Romeo, Edwards, McNamara, Walker, & Ziguras, 2003). Three-to-six-year-old children's behaviours were observed while using touchscreen devices. The researchers reported more negative collaboration instances than positive ones. Children were more interested in controlling the touchscreen device alone rather than sharing it with their classmates.

While there has been a debate over the positive and negative effects of using touchscreen devices, some further studies reported no effect of using a touchscreen device at all. For instance, iPads and picture books were used to examine the word learning performance of children with Autism Spectrum Disorder (ASD) (Allen, Hartley, & Cain, 2015). In this study, children with ASD used iPads or picture books to learn the names of novel objects. The researchers found that as long as the same method

was used, the tool that was used did not create a difference in the children's word learning.

Although there is extensive research on the effects of touchscreen devices on children's other cognitive abilities, to our knowledge research on the effects of touchscreen devices on children's creativity is sparse. A small number of studies that will be discussed are exploratory studies or observational in nature. This could be due to the fact that children's interaction with touchscreen devices is quite a new area and designing experimental studies on children's specific cognitive abilities require time. One study merged digital books with traditional ones to look at the effects of this combination on children's creativity (Sylla, Figueiredo, Pinto, Branco, & Zagalo, 2014). A workshop was created within the scope of this study to introduce children to a hybrid traditional and touchscreen book. This book had a touchscreen as well as physical pages for children to engage with. This interactive book was used to observe children's creative abilities such as storytelling and drawing. The results revealed that children benefited from both the traditional and technological affordances of the hybrid book to create stories as well as drawing. In another study where iPads were used for evaluating children's creativity, the researchers observed that the iPads served as a valuable resource to communicate with children and draw their attention to the activities (Arnott, Grogan, & Duncan, 2016). However, the researchers also suggested that the iPads were only useful as long as the software that was used was child friendly. They concluded that only using a touchscreen device was not sufficient and that the software needed to support the child-centered activity.

It is clear that touchscreen devices have become an important part of children's educational and social lives. Given that the effects of these devices on children's creativity is still not fully understood, more studies are required on the topic. Thus, this

thesis focused on touchscreen use in young children to examine the cognitive and social impacts of using these devices.

1.5 Social Factors and Their Effect on Creativity

1.5.1 Collaboration

Humans are aware of, and engage with other people in their surroundings from the beginning of their lives (Tomasello & Hamann, 2012). There is a developmental trajectory within which children become socially competent members of society (Hay, Payne, & Chadwick, 2004; Howes, 1987). According to Howes's (1987) review on children's social competence, children start interacting with their social environment from infancy and they show their will to engage with the people around them in various ways such as making eye contact, and touching and leaning towards other people. In fact, a recent study revealed that even the human fetus behaviour showed a preference to engage with a face-like stimuli rather than an upside down version of the same stimuli (Reid et al., 2017). By the age of nine to 15 months, infants start paying attention to the same things as the other people around them, or drawing others' attention to the direction they are looking at, and this behaviour is called joint attention (Carpenter, Nagell, & Tomasello, 1998). As children get older, their interactions with others become more than just participating in joint attention. At the age of two years onwards children start collaborating with others for a shared aim (Tomasello & Hamann, 2012). As a result of collaborating for a shared aim, children were found to show prosocial behaviours and liking towards their collaborative partners (Gräfenhain, Carpenter, & Tomasello, 2013; Tomasello, 2014).

Collaboration, or shared cooperative activity, was conceptualised as a combination of three features: 1) mutual responsiveness, 2) commitment to the joint

activity, and 3) commitment to mutual support (Bratman, 1992). Mutual responsiveness means to be aware of, and responsive towards each other's intentions in a joint activity. Commitment to the joint activity means that both parties are willing to participate, to some degree, in the shared activity. And finally, commitment to mutual support means that each member of the cooperative activity is willing to support the other during the joint activity. Although Bratman conceptualised shared cooperative activity with these three features, he also argued that these features do not always take part equally. He suggested that the partakers of the cooperative activity need not commit to the activity equally or do not always support each other; however, these features still act as a guide to describe a collaborative activity.

Humans collaborate for various reasons. They collaborate for fundamental necessities such as foraging (e.g., Tomasello, 2014), however they also collaborate for daily activities such as learning or creating art. Collaboration is a natural part of children's lives, especially in school environment (Azmitia, 1988). For instance, six-year-old children were found to benefit from peer collaboration in terms of producing longer and higher quality writings in classroom setting (Ferguson-Patrick, 2007). This study looked at the effects of introducing a collaborative writing intervention to a small group of students' writing abilities. The observations of children's collaborative writing in dyads revealed that collaborating allowed children to share and discuss their ideas. The members of the dyads added their personal ability and knowledge into the collaborative writing which in turn increased the quality of the writings as well as the quantity of words used. Another study examining British and Mexican children's educational gains from collaboration also revealed that working in collaborative groups helped 9- to 11-year-olds improve their maths and scientific understanding scores (Rojas-Drummond & Mercer, 2003). A study was done to examine the involvement of

creativity in early years education in nine European countries with a project called Creative Little Scientists (Cremin, Glauert, Craft, Compton, & Stylianidou, 2015). The results of this observational study revealed that teachers facilitated group work and collaboration in order to enhance creative outcomes. Children aged 3- to- 8 years old used dialogue frequently while they were completing creative activities such as problem solving and problem finding.

Another way of collaborative creativity is achieved by brainstorming. Osborn (1963) suggested that when matched with the right partner or the small group, people tend to be more creative. He proposed two reasons for groups to be more creative than individuals. He suggested that social facilitation caused by a number of people working on the same topic is one of the reasons. The other reason is that group work creates rivalry which in turn motivates people to be more creative. A study looked at the effects of brainstorming on children's divergent thinking (Buchanan & Lindgren, 1973). Fourth grade students completed Alternate Uses task either as the whole classroom or individually. The results revealed that children who brainstormed as a classroom came up with more creative solutions as rated by independent judges.

The results of these studies suggest that working as a dyad or a group facilitates creative ideation. However, benefiting from group work may depend on children's social abilities such as willingness to work with others, and ability to build and maintain friendships (Gifford-Smith & Brownell, 2003). Similarly, feeling accepted by their peers could have an effect on how much children benefit from collaborating with them (Harter, 1982). Therefore, it can be suggested that success in collaboration may depend on children's social abilities as well as self-perception of their social status among their peers.

1.5.2 Culture

The definition of creativity, or a creative product, also depends on where the creative activity takes place. It has been suggested that different cultures impact both the production of creativity and the evaluation of creative products (Niu & Sternberg, 2002). There are a lot of examples in literature of comparisons between Eastern and Western creativity (for a review see Niu & Sternberg, 2002, 2006). These comparisons generally conclude that Westerners have more developed creative abilities than do Easterners. To give an example, a study which compared Chinese and Australian undergraduate students' creative performance suggested that Australian students outperformed Chinese students on a standardised creativity task (Ma & Rapee, 2015). Nisbett and Masuda (2003) suggested that the ways of thinking were different between Easterners and Westerners. East Asians were described to be holistic thinkers and Westerners were found to be analytical thinkers (Nisbett, Peng, Choi, & Norenzayan, 2001). Holistic thinking refers to paying attention to the whole while analytical thinking means thinking in a more categorical way and paying more attention to the object rather than the whole. While this categorisation may not refer to every situation or every country (Westwood & Low, 2003), cultural differences are still important to consider while measuring creativity.

Oral, Kaufman and Agars (2007) suggested that creativity studies mostly focused on Western cultures and there were not enough studies based on Eastern cultures. In their study they used creativity scales that were originally created for Western cultures to see if the results would be similar for the Turkish sample. The results that were gathered from the Turkish sample were similar to the Western results. This finding suggests that the notion that different cultures have different creative abilities can be challenged.

1.6 Aims of This Thesis

Creativity research benefits from more specific definitions of the term and more specialised ways of measurement. In this thesis, creativity is approached as a domain- and context-specific concept. The overall aim of this thesis is to find out more about young children's creativity and what factors affect how creative young children are. As it has been discussed in this review, there are different ways of measuring creativity, and different ways of being creative. Therefore, this thesis aims to look at creativity from a wider perspective. This thesis is composed of three experimental studies. Within these three studies, this thesis looked at two factors that might affect children's creativity: technology, and peer collaboration. Additionally, this thesis measured creativity in two domains (i.e. storytelling and drawing), in three ways (i.e. a standardised test, judges, and a complementary linguistic measurement) and in two cultures (Turkey and the United Kingdom). The combination of different domains, contexts, and measurement techniques ensured a more multidimensional approach. As Lubart and colleagues (2010) argued, different measurement techniques were used in a complementary way to ensure an evaluation that is more inclusive of different ways of being creative.

The first study looked at the effects of touchscreen use and peer collaboration on children's creative storytelling ability. Six- to seven-year-old children told creative stories in three conditions: using story cubes, using a mobile application version of the story cubes or without using a tool. They told stories completing these three tasks twice: once on their own and once with a classmate. The creativity of the stories was then measured in two ways: by using CAT, and by looking at the linguistic components of the stories.

The second study is a replication of the first study in a different culture. The aim of this study was to look at the generalisability of the results that were gathered from the first study. For this study, the data was collected from five- to six-year-old Turkish children. The tasks and the sessions were the same as in the first study. The same measurement technique as the first study was used to determine the creativity of the stories.

The third study focused more on collaboration while using another domain for measuring creativity: drawing. In order to look in more detail at what might affect children's gains from collaboration, this study also took into account children's perceived peer acceptance scores. The reason for adding this measurement was to find out whether children's collaborative performance would be affected by how they felt among other peers. In other words, this study also measured the effects of feeling accepted on children's collaborative drawing performance. Five- to seven-year-old children completed a standardised creativity test (TTCT-Figural) alone and with a classmate over two sessions. During the solitary session, they also completed a perceived peer acceptance test. Their creativity scores were evaluated according to the TTCT manual and the effects of the perceived peer acceptance scores were also discussed.

CHAPTER TWO

The Effects of Touchscreen Devices and Peer Collaboration on Children's Creativity

The aim of this study was to look at the effects of touchscreen use and peer collaboration on 6- to 7-year-old children's creative storytelling. In two sessions children told stories alone and in dyads. In each session they told three stories: one with storytelling cubes, one with the mobile application of the same cubes on a tablet computer, and one free-form story without a tool. The results revealed that touchscreen use did not affect the fluency, elaboration or the overall creativity of the stories compared to using the traditional cubes. Additionally, children told more fluent stories when they collaborated, but the collaborative stories were less elaborate compared to the solitary stories. The overall creativity of the stories was not affected by collaboration. There was a positive correlation between the length and the creativity of the stories both for the solitary and dyad stories. Different styles of storytelling did not affect the way children shared the work between each other when they collaborated. Finally, children chose the free-form stories as their best story.

2.1 Introduction

While touchscreen devices are changing the definitions of education, entertainment and social interaction (Plowman, Stephen, & McPake, 2010), questions have been raised as to the effects they have on children's lives. Parents, educators and researchers have different, sometimes opposing, ideas about the functionality and expediency of touchscreen devices on children's education and their interaction with others (Plowman & McPake, 2013). This study aimed to contribute to this debate,

concentrating on children's creative storytelling abilities. In the current study, we sought to determine whether: 1) touchscreen devices have an impact on children's creative storytelling abilities, 2) collaboration makes a difference in children's storytelling performance, and 3) touchscreens affect collaborative storytelling.

Children's Interaction with Touchscreen Devices

Today's children are born into an era where technology is a natural part of their daily lives from the very beginning (Flewitt et al., 2014) and it is becoming increasingly important to understand the way they learn how to use different types of technological devices. It was suggested that children's literacy can no longer be evaluated just by their performance on paper based activities and that digital literacy is an important area to focus on (Marsh, 2004; Palaiologou, 2014). Prensky (2001) coined the term *digital natives* to refer to this generation who have the necessary knowledge to use various technological devices from an early age as a result of early exposure to these devices.. While digital literacy is becoming an important aspect of child development, it has also evoked concern, especially among parents and educators, as to whether using technological devices at an early age is beneficial or detrimental for children (Plowman & McPake, 2013). This study will look at the potential effects of using a touchscreen device on children's creative storytelling abilities and collaboration skills compared to a non-technological version of the tool or not using a tool at all.

The amount of time children spend using technological devices has become greater than ever and the starting age for using these devices keeps decreasing to as early as 6 months old (Bedford, Urabain, Cheung, Karmiloff-Smith, & Smith, 2016). Among other types of technological devices, touchscreen devices in particular have been found to appeal to younger children due to their easy-to-control interface and their

portability (Beschorner & Hutchison, 2013; Marsh et al., 2015). Children mainly use tablets to play games or to watch videos among other activities like doing homework or communicating with friends and family (Goh, Bay & Chen, 2015). According to Palaiologou (2014), parents believe that technological devices have become like any other toys for children as they have easy access to these devices at home. A survey done with parents in the United Kingdom demonstrated that if they had access to tablets, 0 to 5 year old children used them for over an hour on a normal weekday (Marsh et al., 2015). Tablets, specifically iPads, have also become a part of educational settings and an increasing number of schools invest in them as a part of their teaching practice (Falloon, 2013). Parallel with the increase in the use of technological devices in various settings, children are reported to have a positive attitude towards using those devices (McKenney & Voogt, 2010). It is clear, then, that touchscreen devices are an important part of children's daily lives and children spend a significant amount of time using these devices from an early age.

Although the interaction of children and technology has been widely researched from many different viewpoints, there seems to be a lack of research on the mere effects of using touchscreen devices compared to non-technological devices. Recently, there has been a study addressing this gap with a different research focus. Researchers compared the effects of using an iPad and a traditional picture book on word learning in children with Autism Spectrum Disorder (Allen et al., 2015). This study demonstrated that there was no significant difference caused by using an iPad over a picture book as long as the same practices were performed with both aids. However, they found a significant effect of using different methods, i.e., different presentation modes of the target object. When the participants were exposed to the stimuli repetitively, they performed much better regardless of the medium of presentation. Another recent study

(Robinson & Brewer, 2016) concluded that using traditional and technological versions of the same executive function tasks (i.e., Tower of Hanoi and Corsi Blocks tasks) created no significant difference among undergraduate students in terms of their performance in these tasks. The results of these studies open a new window into the effects of touchscreen devices on cognitive abilities. It can be inferred from these studies that the effects of touchscreen devices need to be studied more in detail to find out their impact on individuals' cognitive abilities.

Creative Storytelling

Storytelling is a natural part of children's daily activities. Daniels (1996) described children's stories as a combination of their linguistic abilities and imagination. A story is a form of narrative and as Bruner (1987) put forward, narratives are the only way of describing our experiences in life. Daniels (1996) suggested that children frequently tell stories and they use their language abilities as well as their imagination to tell comprehensive and elaborate stories. Children start telling premature stories when they start to form two- and three-word sentences when they are around 18 months old (Marjanovič-Umek et al., 2012). By the age of 5 to 6 years, they are able to tell well-structured stories with a beginning, chain of events, and a conclusion (Broström, 2002). Children's storytelling ability as a research area is important to focus on as it gives valuable information about their narrative abilities (Trousdale, 1990), socialization skills (Miller, Wiley, Fung, & Liang, 1997) and cognitive capabilities (Spencer, Kaijan, Petersen, & Bilyk, 2013). Engel (1995) mentioned three types of stories that children tell: stories of personal experience, stories told collaboratively with others, and fictional stories. In this study we were interested in fictional stories and collaborative stories.

As a way of measuring how creative children are while telling a story, expert knowledge has been used widely (Amabile, 1982; Hennessey et al., 2011; Kaufman et al., 2010, 2007). This means that experts in storytelling such as authors or creative writers have been used to rate the creative value of children's stories. For instance, in his study, Baer (1994) used storytelling together with other techniques such as writing poems and making collages to measure children's creative abilities. Children were asked to tell a story based on a picture book and afterwards these stories were given to the experts to be rated. The experts were not given any criteria as to how they should measure the creativity of the stories. The experts managed to get high agreement based on their personal description of a creative story. This technique is referred to as Consensual Assessment Technique (CAT) (Amabile, 1982).

Storytelling, when not retelling an existing story, is a creative process by nature as it fosters children's imagination (Göttel, 2011; Maker & Mohamed, 2011; Roney, 1989). Divergent thinking is a term which describes a creative thought process, and it means coming up with lots of ideas that are loosely related to each other (Guilford, 1957). There are four subcomponents of divergent thinking; fluency, flexibility, originality and elaboration (Guilford, 1966; Runco, 1992). These subcomponents are measured with standardised tests such as Torrance Test of Creative Thinking (TTCT) (Torrance, 1966). However, as an alternative to using these standardised tests, it is valuable to measure children's creativity while engaging in a daily life activity such as storytelling. While doing this, it is also important to develop an objective approach to capture these components of creativity. The focus of this study is on fluency and elaboration aspects of divergent thinking. The reason for choosing these two components is that, in a storytelling context, it is possible to measure objectively how

fluent or elaborate a story is by using linguistic measurements. However, features such as originality and flexibility rely on subjective decision making.

Fluency describes the number of different ideas that are created, and Guilford (1950) suggested that there is a tendency for people who come up with more ideas to come up with more significant ones. In divergent thinking tasks, fluency is measured by counting the number of ideas individuals come up with. For instance, in the Picture Completion Task in the Figural version of the TTCT, individuals are asked to complete some incomplete drawings in a way that no one else would think of (Torrance, 2017b). The fluency score for this task is measured by the number of drawings individuals come up with. Based on this idea, we propose that in this study, the length of a story gives an idea about the fluency of the story.

Elaboration is the ability to come up with lots of details to make the creative product richer (Guilford, 1967). In the TTCT-Figural, elaboration is measured by the amount of different details that are included in the drawings (Torrance, 2017b). Based on this idea, we propose that the lexical diversity of the stories (i.e. the proportion of the number of unique words in a story to the number of all the words in it) demonstrates the elaboration of the stories. By measuring these linguistic components, this study attempts to reach a more objective measure of creativity. We propose that a more objective measure can be used to complement more widely accepted ways of measuring creativity. Thus, this study uses an objective linguistic measurement alongside a subjective consensual assessment of creativity.

Given that storytelling is a natural part of children's daily lives and that the usage of technology is getting more and more widespread, efforts to create digital storytelling devices have increased during the past decade (e.g. Bayon, Wilson, Stanton,

& Boltman, 2003; Bonanni, Lieberman, Vaucelle, & Zuckerman, 2006; Ryokai, Kowalski, & Raffle, 2011). Most of these devices combine the traditional components of storytelling tools with some extra features that technology can offer, such as video clips and infrared transmitters (Mansilla & Perkis, 2014). Some technological storytelling toys also have interactive features such as voice recording and play-back (e.g. a toy called Dolltalk, Vaucelle & Jehan, 2002), or a touchscreen interface that enables children to alter the storyline by manipulating the characters and the setting of the story (TinkRBook created by Chang & Breazeal, 2011). Using drawing as a medium to tell stories, Kidpad (Benford et al., 2000) enables children to draw pictures on a screen and give them the opportunity to zoom in and out on the screen to focus on different parts of the drawing while telling the story. It also aims to encourage collaboration as it allows more than one child to manipulate the screen at the same time.

Although there have been studies looking at the effects of using a technological storytelling tool on children's storytelling abilities (e.g., Chang & Breazeal, 2011), no study to date has compared the effects of the same storytelling tool presented in the traditional way (i.e. non-technological) and on a technological device. Therefore, it remains unclear to what extent the technology itself plays a role in children's storytelling experience. While acknowledging the important contributions of technological devices on children's performance, a comparison of these tools with their non-technological equivalents is needed to better determine whether there is an impact of using technological devices and, if so, where the impact stems from. It is important to emphasize the word equivalent, as the comparison between a technological and a non-technological device that are not equal can lead to misleading and inconclusive results. Therefore, this study will be tackling the question of whether there is an effect of using

different versions of a storytelling tool (i.e., traditional versus touchscreen) on children's creative and collaborative storytelling abilities.

Collaboration

As a species, humans interact with each other from the very beginning of their lives. Infants display social-cognitive skills as early as 9 to 15 months in the form of joint attention and following adults', especially their caregivers', gaze (Carpenter et al., 1998). When they reach two years of age, children change from solitary to collaborative interactions, and show evidence of equal sharing, cooperating in order to achieve a shared goal, and helping their partners (Tomasello & Hamann, 2012). When children complete a cognitively demanding task collaboratively, such as problem-solving, peers build on one another's actions; hence it requires more cooperative skills than playing a game together (Brownell & Carriger, 1990). Language plays an important role as a shared tool while solving problems or sharing information in a collaborative way (Gould & Dixon, 1993). A study with 6-year-old children suggested that children benefit from talking to each other while collaborating on a creative writing task (Ferguson-Patrick, 2007).

In terms of the benefits and shortcomings of technological storytelling environments on children's collaboration, there are studies supporting both sides. Chung and Walsh (2006) looked at children's collaborative skills on story writing while using a computer. They suggested that young children's attitudes changed from an independent style to a more collaborative style throughout the task. In terms of collaboration, they found that competency in using technological devices played a role in the control of the tools. In some cases trying to control the device created contention between the members of the dyads. Similar results were found in another study on story

writing with preschool children (Åberg et al., 2014). In that study, in some cases, the mere existence of a digital device was found to distract the members of the dyads in a way that the division of the job became more important than the storytelling itself; however this did not affect the way they created the stories and exchanged ideas collaboratively. Comparing traditional and technological storytelling environments for children in schools by using ethnographic observations and teacher interviews, Rubegni and Paolini (2010) suggested that adding a digital-based narrative activity to the classroom environment improved children's collaborative skills and the interaction between the children compared to traditional storytelling activities. They suggested that introducing a technological tool to the classroom that followed traditional storytelling practices (i.e. creating stories using pen and paper and acting them out in the classroom) resulted in better collaboration. Gottel's (2011) review on child-computer interaction studies examined various technological storytelling devices in terms of their ability to foster collaboration. He investigated the features of different digital storytelling tools compared to traditional storytelling practices in terms of their contributions to children's creating, sharing and performing abilities. He concluded that digital tools require some improvements in order to support children's collaborative skills as sufficiently as traditional storytelling environments do. Another recent study (Holt & Yuill, 2017) looked at the effects of using a dual-tablet versus a single tablet on other-awareness of children with Learning Disability Autism (LDA). They suggested that, in order for an activity to be collaborative, sharing the same touchscreen device was not enough. They concluded that, using dual-tablets that are connected to one-another via Wi-Fi connection supported children's other-awareness and communication compared to using one tablet together.

The Current Study

Children's creative storytelling by using different versions of a storytelling game was investigated. The storytelling game consisted of nine cubes, where every cube had different pictures on each face (see Figure 1). The aim of the game is to line up a sequence of cubes and create a story according to this sequence. While the original version of the game uses real cubes, it can also be played on a tablet. In this study, both original and touchscreen versions of the game were used. By doing so, the confounding variables that might emerge from the differences in the tools were aimed to be eliminated. In addition, the impact of different methods of storytelling was also aimed to be examined. The differences between telling a free-form story (i.e. telling a story without using any tools) and telling a story by using a storytelling tool was planned to be investigated. Finally, another aim of this study was to examine the effects of collaborating with a classmate on young children's creative storytelling abilities. To our knowledge, this is the first time an experimental method has been used to examine the question of whether different representations (technological and non-technological) of the same tool affect children's creativity and collaboration differently. This study will contribute to answering questions about causality.

It is hypothesised that as long as the same task is performed, using a technological device will not create a difference compared to the traditional tool based on the results from Allen et al. (2015) and Robinson and Brewer (2016). However, when a different method of storytelling is used (i.e. telling a story by using a tool versus telling a free-form story without using a tool), this will result in differences in children's lexical diversity performance. It is hypothesized that children will tell more lexically diverse stories when they used a tool (either real cubes or app) compared to not using a tool as the pictures on the cubes may trigger the use of a larger variety of words. It is

also expected that collaboration will be beneficial for the length of children's stories since children can build ideas together, and children with weaker storytelling abilities can be helped by children with stronger storytelling abilities. In terms of sharing the work in the dyad condition, it is expected that the stories will be more one-sided in the app task due to children's tendency to try to control the technological device (e.g. Chung & Walsh, 2006). Finally, it is hypothesised that participants will prefer the stories they told using the app compared to the others given that children have been found to have a positive attitude towards technological devices (McKenney & Voogt, 2010).

a. b.

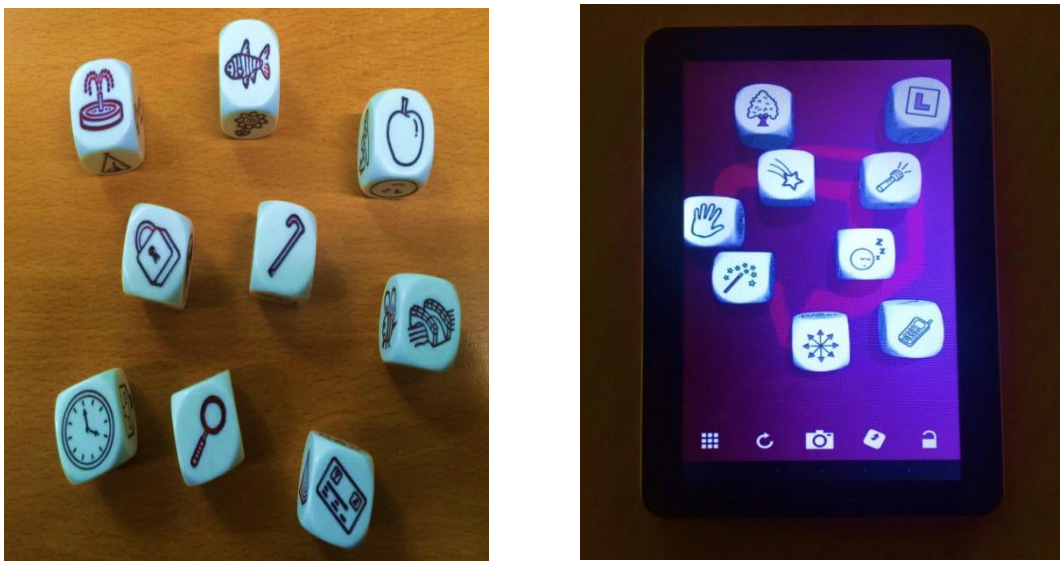

Figure 1. Story cubes physical version (a) and Story cubes app (b). (All rights reserved to The Creativity Hub, Rory's Story Cubes®)

Method

Participants

Participants were recruited from two infant schools located in South Yorkshire, United Kingdom. The schools were classed in the 10% least deprived areas in the county according to the statistics published by the Department for Communities and Local Government (DCLG, 2015). The sample size for this study was determined as a result of a power analysis (Faul, Erdfelder, Buchner, & Lang, 2009). An F test calculation for a large effect size (0.4) and 0.95 power revealed that 18 participants (for this study, 18 dyads, therefore 36 participants) were needed. Sixty two Year-2 students (6 and 7 years of age) participated in the study. As children start telling well-structured stories at the ages of 5 to 6 years (Broström, 2002), this was the initial target age for this study. Because, to gain a clear understanding of how early in life technology use starts to affect children's creative storytelling, looking at children's performance at this age group was essential. However, in addition to the ability to tell well-structured stories, it was equally important for the participants to grasp the rules and requirements of the storytelling game. Therefore, a pilot study was conducted to determine the target age group (see Appendix A).

Twelve of the participants were excluded due to following reasons: not engaging with one or more of the tasks (six), not being matched with another child for the dyad condition due to an odd number of participants (two; one each from two different classrooms), and technical problems with the tablet (four). Therefore, 50 Year 2 students were included in the study (52% male). Their ages ranged from 6 years and 0 months to 7 years and 9 months (M = 7.14 and SD = 0.48). Eighty per cent of the participants were Caucasian, 10% were Asian and 10% were of mixed ethnicity. Fifty-

four per cent of their parents had an undergraduate degree, 34% had a postgraduate degree, 6% completed secondary school and 6% did not report their educational level. Parents or caregivers gave informed consent for their children to participate in the study.

Materials

Questionnaire about children's access to technological devices. A parent report questionnaire investigated children's access to various technological devices and the amount of time they used these devices during the previous day (see Appendix B). Saçkes and his colleagues (Saçkes et al., 2011) suggested that the availability of technological devices at home and in school was important for children's competency in using these devices; therefore information about children's familiarity with various technological devices was collected.

Story cubes. The tool that was used in this study is a commercially available story telling game. The game consists of nine cubes that have different pictures on each side; therefore there are 54 different pictures in total. Cubes are white with pictures engraved on each side of them (see Figure 1a). These pictures include some animals (e.g., a fish, a tortoise, a bumble bee), some tools (e.g., a walking stick, a magnifying glass) and symbols (e.g., a learner driver symbol). Each cube is approximately 2 cm^3 in size. Rules of the game consist of rolling the cubes and telling a story by combining the pictures that are faced up. There is no time limitation for telling the story and there is no specification about the length of the story.

Story cubes app. The story cubes app is the mobile application (app) version of the same game that is accessible on mobile devices such as smart phones and tablets. The app consists of nine virtual cubes that have pictures on each side and the pictures are identical to the ones on the actual cubes. Five buttons are presented on the bottom of

the screen with different functions (see Figure 1b). The second button from the left helps roll the cubes and the participants only used that button during the study. The rules of the game are the same as the ones with the cubes. Participants are asked to roll the cubes by touching the aforementioned button and they tell a story by combining the pictures that are faced up. There is no time limitation and no specification about the length of the story.

Design

A within-subjects design was used. The independent variables of the study were the tool used by children to tell the story (i.e., story cubes, story cubes app, or no tool), and collaboration (alone or with a classmate). The dependent variables were the length and the lexical diversity of the stories and the overall creativity scores for the stories.

The study was conducted in two separate sessions. In one session, each participant told three different stories alone, called the *solitary condition*. They told one story by using the cubes which will be referred to as the *cubes task,* one by using the app which will be referred to as the *app task,* and one without using any material as a baseline condition which will be referred to as the *control task.* In the other session, again, participants told three stories (completing the cubes task, app task and control task) but this time they told the stories with a classmate instead of being alone which will be referred to as the *dyad condition*. Both the order of the tasks (cubes, app and control) and the order of the sessions (solitary and dyad) were counterbalanced. This was done to avoid any order effects that might have interfered with the storytelling performances of the participants in different tasks. There were 12 different orders that occurred as a result of counterbalancing (see Appendix C). Each participant was assigned to one solitary session and one dyad session on two separate days. Twenty-

four of the participants started off with the solitary session while 26 of them started with the dyad session.

Procedure

The study was conducted at infant schools at places suitable both for the school and for the aims of the experiment (i.e. a relatively silent area with a reduced amount of distractors where possible). Participants were asked for their verbal assent in addition to parental consent before starting the experiment. They were informed that the study involved video recording and asked if they were happy with the procedure. After their assent was obtained, children were instructed at the beginning of each task and familiarised with the tools. The instructions that were used for the different tasks are listed below:

Cubes task. Before children started telling their stories using the Story Cubes, they were asked whether they had seen or played with Story Cubes before. Regardless of their answers, they were given the following instruction:

> "Today we are going to tell stories. Do you like telling stories? To be able to tell stories, I brought a game with me. It is called Story Cubes. As you can see, there are nine cubes here and each cube has different pictures on each side. The aim of the game is to roll the cubes and tell a story by combining the pictures that are faced up. Your story can be as long as you want it to be. It can be funny, sad or completely nonsensical. As long as you combine the pictures together it does not matter. You can start with 'Once upon a time' and when you think your story is over, you can say 'The end'. Do you have any questions before starting?"

App task. Before starting the app task, all the children were asked whether they have seen or used a tablet before. The instruction participants received prior to the app task were similar to the cubes task, and can be found in Appendix D.

Control task. In the control task, children were not given any materials and were asked to tell an original story without a prop. The aim of this task was to look at the effects of using a tool while telling a story compared to telling a free-form story without using a tool. The instruction that was given for the control task was similar to the cubes task and can be found in Appendix D.

In the control task, children were instructed to tell an original story. The reason for mentioning originality was to prevent children from telling well-known stories and encourage them to use their imagination. The originality detail was not mentioned for the cubes and app tasks as the children were informed that they needed to tell the story by combining the pictures on the cubes, which should lead to originality in and of itself.

For the dyad condition, the information that was given to the children was the same for all three tasks with this additional information:

> "The most important thing is that you should tell the story together. It is entirely up to you how to divide the work between the two of you, but at the end it should be [first participant's name] and [second participant's name]'s story. I will give you some time to decide how to share the work and when you are ready you can start telling your story."

The instructions were also altered depending on whether it was the participants' first or second session in the study. When it was the second session for the same

participant(s), an introduction was used to remind participants of what they did in the previous session:

"Do you remember what we did last time? We told stories, right? Today, we will do the same, except, you will tell stories with a friend (*or* on your own) this time. I will remind you of the rules for each of the stories. How does it sound?"

After this information, they were reminded of the rules for each task (i.e. the same explanations as the first session were provided). At the end of each session, participants were asked the following question: "You told me three stories, one with the cubes, one with the tablet and one without using anything. Which of these stories do you think was the best story?" and their answers were recorded. Note that it was important to list the tasks in the order the participant(s) told the stories in that specific session.

The entire process was video recorded for transcription purposes. All questions were answered before children started telling the story. The mean duration between the two sessions was 7.48 days (*SD* = 5.88, range: 1-22 days). At the end of both sessions participants were thanked for their time and contribution and they were given stickers.

Transcription, Coding and Analyses

All the stories were transcribed by the experimenter, excluding the small talk or questions during the story telling. Twenty per cent of the stories were also transcribed by two other researchers who were blind to the hypotheses of the study, and changes to the original transcripts were rare.

Transcription for solitary condition. While transcribing the stories, there were some elements that were taken into consideration. 1) In the instances where the child

asked questions whilst telling the story, these questions were excluded from the transcription, e.g. “Can I continue with whichever cube I want?” 2) Extra words, phrases or sentences that do not follow the storyline, e.g., “I will use this picture as a hat although I know this is a tent.” were excluded from the transcription. 3) When the storytelling was interrupted by an external distractor, e.g., it was the child’s medicine time during the storytelling and they were asked to go have their medicine, the conversation, if any had been made, was excluded from the transcription.

Transcription for dyad condition. In addition to the same rules for the solitary session, the transcription of the dyad session stories also included the following rules. 1) In the instances where two members of the dyad used the same words or phrases, they were transcribed repetitively for both children. 2) When the participants talked to each other to plan the flow of the story, these parts were excluded, e.g., “Should we use this cube after this one?” 3) When children had a conversation with each other that was not a part of the story, these conversations were excluded.

Coding and measurement. Two approaches were taken in terms of the coding and measurement of the stories. The combination of subjective and objective measures was used. The subjective measure was the Consensual Assessment Technique (Amabile, 1982) and the objective measures were the analyses of linguistic components of the stories, in this case the length and the lexical diversity of the stories.

Consensual Assessment Technique (CAT). This technique relies on the idea that everyone has an understanding of creativity, however describing or standardising what is creative is challenging (Amabile, 1982; Hennessey et al., 2011). The idea behind this measurement is to get expert, semi-expert or novel raters to evaluate a creative product using their own description of creativity and reach agreement between

independent raters. The raters are not given any definition as to what creativity is; they are expected to use their personal definition. This assessment technique reached high agreement between raters when used for various creative products (e.g., Hennessey et al., 2011; Kaufman & Baer, 2012; Kaufman, Baer, Agars, & Loomis, 2010).

The stories were transcribed and organised so that each document was a stand-alone story with no mention of whether a dyad or a singleton told the story, nor whether an app or tool was used. The stories were then put in Qualtrics software. For the subjective measurement, three raters that were blind to the aims of the study rated each story on a 1 to 5 Likert type scale, 1 being the lowest level of creativity and 5 being the highest level. The raters were asked to read all the stories before starting to rate the stories to get a sense of the entire data (Amabile, 1982). They were informed about the mean age of the storytellers. Inter-rater reliability was calculated using the intra-class correlation (ICC) (Koo & Li, 2016). There was high inter-rater reliability between the raters. The results are demonstrated in Table 1.

Table 1. ICC results using an average-rating, consistency, 2-way mixed-effects model

		95% Confidence Interval		F Test With True Value 0			
	ICC	Lower Bound	Upper Bound	Value	*df*1	*df*2	Sig
Solitary	.900	.868	.925	9.974	149	298	<.001
Dyad	.909	.866	.940	10.98	74	148	<.001

For evaluating the linguistic components of the stories, Computerized Language Analysis (CLAN) software was used (MacWhinney, 2000). CLAN is a language analysis tool that works on a specific transcription format (i.e. CHAT format) and provides information about linguistic properties of the narrative (MacWhinney, 2000). After narratives were transcribed in this specific format (see Appendices E and F for an example), they were checked for some of their linguistic properties. The length and the lexical diversity of the stories were evaluated. The length of the story underlines the inclusion of several ideas. The lexical diversity of the stories is informative about how linguistically rich the stories are.

Length of story. Length of the story was suggested to objectively measure the fluency aspect in terms of the creativity of the stories. In order to measure the length of the stories, the number of tokens in each story was derived using the FREQ (frequency) command on CLAN. This command provided the number of words that had been used (including the repeated words) in each task that was completed by each participant. For the dyad condition, this command provided the number of words used per participant and from this information we also gathered overall dyad story lengths.

In order to compare participants' solitary and dyad performances in terms of the length of the stories, the solitary performances of members of each dyad story were grouped together and the means of their combined solitary performances were calculated. For instance, if participants A and B told a dyad story with cubes, A's performance on the solitary cubes task was summed with B's and this value was divided by two. This was a hypothetical value in order to see how long their story would be if they both contributed to the dyad story with the performance they presented in the solitary condition. Afterwards, we compared this value with their actual dyad

performance together. Any discrepancy between the mean solitary performance and dyad performance was attributed to the effect of collaboration.

Lexical diversity of the story. Lexical diversity of the stories was measured to determine the elaboration aspect of creative storytelling. Lexical diversity is generally determined by type to token ratio which is calculated by dividing the number of unique word types in a specific narrative by the overall number of words (MacWhinney, 2000). For example, in the sentence 'Cats are cats', there are three word tokens and two word types, so the ratio would be 0.67. An alteration to this measurement was required for the aims of this study. In the study participants were asked to tell a story for as long as they wanted and given the individual differences, each child came up with a different length of story. Type to token ratio (TTR) is susceptible to the length of the narrative as it calculated a proportion; therefore, a control for length was needed. For narratives shorter than 50 utterances, a technique named Moving Average Type to Token Ratio (MATTR) has been developed (Covington & McFall, 2010).

The way MATTR calculates lexical diversity is by creating a window of a certain number of words within the narrative (e.g. a window of 10 words) and calculating the TTR for the words in this window and afterwards moving the window to the right by one word each time and calculating the TTRs for these new windows (Covington & McFall, 2010). At the end, MATTR provides the average of the TTRs obtained by these calculations and this final average represents the TTR of the narrative controlled for the length.

Children's abilities to tell lexically diverse stories collaboratively compared to their solitary performances was another interest of this study. The lexical diversity of the collaborative stories were evaluated and they were compared with participants'

combined solitary MATTR scores the same way as it was done to evaluate the length of the stories. A score for each dyad was calculated that was composed of the means of the individual solitary performances of the dyad members. For instance, if children A and B told the dyad cubes story together, A and B's MATTR scores for their solitary cubes tasks were summed and then this value was divided by two. This score was then compared to their actual MATTR scores in the dyad condition.

Best story. Participants' personal preference of the best story for each session was recorded.

One-sidedness of the story. For the dyad condition, children were asked to tell the story collaboratively, however, they were free to decide how to divide the work. Their tendency to collaborate and tell the story together was aimed to be evaluated. In order to measure their likelihood to share the work equally, the one-sidedness of each collaborative story needed to be evaluated. To achieve this, first the percentage of each child's verbal contribution to the dyad stories was calculated using the data from CLAN software. One child's word count was multiplied by 100 and this value was divided by the whole story's word count in order to calculate this child's contribution to the dyad story percentage-wise. For instance, if the overall story length was 200 words and one child said 60 words, the percentage of this child's contribution would be 30%. The shorter contribution to the dyad stories in each task was used by calculating the percentage for the smaller word count in order to see how close this value was to 50%. Fifty per cent would suggest an equal share.

Results

Children's Access to Technological Devices

All participants reported that they had seen and used a tablet before. Table 2 demonstrates different types of technological devices and children's access and usage which were accessed through parental report. Results revealed that tablet usage was the highest among other technological devices with 51.12% of the participants who owned a tablet at home spending time using it.

Table 2. Children's access to technological devices

Type of the device	Ownership (%)	Usage (%)
Desktop computer	34.00	23.53
Laptop computer	86.00	13.95
Tablet computer	90.00	51.12
Smart phone	100.00	18.00
Electronic toy	64.00	18.75

Note. The percentage of usage was calculated among the participants who own each of the devices.

CAT

Figure 2 demonstrates the means and the confidence intervals of the CAT scores. The scores for the solitary bars in the graph were created by calculating the mean of dyad members' individual performances for each task (i.e., (A+B)/2) as described in the coding section in more detail.

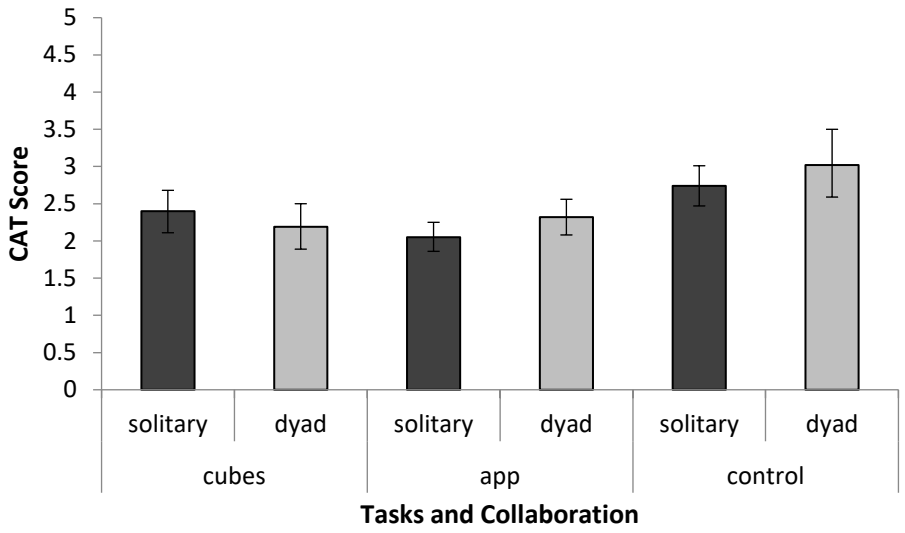

Figure 2. CAT scores of the stories by task and condition. Error bars represent 95% Confidence Intervals.

A two-way repeated-measures ANOVA was used to look at the effects of collaboration and different tasks on children's creative storytelling ability. Collaboration had two levels: solitary and dyad, and tasks had three levels: cubes, app, and control. The results revealed that there was an interaction between task and collaboration, $F(2, 48) = 5.079$, $p = .010$, partial $\eta^2 = 10.159$. Therefore, simple main effects of task and collaboration were evaluated. The results revealed that task had an overall effect on CAT scores. Post hoc tests using a Bonferroni correction revealed that the difference between the cubes and app tasks was not significant, $p = .382$. The difference between the cubes and control tasks, and between the app and control tasks were both significant, $p < .001$, 95% CI [-.471, -.141] and $p < .001$, 95% CI [-.400, -.037] respectively. Participants told more creative stories when they did not use a tool compared to when they used the cubes or the app. In order to look at the simple main effect of collaboration, a series of paired-samples t-tests were carried out for each task. The analyses compared the mean of solitary performances of the dyad members and

their dyad performances. The results revealed that the was no significant difference between the solitary and dyad scores for any of the tasks; $t(24) = -1.177$, $p = .251$ for cubes, $t(24) = 1.959$, $p = .062$ for app, and $t(24) = .749$, $p = .461$ for control task.

Participants' solitary performances were also evaluated to further understand if there was an effect of different task types on children's individual creative storytelling abilities. A within-subjects ANOVA was used to examine the overall creativity of individuals' stories based on three different tasks. The results revealed that there was a main effect of the task, $F(1.56, 76.36) = 18.37$, $p < .001$, partial $\eta^2 = .27$. Post hoc analyses using Bonferroni correction revealed that there was a significant difference between the stories that were told with the cubes and the ones that were told with no tool; and the ones that were told with the app and the ones that were told with no tool, $p = .001$, 95% CI [-.85, -.18] and $p = .001$, 95% CI [-1.01, -.37] respectively. Stories that were told without a tool were significantly more creative than the ones that were told with the cubes or the app. There was no significant difference between the stories that were told with the cubes and app, $p = .09$, 95% CI [-.02, .38].

Length of Story

Figure 3 demonstrates the means and 95% confidence intervals for the length of the stories. The distribution of the length of the stories among participants for cubes, app and control tasks was non-normal across conditions. A natural log transformation normalized the length of the stories (see Osborne, 2010). A two-way repeated-measures ANOVA was used to look at the main effects of the task (cubes, app and control), collaboration (alone vs dyad), and the interaction between the two. There was no interaction between collaboration and task, $F(1.49, 35.96) = .762$, $p = .43$, $\eta^2 = .031$. There was a main effect of task, $F(1.45, 34.87) = 14.58$, $p < .001$, $\eta^2 = .378$. Post hoc

tests using a Bonferroni correction revealed that the difference between the length of the stories told with the cubes and the app was not significant, $p > .999$, 95% CI [-.16, .15]. However, stories told without using a tool were significantly longer than the ones told with the cubes, $p = .001$, 95% CI [-.72, -.18], and the app, $p = .002$, 95% CI [-.73, -.15]. There was also a main effect of collaboration, $F(1, 24) = 4.82$, $p = .038$, $\eta^2 = .167$, which demonstrated that the stories were longer in the dyad condition.

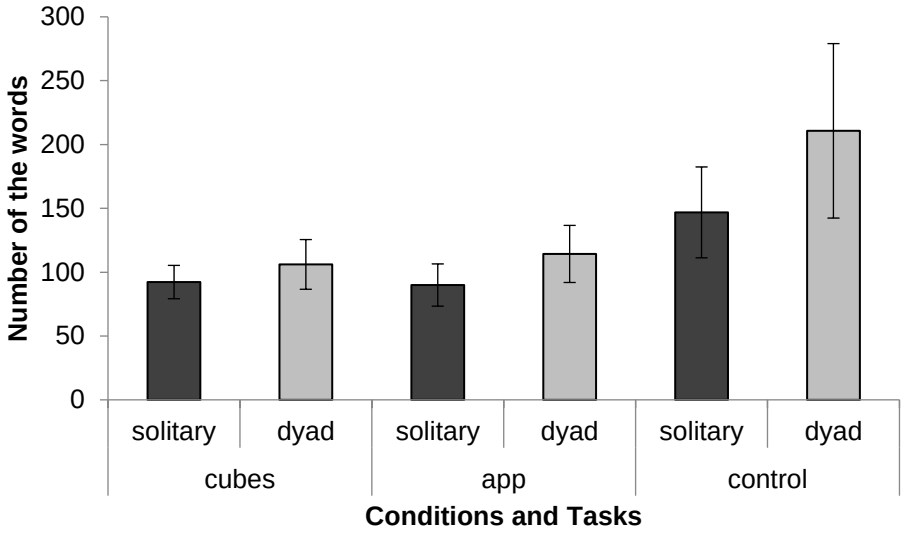

Figure 3. The mean length of stories by task and collaboration. Error bars represent 95% confidence intervals.

Participants' solitary performances were also evaluated to further understand if there was an effect of different task types on children's individual creative storytelling abilities. The length of the stories across tasks were non-normally distributed, therefore a natural log transformation normalised the data (see Osborne, 2010). A within subjects ANOVA showed an overall effect of different tasks on the length of the solitary stories, $F(1.34, 65.56) = 10.635$, $p = .001$, $\eta^2 = .178$. Pairwise comparisons using Bonferroni correction revealed that the difference between the cubes stories and app stories was not significant, $p = .88$, 95% CI [-.071, .178]. However, the difference between the cubes

and the control, and between the app and the control stories were significant, $p = .007$, 95% CI [-.598, -.078] and $p = .002$, 95% CI [-.661, -.121] respectively.

Lexical Diversity

Figure 4 demonstrates the means and 95% confidence intervals for the lexical diversity of the stories. The lexical diversity of the combined solitary stories and dyad stories was non-normally distributed. The MATTR scores were proportions (i.e., they ranged between 0.00 and 1.00), therefore they were multiplied them by 100. In addition, the data was negatively skewed, thus the data was reflected before the transformation (see Osborne, 2010) to make it positively skewed. Afterwards a cube root transformation was applied. A two-way repeated-measures ANOVA was used to look at the main effects of task (cubes, app and control) and collaboration (solitary and dyad) as well as the interaction between them. The results revealed that there was no interaction between task and collaboration, $F(2, 48) = .5$, $p = .61$, $\eta^2 = .02$. Additionally, there was no main effect of task, $F(2, 48) = 2.18$, $p = .15$, $\eta^2 = .083$. There was, however, a main effect of collaboration, $F(1, 24) = 6.03$, $p = .02$, $\eta^2 = .200$. The stories that were told in the solitary condition were more lexically diverse than the ones in the dyad condition.

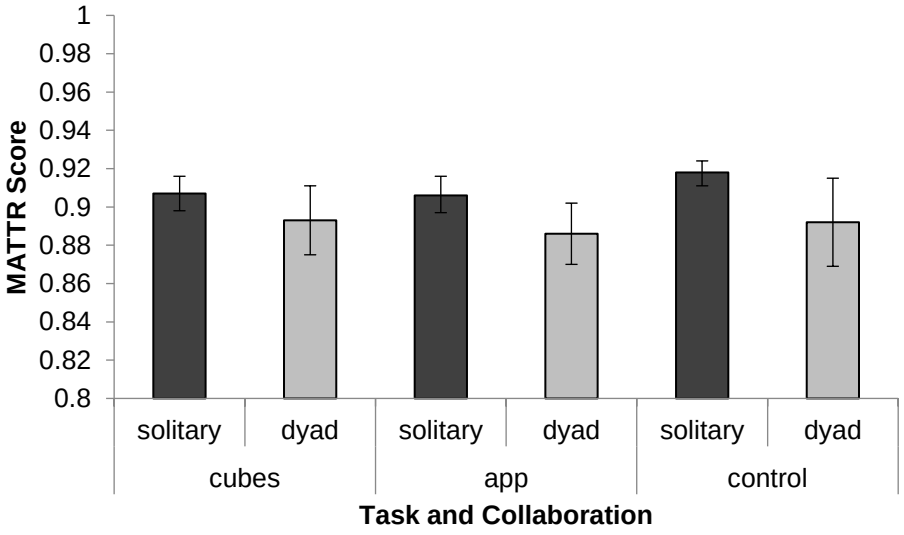

Figure 4. Mean MATTR scores by task and collaboration. Error bars represent 95% confidence intervals.

Participants' solitary performances were also evaluated to further analyse the potential effect of different tasks on children's solitary storytelling abilities. The lexical diversity data for solitary performances were not normally distributed and required transformation. The MATTR scores were proportions (i.e. they ranged between 0.00 and 1.00), therefore we multiplied them by a hundred. In addition, the data was negatively skewed, thus we reflected the data before the transformation (see Osborne, 2010) to make it positively skewed. Afterwards we applied cube root transformation. The results of repeated measures ANOVA on the transformed data revealed that, the type of the task had a significant effect on the lexical diversity of the stories, $F(2, 98) = 8.127$, $p = .001$, $\eta^2 = .142$. Post hoc tests using Bonferroni correction revealed that, the difference between the cubes and the control tasks; and the difference between the app and the control tasks were both significant, $p = .002$, 95% CI [.060, .329] and $p = .002$, 95% CI [.055, .307] respectively. However, the difference between the cubes and the app tasks was not significant, $p > .005$, 95% CI [-.126, .153]. Children told more lexically diverse stories in the control task compared to the cubes and the app tasks.

The correlations between the length (i.e., the fluency) of the stories and the CAT scores for the solitary stories (mean of dyad members' solitary scores) and dyad stories were assessed. Additionally, the correlations between the lexical diversity (i.e., the elaboration) of the stories and the CAT scores were calculated. Table 3 shows the results of these correlations. Note that the dyad elaboration scores (MATTR scores to measure lexical diversity) were reversed and transformed to reach normality. Therefore, the correlation results reported in the table were reversed back to compensate for this transformation (i.e., positive correlations were reported as negative and vice versa).

Table 3. Correlations between fluency and elaboration scores and CAT scores

	Fluency		Elaboration	
	Solitary	Dyad	Solitary	Dyad
CAT_cubes	.764**	.528*	.343	-.210
CAT_app	.600**	.702**	.587*	.234
CAT_control	.653**	.709**	.627**	-.109

Note: The fluency and elaboration scores that are presented in this table are the relevant ones for each row, e.g., the fluency scores on the CAT_cubes row are the fluency scores for cubes stories.

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed)

Best Story

Of the 50 participants that told individual stories, 43 of them chose one of the three stories as their best story. Fourteen of the children chose the stories they told with the app, and 22 of them chose the free-form stories. A chi-square goodness-of-fit test indicated that children's choices were not equally divided by just over half of the children choosing the free-form stories as their best story, $X^2(2) = 7.860$, $p = .020$.Of the 25 dyads in the study, 15 of them agreed on the same story as their best story. Five of these dyads preferred the stories they told using the cubes as their best story, 2 of them preferred the one they told with the app, and 8 of them preferred the free-form story. A chi-square goodness-of-fit test indicated that the dyads' preferences were not significantly different, $X^2(2) = 3.600$, $p = .165$.

One-Sidedness of the Dyad Story

Figure 5 shows the means and 95% CIs for children's tendency to collaborate and tell the story by sharing the verbal work equally. An ANOVA found no significant difference between the one sidedness of the stories across tasks, $F(2, 48) = .092$, $p = .91$, $\eta^2 = .004$.

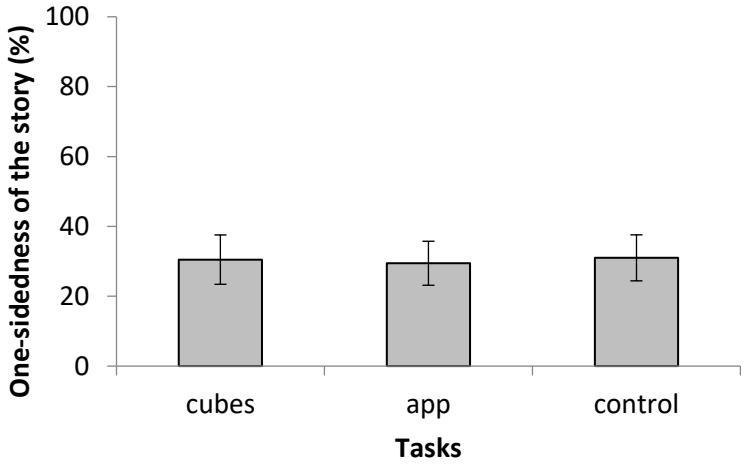

Figure 5. One-sidedness of the stories by task. Error bars represent 95% confidence intervals.

Discussion

This study aimed to look at the effects of different tools (technological, non-technological, or no tool) and collaboration (telling a story alone or with a friend) on 6- to 7-years-olds' creative storytelling abilities. Both the subjective (CAT) and objective (linguistic) measurements revealed that the medium of the storytelling task had no effect on the creativity of the stories. However, not using a tool to tell stories did create a difference. Children told more creative (according to CAT results) and longer stories when they told a free-form story. Lexical diversity results did not differ across tasks (cubes, app and control). In addition, collaboration was not found to affect the overall

creativity scores (CAT results). However, collaboration affected both the length and the lexical diversity of the stories. Collaboration was found to be beneficial for creating longer stories; however, the dyad stories were significantly less lexically diverse. Moreover, using a technological device did not affect collaboration adversely in terms of the creativity and the linguistic components of the stories, nor the one-sidedness of the stories. Finally, both in the solitary and dyad conditions, the majority of children preferred the stories they told without using a tool.

Effects of Tools and Technology

The fact that the stories created with the help of cubes did not differ from those created with a tablet is in line with the literature (e.g. Allen et al., 2015; Robinson & Brewer, 2016) and our hypothesis. Regardless of whether children used the tools on their own or with a friend, technological and non-technological versions of the game did not create a difference for either the creativity or the linguistic components of the stories. These findings are striking as parents and educators have been found to rely on technological devices for supporting children's cognitive abilities (e.g. Falloon, 2013). This study suggests that using a technological device does not create a benefit or a detriment by itself.

Interestingly, stories told without tools were the longest and the most creative. One reason for this might be that the participants were free to choose whichever topic they wanted and there was no tool to restrict them. Even though the participants were informed before each task that their story could be as long as they wanted it to be, the cubes and the app tasks seemed to have created a restriction as there was a limited number of cubes to be used. This might have restricted their creativity. Future research

should examine how individual differences among children might affect how tools impact their creative storytelling abilities.

Another possibility for the free-form stories to be rated as more creative may stem from the fact that the stories that were created with the cubes and the app inevitably shared similar topics as all the participants used the same set of cubes unlike the free-form stories where participants were free to tell a story about any topic they wished. The CAT raters were not informed about the conditions in which children created the stories. However, it is possible that they realised a repetition of some topics and this might have affected their rating. It could have affected their judgement of cubes and app stories negatively and made them rate the free-form stories as more creative. In order to avoid the effect of repetition on evaluation, and as a standard procedure when using CAT, the raters were asked to read all the stories before they started to rate them. However, their opinions on which aspects of the stories they found creative were not sought. Future studies may consider obtaining feedback from the CAT raters regarding their decision-making process while rating the creative value of the stories.

The correlation between the length of the stories and the creativity scores was of importance. This result suggested that longer stories were more likely to be rated as more creative. As Guilford (1950) suggested, the reason for this might be that children who came up with more ideas, and hence told longer stories, were more likely to come up with more significant ones. Even if this is not enough evidence to suggest that the length of a story is a good measurement of creativity, it was proposed that an objective linguistic measurement of a story could give ideas about this story's creative value.

Our hypothesis that using a tool would enhance lexical diversity of the stories was not supported. This finding suggests that using different pictures to tell a story did

not encourage children to use a more lexically diverse language while telling their stories. During testing, if a child asked the name of an object or a symbol on the cubes, the experimenter did not provide the word and encouraged them to name the pictures the way they interpreted them. Hence, although the use of different words might have been prompted by the presentation of the pictures on the cubes, the actual ability to use different words emerged from children's prior knowledge of the words. Future research might benefit from having a baseline measurement of children's vocabulary knowledge.

Together with the length of the study, the lexical diversity would also be expected to correlate with creativity scores. However, the results revealed that the lexical diversity of children's stories did not correlate with the overall creativity scores. This might suggest that although the lexical diversity score measured the richness of the stories linguistically, it did not account for the flow of the ideas. Thus, while the story was linguistically rich, it could be poor in structure and overall might not be well-structured (Broström, 2002) and score low for overall creativity.

Collaboration

It was found that children created significantly longer stories when they collaborated. This finding supports our hypothesis. It was suggested that children would benefit from collaborating in terms of creating longer stories. However, there was no effect of collaboration on children's overall creativity scores. It is important to mention that a longer story by itself does not always mean a better story. Children could just be repeating their own or each other's words. Additionally, collaborating for a cognitively demanding task such as creative storytelling might have been challenging for dyad members (Brownell & Carriger, 1990). Indeed, when the lexical diversity of the dyad stories was compared to the combined solitary performances, it was found that solitary

stories were more lexically diverse than the dyad stories. This finding suggests that children might be motivated to talk more when they are with a friend; however, they do not always create more elaborate stories. The CAT results also support this possibility as collaboration was not found to affect children's creativity scores. This is an interesting finding in terms of the value of collaboration among children. One possible explanation for why dyad stories are less lexically diverse could be that one of the dyad members might be hoping to talk longer than their friend while telling a story together. Perhaps competition in speaking meant children repeated themselves, or each other, to make sure they were heard rather than focusing on the content of the story. This might have caused the solitary stories to be more lexically diverse as the situation would involve no competition. Future studies can examine these results more in detail to find out what other factors might play role in creative collaboration. One possibility might be that children's personality and social abilities could play a role in how they collaborate and how much they gain from collaboration.

One Sidedness of the Stories

Collaboration is found to be beneficial for the length of the stories; however, an important question that remains unanswered is the uncertainty of how children divide the work while they are collaborating. The potential domination of one of the members of the dyads while telling the story was investigated. Even if the outcome story is longer when told in a collaborative way, this does not mean the collaboration will benefit both members of the dyad equally. The hypothesis that using the tablet would create more one-sided stories was not supported, as using a tablet was not more detrimental to collaboration than the other tasks. This finding is interesting when compared to the findings of Holt and Yuill's study (2017). They found that children with learning disability and autism showed more other-awareness and they communicated with each

other more when they collaborated on a dual tablet as opposed to sharing one tablet. Current study did not find a negative effect of sharing one tablet; however, it would be informative to conduct this study with dual tablets. It might be possible that children would have benefited from tablet use if they used dual tablets.

When children told dyad app stories, there were situations where children focused on deciding who would control the tablet more than telling the story. This is in line with previous findings about technology use (e.g. Åberg et al., 2014). However, again, these instances did not end with one child dominating the usage of the tablet and telling the bigger portion of the stories more than in other tasks. This finding is still valuable in terms of the usage of technological devices in school and home environments with the expectation to enhance collaboration (e.g. Rubegni & Paolini, 2010). Current study suggested that the presence of a tablet (or a tool in general) did not make children more likely to share the work equally; however, it also did not diminish their collaboration. As well as there being no difference between physical cubes and the app, there was also no difference between using a tool and telling a free-form story in terms of children's behaviour on the division of the task.

In a setting where children tell stories with friends in their school environment, measuring definite outcomes could be challenging as children do not strictly follow the rules. For instance, there were occasions where one child actually created the ideas, however instead of saying them out loud; they whispered them to their peer's ear. When this was recorded and transcribed, it was treated as though the child who was telling the story was creating it by themselves which is misleading at times. One of the limitations of this study was the inability to capture the behaviours of children while on task. Although the instances where children deviated from the general rules of the study were

rare, future studies may follow a mixed methods approach to overcome missing out these types of occurrences.

Usage of Technological Devices

Sackes and colleagues (2011) suggested that the availability of technological devices plays an important role in children's competency in using these devices. When parents of the participants were asked about the technological devices they had at home, the overall percentages of digital ownership was high. Specifically related to our study, 90% of the parents reported having a tablet at home. As mentioned earlier, all the participants had seen and used a tablet before even if they did not own one at home. All the participants were competent touchscreen users and none of them reported difficulties using them.

In addition to ownership of technological devices, we also asked parents about their children's use of technological devices. The results demonstrated that, when they had access, a greater number of children preferred to spend time using tablets compared to other technological devices. In their studies Beschorner and Hutchinson (2013) and Marsh and colleagues (2015) also suggested that tablets appealed to younger children more than other devices. However, at the end of each session when children were asked to choose their favourite story, the app task was the least favourite both in the solitary and dyad sessions. This finding is somewhat surprising as far as children's preferences are concerned. It may imply that when there are other alternatives, technological devices may not always be children's most favoured option.

Conclusion

This study contributes to the emerging field of children and technology. Using a touchscreen device did not affect children's creative storytelling abilities in comparison to its non-technological equivalent. In addition, using a tool in general, whether technological or non-technological, had a detrimental effect as stories were shorter and less creative. Furthermore, tools neither improved nor diminished the lexical diversity of the stories. Children told longer stories when they collaborated with a classmate; however, the stories were less lexically diverse compared to their solitary performances, and also the solitary and collaborative stories were not different in terms of creativity scores. Surprisingly, using the tablet was children's least favourite option with which to tell a story. Findings of this study contribute to the debate about the benefits and shortcomings of technology in young children's cognitive and social skills. The results demonstrated that technological devices do not have positive or negative impacts on creative storytelling purely by themselves, and the way they are used should be considered in an attempt to discover their role in children's lives. Future studies may consider looking into how children's other social and cognitive skills are affected by technology, tools, and collaboration. Additionally, the impact of social abilities may be taken into account to better understand the circumstances that support or diminish children's creativity.

CHAPTER THREE

The Impact of Culture on Creative Storytelling: A Replication Study with Turkish Children

In light of the results of the study in the previous chapter, the effects of different tools and collaboration on children's creative storytelling abilities was investigated in more detail. In this chapter, the aim was to examine the generalisability and/or cultural dependency of the results obtained from the previous study in a different cultural setting. In particular, this study was concerned with whether children from Turkey would act similarly to children in the UK. The results of this replication study revealed that, again, there was no difference between the stories that were told with the app and the physical cubes in terms of creative and linguistic components. The dyad stories were longer and more creative than the solitary stories. There was no effect of the tool type on one-sidedness of the stories. Finally, children preferred the stories they told using the tablets both in the solitary and dyad conditions.

3.1 Introduction

Psychology as a science has been accused of not involving enough studies based in developing countries (Kagitcibasi, 1995). More specifically, in developmental psychology research, the WEIRD (Western, educated, industrialised, rich and democratic) countries were found to be overrepresented compared to developing countries (Nielsen, Haun, Kärtner, & Legare, 2017). This argument still holds true when it comes to research on creativity. Oral, Kaufman and Agars (2007) argued that creativity was an understudied topic in developing countries. As most of the

standardised measures were developed in Western countries (e.g., Guilford, 1966; Torrance, 1966; Wallach & Kogan, 1965), even when these measures are used in non-Western countries, the results may not be totally convincing. This study aimed to examine children's creativity in a non-Western country without using a standardised measure.

In Chapter two, the current literature on children's interaction with touchscreen devices, their abilities in creative storytelling, and their tendency to collaborate with classmates was revised. The introduction section of this chapter will focus more on the cultural aspects of these topics. The concept of individualistic-collectivist countries and the potential effect of this dichotomy on creativity will be discussed.

As the study in Chapter Two was conducted in the UK, the results were only representative of British culture. In order to obtain more generalisable results, replication studies in different cultural settings are needed. This issue has been a concern in creativity studies. Most creativity studies were found to be representative of Western cultures and similarly the majority of the data were collected in Western countries (Oral, Kaufman, & Agars, 2007). However, in order to know more about the effects of different cultures on creativity, if there is an effect, studies should be done in countries with different cultural backgrounds. Therefore, this study aimed to replicate the previous study which was conducted in the UK, in a country that is not traditionally described as a Western country, Turkey.

In various ways, Turkey is different from the UK, including economic, social, and cultural aspects. Turkey is considered an upper-middle income country (The World Bank, 2017) and it is large and fast-growing (OECD, 2016). The United Kingdom, on the other hand, is considered as the fifth biggest economy in the world (Hutchings,

2017). Together with this economic difference between these two countries, there is also cultural difference. Cross-cultural studies have used a strong dichotomous description of Eastern and Western countries based on their geographical location. In a review paper, the United Kingdom, or more precisely England, was defined as an individualistic country together with other English speaking countries (Triandis, 1993). In the same paper Turkey was identified as a collectivist country.

One of the distinctive features of the members of collectivist cultures is their tendency to value the group they belong to, and define themselves as a member of this group rather than as an individual (Triandis, McCusker, & Hui, 1990). Therefore, concepts such as family and ethnic group are definitive features for members of collectivist cultures. Members of individualistic cultures on the other hand describe themselves with their unique abilities and features. Additionally, Markus and Kitayama (1991) argued that while Eastern cultures value relatedness and harmony, Western cultures value independence and individuality over connectedness.

Creativity is an interesting topic to evaluate cross-culturally. Triandis's review (1993) explicitly attributed creativity to be a value of individualistic countries. In this review, creativity was described as one of the features of individualistic people together with being broadminded and enjoying life. As opposed to this description, members of collectivist cultures were described as respectful and polite who follows traditions. Unsurprisingly, it is proposed that creativity research is insufficient in non-Western cultures (Oral, Kaufman, & Sexton, 2004). Throughout time more cross-cultural studies were completed to compare creative abilities, similarities and differences of people from Eastern and Western cultures (e.g., Ma & Rapee, 2015; Niu & Sternberg, 2002, 2006). Niu and Sternberg's (2002) review addresses the comparison between Eastern and Western creativity from different perspectives. From an implicit point of view, some of

the values that were attributed to creativity were found to be different. While Westerners valued the individuality of creativity such as aesthetic taste and humour, Easterners were found to value social and moral aspects of creativity. However, they agreed on the fundamental components of creativity such as imagination, originality and independence. From an explicit point of view, the authors evaluated studies that compared the creative performance from Eastern and Western cultures. One important conclusion from this review is that comparing Eastern and Western cultures' creativity based on a divergent thinking task that was created for Westerners might be misleading. Instead they suggested that the focus should be on the creative outcome that has ecological validity. For instance, Amabile (1982) used creative products such as collages or poems in order to examine people's creative potential. Especially in cross-cultural studies, using a creative product and getting independent judges to rate the creativity of this product was suggested to be a valid approach (Niu & Sternberg, 2002).

Traditionally Turkey has been considered a collectivist country in studies where a large number of countries are compared (e.g., Suh, Diener, Oishi, & Triandis, 1998). This might be due to the geographical location and traditional values of the country (Triandis, 1993). For instance, Turkish culture values communities such as family and ethnic groups and it is common for individuals to define themselves as members of these communities (Goregenli, 1997). However, more detailed studies that focused on data only from Turkey revealed that it was not possible to describe Turkey's cultural standpoint with a binary description such as individualistic or collectivist. For instance, a study that was done with Turkish participants revealed that Turkish adults displayed both collectivist and individualistic features (Goregenli, 1997). Another study that was done with Turkish undergraduate students and academics revealed that the participants showed individualistic tendencies, and their life satisfaction and self-esteem were

positively correlated with their individualistic tendencies (Yetim, 2003). Although both of these studies mention that the cultural values of Turkey "hold a position closer to the collectivism side of the dichotomy" (Goregenli, 1997, p. 792), they still argue that this dichotomy is no longer sufficient to describe Turkey's cultural disposition (Yetim, 2003). Therefore, while being somewhat different from more individualistic Western cultures which includes the UK, Turkey also cannot merely be described as a collectivist country.

While Turkey does not fit the description as an Eastern or a Western country in terms of individualistic-collectivist dichotomy (Goregenli, 1997; Yetim, 2003), it is still interesting to readdress the concept of creativity in this country. Even if Turkey cannot be defined as an Eastern country, it still holds many collectivist features. Additionally, Turkey is not considered as a WEIRD country, which makes the research in this country valuable in terms of the generalisability of creativity research into a wider range of cultures. For instance a series of studies were conducted to examine whether the results of divergent thinking measurements with Turkish participants would follow a similar pattern to the findings from studies in Western countries (Oral, Kaufman, & Agars, 2007). In three different studies, the authors conducted divergent thinking tests with children, a creative personality scale and a self-report creativity test with college students. The results of these three studies generally replicated that of Western findings. However, as mentioned earlier, Niu and Sternberg (2002) suggested that the comparisons that were done using standardised measures which were originally developed with Western cultures in mind could be misleading. They suggested that different approaches should be taken to measure creativity in different cultures, such as using independent judges to rate the creative outcome. This study therefore uses a non-standardised creativity measurement which relies on measuring the outcome of an

everyday activity -storytelling. Creativity was measured in two ways: using objective linguistic measures and independent judges' rating.

In their review, Westwood and Low (2003) suggested that while culture could be one of the factors that impacts creativity, it was not the only predictor of creative ability. They proposed that creative abilities could not be simply attributed to specific cultures, and that the differences between cultures made creative process more diverse. This study aimed to collect evidence to tackle the cultural explanations of creativity. Therefore, this study has two aims. First, to look at how Turkish children's creative storytelling abilities are affected by technology and collaboration. Second, it aims to tackle the claims about the culture-dependency of creativity by replicating a UK study in a different culture -Turkey.

Children's Interaction with Touchscreen Devices

The use of touchscreen devices among young children has increased around the world (e.g. Beschorner & Hutchison, 2013; Marsh et al., 2015) and Turkey is no exception (e.g. Dinleyici, Carman, Ozturk, & Sahin-Dagli, 2016). The rise in children's access to touchscreen devices plays a role in this. A study looking at the effects of media use on Turkish children (Dinleyici et al., 2016) suggested that 71.2% of the participants in that study had access to a tablet at home and 15% of children between the ages of 2 to 5 years spent time using tablets. This increased to 55.5% for children from 6 to 11 years of age. This study also demonstrated that children used tablets during family times such as lunch or dinner. Additionally, parents reported using tablets as a tool for rewarding or punishment. Another study looking at parental attitudes and opinions on preschool children's smartphone use in Turkey revealed that around 70% of parents had installed mobile applications on their smartphones for their children (Genc,

2014). Among the various mobile applications that the parents installed for their children were games (59%) that mainly aim to entertain, and educational applications (26%). This study also demonstrated that children between 3 to 6 years of age spent around half an hour to one hour per day using their parents' smartphones.

Together with the tendency to use touchscreen devices in everyday life, digital education also becomes more and more important in Turkey (Tunç & Karadağ, 2013). The involvement of digital aids in education is considered a way of keeping up with Western countries (OECD, 2016). Therefore, it is clear that Turkish children interact with touchscreens in various settings.

Creative Storytelling

Storytelling is susceptible to, and roots from, storyteller's cultural background. Bruner suggested that narratives are highly affected by people's cultural background and are "a culture's coin and currency" (Bruner, 2002, p.15). He put forward that children learn to engage in storytelling early in their lives and use it as a crucial tool for social interaction. Tutas (2000) also suggested that stories mirror the cultural heritage of a nation. Not only do stories shed light on different cultures, cultures also affect the way stories are created. In their study, Küntay and Ervin-Tripp (1997) suggested that there was an effect of culture on children's storytelling abilities. In their study, Turkish children tended to take turns while telling a story together. In line with this finding, Küntay and Senay's study (2003) on children's narrative abilities in a naturalistic school setting revealed that children are more likely to use the previous person's story's topic as a starting point for their own story. Three- to 6-year-olds were found to pay attention to the previous peer's topic of the story and created a narrative that was related to this

topic. This stems from a school culture where children are expected to listen to each other and collaborate.

While storytelling can be used as a pastime activity, more and more schools have started to use it as a technique for education. Storytelling has been used for teaching in early years education in Turkey (Kabadayi, 2005) and found to support children's communication and language abilities. Kabadayi (2005) suggested that an education model that benefited from storytelling would create better outcomes in areas such as social, educational, psychological and linguistic development. Additionally, digital storytelling as a concept in art education was suggested to induce creativity (Tunç & Karadağ, 2013). They argued that digital storytelling allows a more interactive environment compared to most traditional storytelling activities and as a result children get more engaged with the activity and become more creative.

Collaboration

Collaboration is a way of socialising and children collaborate for various reasons. As mentioned in Chapter Two, children start having collaborative interactions with people around them at the age of 2 years (Tomasello & Hamann, 2012).

When children tell fictional stories in a collaborative environment, especially about their lives, they tend to follow a previous individual's story and add their own experiences (e.g. Umiker-Sebeok, 1977). When Turkish children's narratives were examined, the researchers observed a similar pattern. In Küntay and Ervin-Tripp's study (1997) on children's naturalistic narratives, they found that when one child talked about their personal life experience, the other child tended to take this topic on board and followed it with examples from their own life. This may be an example of collaborating to create a coherent story. Similarly, in a later study (Küntay & Şenay, 2003), preschool

children were found to listen to each other's stories in order to expand on them when they were telling a story together.

The Current Study

This study was conducted as a replication of the study in Chapter Two which concerned British children's storytelling abilities and how technology and peer collaboration affected this ability. The current study was conducted to evaluate Turkish children's storytelling abilities using the same methodology and in doing so create an opportunity to derive cross-cultural results.

The study aimed to look at the following: 1) The effects of different tools on Turkish children's storytelling abilities. 2) The effects of collaboration on the creativity, length and lexical diversity of the stories. 3) The effects of touchscreens on children's collaborative tendencies. 4) Children's preference for their best story. 5) One-sidedness of the stories. Another aim of this study was to look at the effects of culture. It was hypothesised that Turkish children would perform better when they collaborated in terms of both the linguistic components and the creative value of the stories based on the results of earlier studies that suggest that Turkish children listen to each other and build on each other's stories (Küntay & Şenay, 2003; Küntay & Ervin-Tripp, 1997). Additionally, it was hypothesised that Turkish children would value playing with the touchscreen device compared to the other tasks. This hypothesis is based on the fact that Turkish children were found to use touchscreen devices from an early age (Dinleyici et al., 2016). Additionally, based on Turkey's economic position compared to the UK it is plausible to suggest that children from the UK have more access to touchscreen devices than Turkish children. From this perspective, children in Turkey might find touchscreen devices more attractive.

Method

Participants

The study was conducted in a private kindergarten in West Turkey. The sample size was decided as a result of a power analysis (Faul et al., 2009). An F test calculation for a large effect size (0.4) and 0.95 power revealed that 18 dyads (i.e., 36 participants) were needed. Sixty preschool children participated in the study. Ten of them were excluded for the following reasons: not completing one or more of the tasks (four), being coupled with a participant who could not complete their solitary tasks (three), the child not being in the school for the second session (two) and an odd number of participants in one classroom (one). Therefore, 50 preschool students were the participants of the study (56% female). Their ages ranged from 5 years and 2 months to 6 years and 4 months (M = 5.76 and SD = 0.30). In the current curriculum, Turkish children start formal education when they turn 7, before which they attend kindergarten. Participants for this study were chosen from the oldest age group in kindergarten. Formal education was considered to have an effect on children's linguistic abilities as they start to learn how to read and write. In order to keep the education levels of Turkish and British children considerably similar in this replication study, the Turkish participants were chosen from kindergarten students, albeit they were younger. All the participants were Turkish and spoke Turkish as their first language. They were recruited from a private school in Izmir. Parental education level was as follows: 66.7% of the parents had an undergraduate degree, followed by 27.1% of the parents having a high school degree, 4.2% having a pre-university degree (a special type of degree that is shorter than an undergraduate degree), and 2% having a postgraduate degree. The education information was missing for 4% of the parents.

Materials

The materials for this study were the same as those in Chapter Two, except for the parental report questionnaire. As this study followed an opt-out consent procedure, parental information in terms of children's touchscreen use at home was missing. Note that the principal of the school requested opt-out consent for parents and gave opt-in consent for this study.

Story Cubes and the mobile application version of Story Cubes were used as materials for this study (see Figure 1). Story Cubes is a storytelling game that consists of 9 small cubes with different pictures on each side. The aim of the game is to roll the cubes and tell a story by combining the pictures that are faced up. There is no time limitation to tell the stories. The mobile application version of the game is identical to the physical game, except for being presented on a mobile device (for detailed information see Chapter 2 Methodology section).

Design

The design of the study was identical to the design of the study in Chapter 2. A within-subjects design was used with the tasks (cubes, app, and no tool) and collaboration (solitary and dyad) being the independent variables. In a counterbalanced order, children completed three tasks in either the solitary or the dyad condition in one session. Afterwards they completed the other condition in a separate session. The orders occurred as a result of counterbalancing can be found in Appendix C. The dependent variables were, again, the overall creativity score of the stories, the length and the lexical diversity of the stories. Additionally, information regarding children's self-evaluation for their best story both in the solitary and dyad conditions was collected.

Finally, the dyad stories were evaluated in terms of one child's potential domination while telling the story, in other words, the one-sidedness of the stories.

Procedure

The study was conducted at the kindergarten in a separate room. Participants were taken out of their classes individually or in pairs while the rest of the class continued their school work. Participants were asked for their verbal assent before starting the experiment. They were informed that the study involved video recording and were asked if they were happy with the procedure. After their assent was obtained, children were instructed at the beginning of each task and familiarised with the tools. The same instructions as the first study, though in Turkish, were used (see Appendix G for the Turkish instructions). In a counterbalanced order, children either started with the solitary session where they told stories alone, or with the dyad session where they told stories with a classmate. There were three tasks in each session. Children were asked to tell a story by using the cubes, the app and no tool, in a counterbalanced order. In the solitary session they told these stories alone, whereas in the dyad session they were expected to collaborate with a classmate. Participants had the opportunity to ask questions before the experiment started.

Transcription, coding, and analyses. All the stories were transcribed by the experimenter, excluding small talk or questions. Similar to the study in Chapter two, two approaches were taken in terms of the coding and measurement. The subjective measurement of the stories was achieved using the Consensual Assessment Technique (CAT) (Amabile, 1982). In order to measure the creativity of the stories more objectively, linguistic components of the stories were also evaluated, i.e., length and lexical diversity of the stories.

To do the CAT measurement, transcribed stories were organised as stand-alone stories regardless of being told by one child or a dyad. No identity information was linked to the stories, so the storyteller could not be identified. The stories were then shared with three Turkish Psychology undergraduate degree students, using Qualtrics software. The students were blind to the aims of the study and were asked to rate the stories in terms of their creative content. Following Amabile's (1982) rules, the raters were not given a specific description of creativity and were asked to use their personal definition of creativity. They were asked to rate each story on a 1 to 5 Likert type scale, 1 being the lowest level of creativity and 5 being the highest. They were asked to read all the stories before starting to rate to get a sense of the entire sample (Amabile, 1982). The raters were informed of the mean age of the storytellers. Inter-rater reliability was calculated using intra-class correlation (ICC) (Koo & Li, 2016). There was high inter-rater reliability between the raters. The results are demonstrated in Table 4.

Table 4. ICC results using an average-rating, consistency, 2-way mixed-effects model

		95% Confidence Interval		F Test With True Value 0			
	ICC	Lower Bound	Upper Bound	Value	*df*1	*df*2	Sig
Solitary	.900	.853	.934	9.988	74	148	<.001
Dyad	.868	.828	.900	7.564	158	316	<.001

In order to analyse the linguistic components of the stories, CLAN software (MacWhinney, 2000) was used. Transcribing and coding on CLAN was done the same way as the previous study. The stories were transcribed in a specific way (i.e. CHAT

format, see Appendix F for an example) and the length and the lexical diversity of the stories were calculated using the software. The software is available for coding and analysing in Turkish. Following the transcription, the length and the lexical diversity of the stories in solitary and dyad conditions were analysed.

Similar to the previous study, the participants were asked to rate their best story both when they told a story alone and with a peer. Additionally, one-sidedness of the stories was also calculated in order to evaluate whether one child in the dyad condition told the majority of the story rather than sharing the work equally with their partner.

Results

CAT

Figure 6 shows the means and confidence intervals of the CAT scores across conditions and tasks. In order to compare the CAT scores in the solitary and dyad conditions, we repeated the same method that was used in Chapter 2. The means of the dyad members' individual CAT scores were calculated, and this value was compared with their actual dyad performance (see Procedure section of Chapter 2 for further details).

A two-way within-subjects ANOVA was used to look at the effects of task (three levels: cubes, app, control) and collaboration (two levels: solitary, dyad) on children's CAT scores. There was no interaction between task and collaboration, $F(2, 48) = .433$, $p = .651$, $\eta^2 = .018$. There was a significant main effect of collaboration on children's creative performance, $F(1, 48) = 17.024$, $p < .001$, $\eta^2 = .415$. Dyad stories were significantly more creative than solitary stories. However, there was no effect of task, $F(2, 48) = .143$, $p = .867$, $\eta^2 = .006$.

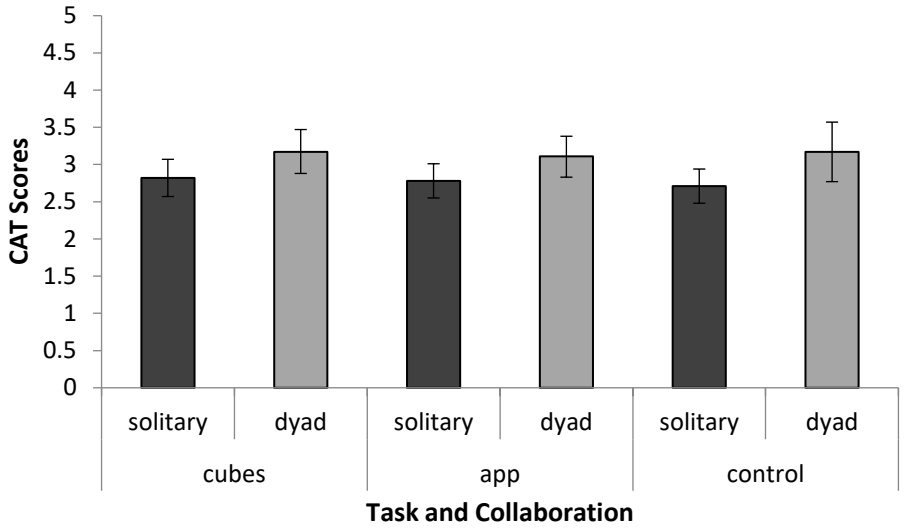

Figure 6. CAT scores of the stories by task and condition. Error bars represent 95% Confidence Intervals.

Participants' solitary performances were also evaluated to find out a potential effect of different tasks on children's individual creative performances. A within-subjects ANOVA was used to look at children's individual CAT scores. The results revealed that there was no significant difference between children's performances on different tasks, $F(1.66, 81.45) = .85$, $p = .43$, $\eta^2 = .02$.

Length of Story

Figure 7 shows the means and confidence intervals of the length of the stories. In order to compare the length of the stories in the solitary and dyad conditions, the same method that was used in Chapter two was repeated. The mean length of the dyad members' individual stories was calculated and then this value was compared with their actual dyad performance (see Procedure section of Chapter two for details). Data was non-normal across tasks and conditions; therefore natural log transformation was used to normalise the data (Osborne, 2010).

The main effects of task and collaboration on the length of the stories, and the interaction between the two were evaluated. A two-way within-subjects ANOVA revealed that there was no interaction between collaboration and task, $F(2, 48) = .201$, $p = .819$, $\eta^2 = .008$. There was a main effect of task, $F(1.53, 36.70) = 7.684$, $p = .003$, $\eta^2 = .243$. Pairwise comparisons using a Bonferroni correction were performed to demonstrate the difference between three tasks. The results revealed that participants told significantly longer stories when they did not use a tool compared to using the app, $p = .005$, 95% CI [-.48, -.08]. The difference between cubes and app, and between cubes and control were not significant, $p = .21$, 95% CI [-.03, .22] and $p = .113$, 95% CI [-.41, .03] respectively. There was also a main effect of collaboration, $F(1, 24) = 43.408$, $p < .001$, $\eta^2 = .644$. Participants created longer stories when they collaborated with a classmate compared to their solitary performance across tasks.

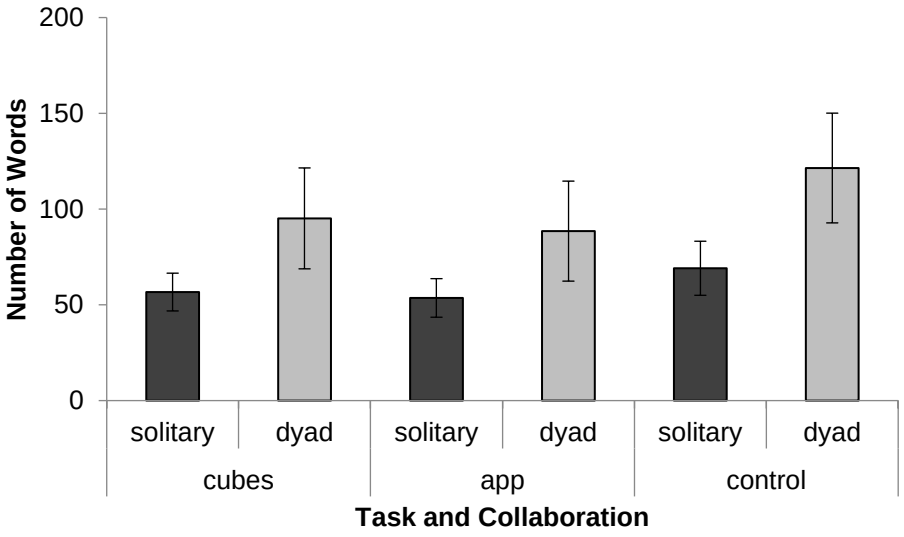

Figure 7. The mean length of stories by task and collaboration. Error bars represent 95% confidence intervals.

Participants' individual performances were also evaluated to look for the effect of different tasks on children's creative storytelling abilities. A within-subjects ANOVA

was used to look at the differences between different storytelling methods. The results revealed that, again, there was no difference between children's individual performances while completing different tasks, $F(1.53, 75.06) = 3.61$, $p = .06$, $\eta^2 = .07$.

Lexical Diversity

One dyad was excluded as it was an outlier. Outliers are described as data points that are extremely (i.e. 3 standard deviations or more) removed from the mean of the values (Dixon, 1950). Osborne and Overbay (2004) argued that the analyses that were done with or without the outliers showed significant differences, and thus they suggested removal of the outliers. Therefore, the outlier in the data was removed, leaving 24 dyads for lexical diversity analysis. Figure 8 shows the mean and the 95% CIs for the lexical diversity of the stories. In order to compare the solitary and dyad performances, the solitary performances of the dyad members were summed and divided by two. Then this value was compared to their actual dyad performance. The MATTR scores, which demonstrated the lexical diversity of the stories, were non-normally distributed. First the MATTR scores were multiplied by a hundred as they were proportions. Afterwards, as the data was negatively skewed, the data was reversed and then cube root transformation was applied (Osborne, 2010). Then a factorial within-subjects ANOVA was used. The results revealed that there was no main effect of task, $F(2, 46) = 1.585$, $p = .21$, $\eta^2 = .064$; no main effect of collaboration $F(1,23) = 2.201$, $p = .15$, $\eta^2 = .087$; and no interaction, $F(2, 46) = 1.190$, $p = .36$, $\eta^2 = .016$.

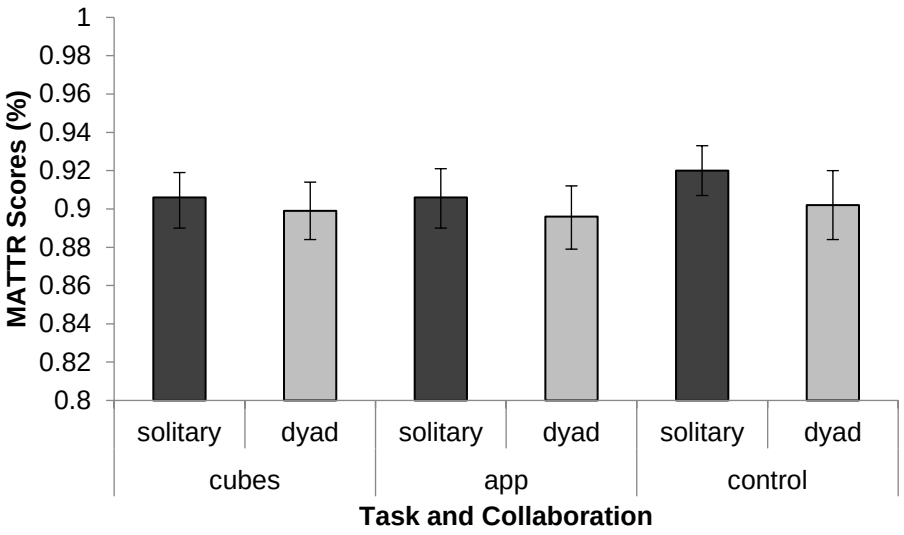

Figure 8. Mean MATTR scores by task and collaboration. Error bars represent 95% CIs.

In order to examine the effects of different tasks on children's creativity at an individual level, their solitary performances were also examined. A within-subjects ANOVA compared individuals' lexical diversity performances across three tasks. The results revealed that different tasks did not create a significant difference on children's solitary performances, $F(1.26, 61.95) = 2.39$, $p = .12$, , $\eta^2 = .05$.

The correlations between the fluency of the stories and the CAT scores for solitary (mean of dyad members' solitary scores) and dyad stories were assessed. Additionally, the correlations between the elaboration scores and the CAT scores for solitary and dyad stories were also evaluated. In Table 5, the results of these correlations are presented.

Table 5. Correlations between fluency and elaboration scores and CAT scores

	Fluency		Elaboration	
	Solitary	Dyad	Solitary	Dyad
CAT_cubes	.750**	.737**	-.059	.277
CAT_app	.828**	.740**	.246	.239
CAT_control	.569*	.775**	-.009	.033

Note: The fluency and elaboration scores that are presented in this table are the relevant ones for each row, e.g., the fluency scores on the CAT_cubes row are the fluency scores for cubes stories.

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed)

Best Story

Of the 50 participants in the solitary condition, 44 of them chose one of the three stories as their best story, while 6 of them expressed that they liked all their stories equally. Fifteen participants preferred the stories they told using the cubes as their best story. Seventeen participants preferred the stories they told using the app as their best, and finally 12 of them preferred the free-form stories. A chi-square goodness-of-fit test revealed that there was no significant difference between these choices, $X^2(2) = .864$, $p = .649$.

Of the 25 dyads that participated in the study, only 12 of them agreed on one type of story as their best story. Three dyads chose stories they told with the cubes as their best story. Five of them chose the stories they told with the app, and finally 4 of

them chose the free-form stories as their best story. A chi-square goodness-of-fit test obtained no significant difference between these choices, $X^2(2) = .500$, $p = .779$.

One-Sidedness of the Dyad Story

Figure 9 demonstrates the percentages of one-sidedness of the dyad stories across the three tasks. A repeated measures ANOVA revealed that there was no difference in the one-sidedness of the stories caused by different tasks, $F(2, 48) = 1.176$, $p = .317$, $\eta^2 = .047$.

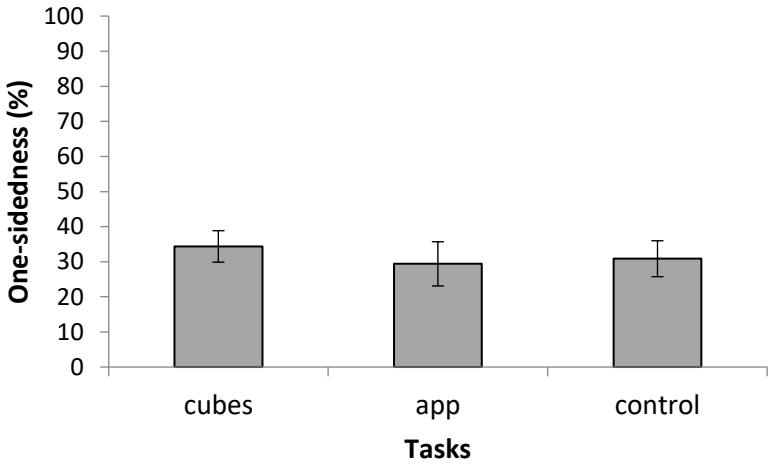

Figure 9. One-sidedness of the stories by task. Error bars represent 95% CIs.

Discussion

The aim of this replication study was to find out how technology and peer collaboration affected Turkish children's creative storytelling abilities and to look at the effects of culture. The effects of culture in children's storytelling abilities have been underlined by some researchers (e.g. Bruner, 2002). Storytelling cannot be separated from the storyteller's cultural background and therefore evaluating a different culture was informative.

The results revealed that the medium of the storytelling task (touchscreen versus physical cubes) did not create a difference in terms of the creative or linguistic outcomes of the stories. However, not using a tool created longer stories compared to using an app. There was no effect of different tools or not using a tool on the lexical diversity of the stories. In terms of collaboration, dyads did significantly better than singletons in terms of telling longer and more creative stories. There was no effect of collaboration on the lexical diversity of the stories. Using physical cubes, an app or not using a tool did not affect the one-sidedness of the stories. Finally, children did not show a clear preference for any of the storytelling methods when choosing their best story.

Effects of Tools and Technology

In terms of the effects of using a touchscreen tool versus a physical tool, the results were consistent in both countries. This finding suggests that when the same task was performed, the type of the aid that was used had no effect on children's storytelling performance. Past research also suggested that using the technological versus physical versions of the same tool did not create a difference on individuals' performance (Allen et al., 2015; Robinson & Brewer, 2016). Moreover, using a tool (either physical or touchscreen) correlated with shorter stories in both countries. The current study also suggested that there was a positive correlation between the length and the creative value of the stories. These findings bring up the question of the benefits of tool use in storytelling. It can be suggested, based on the results of the two studies, that children do not need a prompt to tell longer stories, and just being given the opportunity to tell stories is actually enough for them to create longer stories. The possibility that children might have found the tool restricting has been replicated in this study. This finding has educational implications as schools spend a considerable amount of money on

supplying technological devices (Falloon, 2013). This study, together with the previous study, suggests that in order to make children more creative, supplying technological devices may not be an optimal solution. Alternatively, having free-form storytelling activities embedded into the curriculum could have more benefits.

Some Turkish children in the sample expressed explicit interest in the touchscreen device. During data collection, they appeared to be distracted by details about the tablet such as the brand of it, and how it compared to their personal tablet at home. Additionally, while completing the other tasks, some of the participants were looking forward to completing the app task, especially when it was their second session, as they were aware that they were going to complete a task with the tablet. However, the actual analyses of their stories revealed that they did not create longer, more lexically diverse or more creative stories while completing the app task, nor did they choose the stories they told with the app as their best stories. Whereas for the UK sample, there was a contingency between the most creative stories they told and their self-evaluation of the best stories; both of which were the stories they told without using a tool. Free-form stories were also the longest stories for the UK children. It is possible that British children spent more time and put more effort into preparing their best story. Previous research in Turkey (e.g., Dinleyici et al., 2016) revealed that preschool children in Turkey enjoyed spending time using touchscreen devices, so this was expected to affect their choice of best stories. Also, the difference between Turkish (OECD, 2016) and British (Hutchings, 2017) economies was expected to have caused Turkish children to value tablets more than British children did. However, neither their performance nor their preference of the best stories were affected by different representations of the same tool. The participants of the current study were from a private school in Turkey in order to keep the income levels of Turkish and British participants more similar. It is possible

that growing up in a family with a better income level than an average Turkish family have affected their attitude towards using a touchscreen device. Future studies can investigate the effects of income on children's attitude towards using touchscreen devices.

Collaboration

As hypothesised, the collaboration results differed in terms of creativity and lexical diversity among Turkish and British participants. While collaboration did not have a significant effect on British children's creativity, it positively affected Turkish children's creativity. In terms of lexical diversity of the stories, the performance of Turkish children did not change in the solitary and dyad conditions. British participants, on the other hand, did significantly worse when they collaborated. Previous research found Turkish children follow each other's stories and add to the previous person's story when they collaborated (Küntay & Ervin-Tripp, 1997; Küntay & Şenay, 2003). Perhaps this tendency helped Turkish children to become more efficient collaborators. Another possibility is that the culture might have played a role in these results. Western cultures are more defined with individualistic tendencies (Markus & Kitayama, 1991; Triandis, 1993) and thus children from the UK might be expected to perform more creatively when they were in charge of the task alone. Turkish culture, on the other hand, is defined as a non-Western culture with more collectivist values which values harmony and connectedness (Markus & Kitayama, 1991; Triandis, 1993). Although it was suggested that Turkish culture could not be defined purely as a collectivist culture, these values are still found to be embedded in the culture (Goregenli, 1997). Therefore, this mixture of collectivist and individualistic features of Turkish culture might have caused Turkish children to perform equally well alone and in dyads in terms of the lexical diversity of the stories. In terms of the creativity of the stories however, Turkish

children demonstrated more collectivist features by performing better as dyads than as individuals. These complex results present a clear example of the complex nature of Turkish culture.

One of the limitations of this study was the age difference between the Turkish sample and the UK sample. The mean age for the UK sample was 7 years and 1 month whereas this was 6 years and 2 months for the Turkish sample. This difference emerged as a result of different education systems in two countries. While Turkish children start formal education when they turn 7, British children spend another year in the infant school and start formal education when they are 8 years old. The age difference between the British and Turkish samples prevented a direct comparison between them. Therefore, instead of a direct statistical comparison, we were interested in the patterns that emerged in different cultures. Specifically, we were interested in the changes that occurred as a result of being appointed to different conditions. Therefore, age, by itself was not the main point of interest in our study as the experiments were done within subjects, and the comparison between Turkish and British data was done in terms of the patterns that were observed, rather than the differences between individuals' performances. The different patterns that were observed in two countries might have emerged as a result of the culture or the age difference between the participants in two samples.

One-Sidedness of the Stories

Touchscreen devices were expected to result in one child's dominancy while telling collaborative stories. However, this was not observed in either country. We expected there to be more disagreements while deciding how to share the work while using the tablet in the dyad condition, and as a result a domination of one of the two

children; however, there was no significant effect of the type of the tool on the one-sidedness of the stories.

Conclusion

This study contributes to both the literature on creativity in non-Western cultures and to cross-cultural studies of child development. Some of the results were found to be generalisable across different cultures, such as the potentially restrictive effect of tool use in storytelling and the equity of touchscreen and non-touchscreen devices when the same activity was performed. There also appeared to be cultural differences, specifically in terms of collaboration. Turkish children either did better or equally well when they collaborated compared to when they were alone. However, British children experienced drawbacks from collaborating in terms of telling rich stories, although there was no difference in terms of their creativity. Future studies may look into these findings in more detail, such as analysing the structure of dyad and solitary stories and looking at emerging patterns in children's stories from different cultures.

CHAPTER FOUR

The Effects of Peer Collaboration and Perceived Peer Acceptance on Children's Creative Drawing

This chapter will examine collaboration in more detail and try to find out how and in what conditions peer collaboration affects children's creativity. The previous studies demonstrated that touchscreen use by itself did not affect children's creative storytelling abilities. However, peer collaboration had mixed effects. The first aim of this study is to evaluate whether collaboration affects creativity in another domain, drawing. The second aim is to find out whether children's own perception of peer acceptance affects their collaborative performance. Seventy two participants aged 5 to 7 years completed a creative drawing task alone and with a classmate. They also completed a perceived peer acceptance test. The results revealed that children performed better as a dyad compared to being alone in terms of fluency of their drawings. Additionally, the higher peer acceptance score the dyad received, the less elaborate their drawings were.

Introduction

Children's collaborative skills is an interesting topic to work on for two reasons. First, it is important from a cognitive and educational perspective to know whether and under which conditions children benefit from collaboration (e.g., Park & Lee, 2015). Second, success or failure in collaboration can give clues about children's social skills (e.g., Gommans, Segers, Burk, & Scholte, 2015) or vice versa. The previous two studies in this thesis demonstrated that on a creative storytelling activity, children benefited from collaboration in terms of telling longer stories consistently across two cultures.

However, in terms of the overall creativity of the stories, which was rated by independent judges, while children from Turkey benefited from collaboration, children from the UK performed similarly alone or in pairs. Additionally, in terms of telling lexically rich stories, children in the UK performed significantly worse when they collaborated with a friend. The children in Turkey, on the other hand, neither benefited nor experienced drawbacks from collaborating in terms of the lexical diversity of the stories. These results brought up the question of the conditions under which children might or might not benefit from collaboration. The previous studies in this thesis considered technology and culture as potential factors. However, these studies did not take into account children's social abilities. Therefore, any effect caused by children's attitudes towards collaborating remained undiscovered. The aim of this study is to further analyse the circumstances that affect children's creativity. Thus, this study has two aims: 1) to look at children's collaborative skills in another creative domain, drawing, to gain a broader understanding of the effects of collaboration on creativity, 2) to evaluate the effects of children's perceived peer acceptance on their collaborative performance.

Measuring Creativity

Creativity is an umbrella term that involves many components. Among these components fluency, flexibility, originality and elaboration are the most commonly used ones to measure creativity (Guilford, 1957, 1966). Fluency refers to the number of valid ideas. Flexibility is the ability to switch between different categories. Originality describes the uniqueness of the ideas. Finally elaboration is the level of details in a given creative product (Guilford, 1966). For instance, in the Torrance Tests of Creative Thinking (TTCT)-Verbal, there is an Unusual Uses section where participants are asked to come up with alternative uses for a cardboard box (Torrance, 1966). In this task, the

number of different uses that the participant came up with would refer to the fluency score. Originality would refer to how their ideas differ from other people (i.e., whether they come up with ideas that other people did not think of). For flexibility, the answers would be put under categories, such as household items or body parts, and their ability to switch between these categories would determine their flexibility score. The figural version of the TTCT also includes elaboration scores. For instance, when participants are asked to complete 10 incomplete pictures within a limited time, the number of details they put into the drawings that go beyond what is needed to work out what the drawing depicts, determines the elaboration score for that drawing.

Various measurement techniques have been used to capture creative abilities of individuals (e.g., Mednick, 1962; Wallach & Kogan, 1965). The TTCT (Torrance, 1966) has been considered to be one of the most commonly used creativity tests (e.g., Lissitz & Willhoft, 1985). In this study, the figural form was used. The TTCT Figural aims to measure the three most commonly measured divergent thinking skills through drawing; fluency, originality and elaboration, together with other skills such as resistance to premature closure, abstractness of titles, and a list of 13 other skills which are combined underneath the "Checklist of Creative Strengths" (Torrance, 2017b).

Young Children's Creative Drawing

Children participate in drawing early on in their lives (Dziedziewicz, Oledzka, & Karwowski, 2013) and their skills improve in parallel with their cognitive and biological development (e.g. Lambert, 2005). Children start to draw around two years of age (Strauss, 1978). However, their interest in making marks on surfaces, such as smearing milk onto a dark coloured carpet and enjoying this activity, starts as early as six to eight months (Matthews, 2003). A study looking at the effects of children's own

attitudes, and their parents' and teachers' attitudes, towards drawing revealed that around 80% of 5-to 7-year-olds had a strong positive attitude towards drawing (Burkitt, Jolley, & Rose, 2010).

Drawing is a crucial step for children's cognitive development as it allows children to understand, appreciate, and use symbols and signs (Matthews, 2003). Indeed, children do not always create representational drawings where they copy a figure or another drawing. Sometimes children draw in a more abstract and symbolic way. It has been argued that in an educational setting, children should not only be evaluated by their ability to copy what they see in front of them. Instead, these abstract and spontaneous drawings should also be appreciated and encouraged (e.g., Lambert, 2005). Children's drawings exhibit their creativity as they use drawing as a way to communicate the stories inside their heads (e.g., Coates & Coates, 2006).

As a result of being a creative activity (e.g., Coates & Coates, 2006; Lambert, 2005), drawing has served as a technique to measure creative abilities, especially with children (e.g., Dziedziewicz et al., 2013; Kim, 2006; Torrance, 1966). As well as being a very natural activity for children (Strauss, 1978), drawing is also a useful alternative for measuring younger children's creativity as they may not have the ability to read, write or use language in a proficient way. In this sense, measuring young children's creativity with a language-based test such as TTCT's verbal version (Torrance, 1966) could yield to misleading results.

Collaboration and Creativity

Collaborating is a natural and social part of children's lives be it with their parents, other adults, or peers (Plötner, Over, Carpenter, & Tomasello, 2015). Earlier in their lives, children benefit from collaboration from a more one-sided perspective where

they get help from the adults around them. However, by the age of two years, they start to collaborate toward a mutual aim and work together with their collaborative partner (Tomasello & Hamann, 2012). At around three years of age, children begin to value the person they are collaborating with and show prosocial behaviours towards them (Gräfenhain et al., 2013). At the age of five years onwards, children start to have a positive preference for the person they collaborate with and like them more (Plötner et al., 2015).

Collaboration was found to affect children's abilities in various ways. For instance, a study was done to measure the effects of collaboration on children's problem solving abilities (Fawcett & Garton, 2005). In this study, three types of dyads were created whereby children were allocated into high/high, high/low or low/low groups based on their cognitive abilities. There was also a control group that consisted of individuals rather than dyads. The other condition was that half of the dyad groups were allowed to talk to each other while working on the task together, whereas the other half was not allowed to talk. After the creation of the groups, the participants were asked to complete sorting tasks in as many different ways as they could. After this task, they underwent a post-test to examine the effects of working collaboratively. The results revealed that the only group of children who gained from collaboration were the ones who initially scored low and were then matched with a high ability partner. Additionally, within the high-low pairs, being able to talk had a positive effect. An earlier study (Garton & Pratt, 2001) also found that collaborating with a more able partner and talking to them helped children with low problem solving abilities.

Creativity has been conceptualised as a combination of individual and social activity and as such creativity can exhibit itself as a collaborative activity (Fischer, Giaccardi, Eden, Sugimoto, & Ye, 2005). Fischer and colleagues suggested that

although creativity is often conceptualised as a result of individual muse, it is usually an outcome of a social activity. More specifically, they put forward that categorising individual and collaborative creativity as two separate entities is not accurate as often these two are integrated.

Children collaborate for various reasons and it is more pronounced in the school environment as it is common to work in groups (e.g., Azmitia, 1988). Drawing is one of the activities children participate in with their friends at school (Laroche, 2015). Drawing collaboratively with a grown-up was found to support children's creative abilities (Kouvou, 2016). However, in order for the collaboration to result in creative drawings, the collaboration needed to be an equal one rather than a power relationship where the child would feel like they were being taught how to draw by the adult.. Drawing collaboratively with a peer was also suggested to support children's creative skills as it gave them the opportunity to discuss what to draw and how to improve the drawing (Coates & Coates, 2006).

Social Factors and Collaborative Creativity

Whether they collaborate to creatively solve a problem (e.g., Fawcett & Garton, 2005) or to create drawings together (Coates & Coates, 2006), children's personality, social values, and attitudes towards others and themselves may play an important role in collaborative creativity. For instance, the effects of friendship on composing a musical piece collaboratively was examined, and it was revealed that friends made better pairs than non-friends in terms of creating a higher quality musical piece (Miell & MacDonald, 2000). Friendship was also found to enhance children's collaborative writing abilities (Jones, 1998). The popularity of a member of the dyad was another factor that impacted how the other member benefited from the collaboration (Gommans

et al., 2015). Children were more likely to learn from a dyad member if they perceived them to be more popular than themselves. Another study took this one step further by comparing the effects of working with a partner with higher ability versus higher social skills (Park & Lee, 2015). This study revealed that, low ability children benefited more from the dyad member who was more socially advanced, even if this member did not have higher scores on the test.

An additional social factor which may affect collaborative creativity is peer acceptance. As social beings, children seek human interaction from an early age. A "developmental pathway" has been suggested through which young children build their social group starting from as early as infancy (Hay, Payne, & Chadwick, 2004, p. 100; Howes, 1987). Children seek to make friends, and in order to make friends, it is crucial for them to be accepted by other peers. Peer acceptance was listed as one of the three components of social competence together with 'behavioural, cognitive, and affective skills' and 'social engagement and motivation' (Vaughn et al., 2009).

Peer acceptance is important for young children as it contributes to children's emotional wellbeing. A study looked at young children's responses to being accepted or rejected as playmates by other peers (Howarth, Guyer, & Perez-Edgar, 2013). In this study, 4-to 7-year-old participants rated pictures of unfamiliar children around their age in terms of the likelihood of becoming friends with the children in the pictures. Afterwards, they were told that the children in the pictures were contacted and that they made decisions about whether they would want to be friends with the participants. The participants were then given the information about whether these strangers accepted or rejected them as play friends. The results revealed that the participants were the happiest when they were accepted by the children that they wanted to be friends with.

Conversely, they were upset to find out that the person they chose to be their friend rejected them.

Current Study

In this study, children's individual and dyad performances on creative drawing were evaluated to look at the effects of collaboration. Additionally, the effects of children's perceived peer acceptance on their collaborative creative drawing skills were examined. Although there were studies looking at the effects of children's perception of the other dyad member's popularity on the success of collaborative problem solving (e.g., Fawcett & Garton, 2005), to our knowledge, no research has looked at the effects of children's self-perception of peer acceptance on their collaborative divergent thinking. In this study, children's solitary drawing performance was compared to their dyad performance in terms of the level of creative outcomes (i.e., fluency, originality and elaboration) in an attempt to see whether there was a difference between solitary and dyad performances. We also examined whether their perceived level of peer acceptance would play a role in their collaborative creativity. It was hypothesised that (1) children's fluency scores would increase when drawing in dyads based on our findings on storytelling, and (2) participants with a high perceived peer acceptance score would perform better in the collaborative condition than the ones who perceived themselves to be less accepted by their peers.

Method

Participants

The sample size for this study was decided as a result of a power analysis for large effect size for an F test (Faul et al., 2009). The effect size was 0.4, the α error

probability was 0.05 and power (1 - β probability) was 0.95. The minimum number that was needed according to these values was 24 dyads (i.e. 48 participants). Seventy six participants took part in the study. Four of them were excluded due to an odd number of participants in their classrooms. As a result, 72 5- to 7-year-old students participated in the study (55.6 % male). The age range was 67 to 90 months (M = 78 months, SD = 6 months). Data were collected in one infant school in South Yorkshire. Five classrooms were involved in the study; two of them were Year 1 classrooms, two of them were Year 2 classrooms and the final one was a mixed classroom of Year 1 and Year 2 students. Fifty percent of the participants attended Year 1 and 50% attended Year 2. The school was in an area which was in the 10% least deprived areas in the county according to the statistics published by the Department for Communities and Local Government (DCLG, 2015). Parents or caregivers gave informed consent for their children's participation in the study.

Materials

Torrance Test of Creative Thinking (TTCT) Figural Form. The TTCT figural form was used to measure participants' divergent thinking abilities. The TTCT was developed over 25 years to be used with a wide age range, starting from kindergarten level all the way through adulthood (Torrance, 2017b). The TTCT Figural test consists of two forms (Form A and Form B) and there are three activities in each form: Picture Construction activity, Picture Completion activity, and The Lines (The Circles in Form B). For the aims of this study, only the Picture Completion activity was used.

The Picture Completion activity consists of 10 incomplete drawings. The aim for the participants is to complete these drawings and turn them into complete pictures

and give each of them a title in 10 minutes (see Figure 10). The incomplete picture stimuli are different in forms A and B but otherwise the aim is the same. This task measures the fluency, originality and elaboration of the drawings as well as some other components of creative thinking. For this study, we focused on the three main components of creative thinking (i.e. fluency, originality and elaboration). In order to measure fluency, the number of drawings that are completed within 10 minutes is evaluated. If the participants use the stimulus (i.e., the incomplete drawing) as part of their drawing, and produced a drawing that is not abstract, they receive one point for the drawing. Therefore children could score between 0-10 for fluency. If a drawing scores zero points for fluency, it is excluded from further evaluations. For originality, there is a list of common responses that children came up with based on the drawings that were produced repetitively during the development and standardisation of the TTCT. Thus, if participants produce a drawing that falls into this list, they get zero points for that drawing, and if their drawing is not on the list, and therefore original, they receive one point. Based on this scoring, again, the scores for originality can vary between zero and 10. Elaboration is measured based on the level of detail in the drawings. Elaboration points are given for any extra detail that goes beyond the basic requirements of a drawing to be identified as what the title suggests the drawing is. For instance, if the participant gave the title “tree” for their drawing, the coder must look for the minimum level of details for a drawing to be a tree, such as a trunk, some leaves and some branches. Anything that goes beyond it, such as fruit or flowers, would be considered as elaboration. If the participants added 0-8 details throughout the entire activity (0-9 for Form B) then they would receive one elaboration point. If the participants added 9-17 details (10-19 for Form B), they would get two elaboration points, and so on. The drawings can score from one to six points for this measurement (Torrance, 2017a).

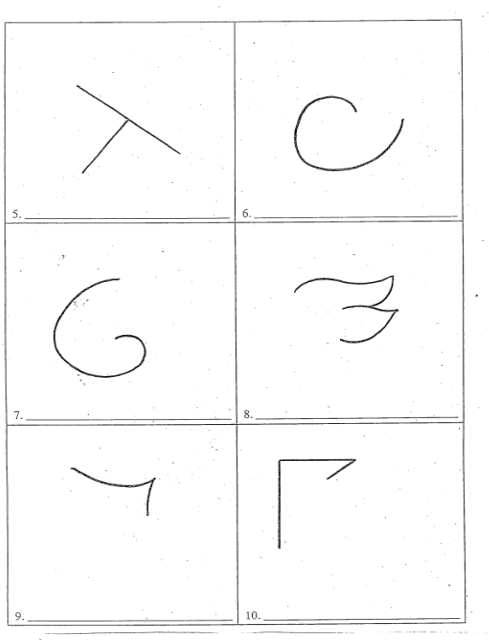

Figure 10. Torrance Test of Creative Thinking- Figural version. Sample incomplete drawings from The Picture Completion Activity.

The Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSA). The PSPCSA (Harter & Pike, 1984) is an adaptation of The Perceived Competence Scale for Children (Harter, 1982) for children aged 4 to 7 years. There are two versions of the tool: one for pre-schoolers and kindergartners and one for first and second graders. In this study, the version for first and second graders was used. The tool consists of four subscales: cognitive competence, physical competence, peer acceptance and maternal acceptance. For the aim of this study, which was to measure children's self-perception of peer acceptance, only the peer acceptance subscale was used. This subscale consists of six items which are represented in pictures as some children are not competent readers. There are different sets of pictures for boys and girls. The scenarios in the items are exactly the same; however, the pictures of the children depicted are either boys or girls depending on the gender of the participant. The authors suggested that pictorial stimuli were easier for younger children to engage with

and attend to (Harter & Pike, 1984). Each question in the peer acceptance subtest depicts two alternative scenes of a certain social situation featuring the same child. For instance, one of the questions in the test (i.e., Item 14, see Figure 11 for the girl's version) pictures a child in a playground playing with one friend in one of the alternative scenes and playing with four friends in the other. The experimenter shows the pictures to the participants and reads the following: "This girl/boy [experimenter points at the child that plays with five friends] has lots of friends to play with on the playground, and this girl/boy [experimenter points at the child that plays with one friend] does not have very many friends to play with on the playground. Are you more like this [experimenter points at the child playing with four friends] girl/boy or this [experimenter points at the child playing with one friend] girl/boy?" After the participant points at which child is more like themselves, they are then asked to rate the level of resemblance between the participant and the child in the specific situation. In this example they are asked, "Do you have a whole lot of friends to play with or pretty many?" if the child chose the picture with four friends. If the participant chose the child that plays with one friend, they are asked "Do you have a few friends or hardly any friends?" The experimenter points at the relevant circle on the page with the pictures while asking the question. Based on the participants' answer, they get between one and four points for each question (Harter & Pike, 1984). The overall score a child can get from this test varies from six to 24 and a higher score means a higher self-perceived peer acceptance level.

ITEM 14

This girl doesn't have very many friends to play with on the playground.
Do you have:

Hardly any friends OR A few

1 2

This girl has lots of friends to play with on the playground.
Do you have:

Pretty many OR A whole lot of friends

3 4

Figure 11. The PSPCSA Peer Acceptance Subtest Item Number 14 (Note that when the test is applied, the pictures face the participants while the item explanations face the experimenter. The participant and the experimenter are sat on a table facing each other. Therefore, circles 1 and 2 match with the picture with the girl with one friend and circles 3 and 4 matches with the girl with four friends.)

Design

A within-subjects design was used for this study. The independent variables were the collaboration level (solitary and dyad) and the PSPCSA scores of the participants. The dependent variables were the creativity levels of children's drawings (i.e. fluency, originality and elaboration).

The study was conducted in two separate sessions. In a counterbalanced order, the participants completed the drawing task alone and with a classmate. The interval between the two sessions ranged from one to seven days (M = 2.68 days, SD = 1.99). Form A and Form B of the Picture Completion task were used in order to avoid practice effects. Each participant was assigned to one solitary session, therefore to one of the two forms, and to one dyad session, and the remaining form, on two separate days. The forms that were used in solitary and dyad conditions were counterbalanced. Half of the participants started testing with the solitary session. Half of these participants used Form A and the other half used Form B. Similarly, half of the dyads that started with the dyad condition started with Form A and the other half started with Form B. Participants always completed the PSPCSA in the solitary session as the task includes personal questions. The PSPCSA always followed the Picture Completion task.

Procedure

The study was conducted at an infant school in the reception area. It was a separate area from the classrooms and therefore was relatively silent. Participants were given information about the study and they were asked for verbal assent in addition to the parental consent that was obtained earlier. All of the participants agreed to take part in the study. Following verbal assent, children were familiarised with the testing tool. The experimenter gave information about the Picture Completion task. The standard

procedure with adults is that they have 10 minutes to complete both the drawings and the titles. However, given that the age group in our study was 5 to 7 year olds, and that not all the participants were competent in writing, 10 minutes were given for the completion of the drawings only. The participants were informed at the beginning of the task that the experimenter was going to help them with writing the titles at the end. Therefore, they were asked to think of interesting titles for their drawings while completing them, and the titles were written by the experimenter afterwards. A stopwatch was used to measure the time. If the participant completed all 10 pictures in fewer than 10 minutes, they were prompted once with the following, "You still have plenty of time. If you would like to go back to your original drawings and add more details, you can do so." This was done to prevent children from stopping drawing early because of not being able to judge how long 10 minutes lasted. If the participant still preferred to stop after this information, then the task was stopped.

As mentioned before, the PSPCSA was always completed in the solitary session, following the completion of the Picture Completion task. Children were informed that they would do an activity which is like a picture game. They were then presented the PSPCSA Peer Acceptance test. The participant sat at the table opposite the experimenter. The test was put in a folder such that all the pictures faced the participant and all the directions for each question faced the experimenter. The experimenter noted the answers of the participants on a coding sheet.

In the dyad session, children were given one Picture Completion task and one pencil to complete the task. After the standard instructions they were also given the following instructions:

"You can see that there are two of you but there is only one pencil. So you can either take turns to do your drawings, or one of you can give ideas while the other is doing the drawing. It is entirely up to you. The important thing is that I want you to work on this task together."

The dyad session only involved the TTCT task. At the end of both sessions, children were given stickers.

Data Coding and Analyses

The Picture Completion Test was coded by two independent raters who were blind to the aims of the study. They were trained by the experimenter and were given two sample forms to practice. The sample forms were of the participants who completed one session of the study but could not continue because of the odd number of participants in their classroom. After they completed the sample forms, the coders and the experimenter came together to compare the forms they independently coded. Any discrepancies and uncertainties were discussed before they started the actual coding. Both coders coded the entire data set. Inter-rater reliability was calculated using intra-class correlation (ICC). ICC estimates and their 95% confidence intervals were calculated based on a mean-rating (k = 2), absolute agreement, 2-way mixed-effects model (Koo & Li, 2016). The results are presented in Table 6.

Table 6. ICC results using an average-rating, absolute-agreement, 2-way mixed-effects model

		95% Confidence Interval		F Test With True Value 0			
	ICC	Lower Bound	Upper Bound	Value	*df*1	*df*2	Sig
Fluency	.855	.785	.902	7.250	109	109	<.001
Originality	.788	.627	.871	5.508	109	109	<.001
Elaboration	.881	.827	.918	8.501	109	109	<.001

Results

The means and 95% CIs for fluency, originality and elaboration scores for the solitary and dyad conditions are displayed in Figure 12. Among the creativity scores, elaboration had a positive correlation with age, both for the solitary and dyad conditions, r =.319, p = .006 and r =.415, p = .012 respectively. The gender of the children did not have an effect on their creative abilities (all p's >.05). However, gender had an effect on children's PSPCSA scores. An independent samples t-test revealed that girls scored significantly higher on PSPCSA than boys did, $t(70) = -2.498$, p = .015. There was no significant correlation between the participants' age and their PSPCSA score, r = -.051, p = .668.

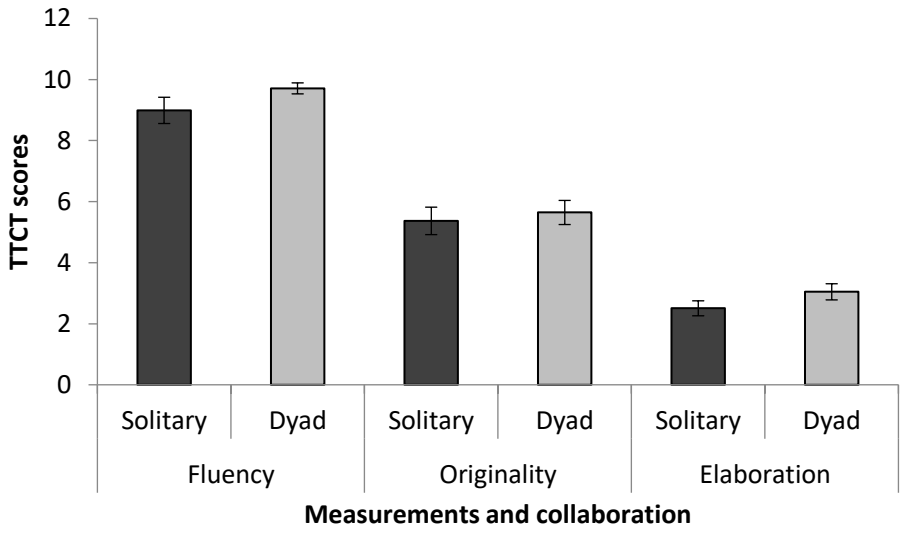

Figure 12. The means and 95% Confidence Intervals for Fluency, Originality and Elaboration scores in solitary and dyad conditions

In order to look at the differences between children's solitary and dyad performances, a similar technique to the one in Chapters 2 and 3 was used. The mean of the dyad members' solitary performances was calculated and this value was compared to their actual dyad performance. For instance, if A and B did the drawing together, first their mean solitary performances [(A + B) / 2] were calculated, and then this value was compared to their actual dyad score for each creativity measurement. This calculation was done to demonstrate what the dyad performance of the two people would be if they would perform equally in their solitary and dyad performances. Any difference between the mean solitary score and the dyad score was attributed to the effect of collaboration.

The fluency data were not normally distributed. Therefore, a Wilcoxon signed ranks test was used to look at the effects of condition on fluency scores. The results revealed that, there was a significant difference between the solitary (M = 8.99, SD = 1.21) and dyad (M = 9.71, SD = 0.77) conditions, Z = -3.355, p = .001. The median score was 9.25 for the solitary condition and 10.00 for the dyad condition. Eighteen

dyads performed better when they collaborated, while four dyads did worse and 14 remained the same.

In order to look at the differences between solitary and dyad originality scores, a paired-samples t-test was used. The results revealed that there was not a significant difference between the solitary (M = 5.37, SD = 1.44) and dyad (M =5.65, SD = 1.70) originality scores; $t(35) = -.772$, $p = .445$.

A repeated-measures Analysis of Covariance (ANCOVA) was used to measure the effects of collaboration on elaboration scores while controlling for the age of participants. The results revealed that there was no significant difference between the solitary and dyad performances of the participants, $F(1, 34) = .498$, $p = .485$.

Pearson's correlation coefficients were calculated between the PSPCSA scores (M = 17.02, SD = 3.36), and the creativity measurements (i.e. fluency, originality and elaboration) for the solitary condition. Gender was controlled for for fluency and originality scores, and age and gender were controlled for for the elaboration scores. The results revealed that there was no significant correlation between PSPCSA score and fluency, $r = .055$; originality, $r = .184$; or elaboration, $r = -.032$, all p's > .05. In order to look at the correlation between PSPCSA scores and creativity measurements for the dyads, the mean of the PSPCSA scores of the dyad members were calculated. Afterwards the correlation between this value and the dyad scores for the creativity measurements was analysed. The results revealed that there was a significant negative partial correlation between the PSPCSA scores of the dyads (M = 17.03, SD = 2.36) and their elaboration scores (M = 3.05, SD = 1.12) when controlling for age and gender of the participants, $r = -.419$ $p = .014$. This suggests that children scored lower in elaboration as they felt more accepted by their peers. There was no correlation for

fluency or originality scores when controlling for gender of the participants, r = -.002 and r = -.325 respectively, (both p's > 0.05).

The difference between the mean of the dyad members' solitary performance ((A+B)/2) and their dyad performance for each creativity measure was calculated. This was done to examine whether the difference between the two would correlate with participants' mean PSPCSA score (mean of the dyad members' PSPCSA scores). A Pearson's correlation was run and it revealed that for elaboration there was a negative correlation between the difference of children's mean and actual dyad performance (M = 0.54, SD = 1.18), and their PSPCSA scores (M = 17.03, SD = 2.36), r = -.349 p = .037. There was no correlation for fluency and originality scores, r = -.230 and r = -.268 (both p's > 0.05).

The absolute differences between two dyad members' PSPCSA scores were calculated (PSPCSA_diff). This value was then correlated with their dyad creativity scores (fluency, originality and elaboration). This was done to see whether the difference between two dyad members' levels of perceived peer acceptance would correlate with their creative performance. The results revealed no significant correlation between PSPCSA_diff and dyad fluency, originality, and elaboration scores, r's = -.117, -.079 and .017 respectively, all p's > .05. The correlation between PSPCSA_diff and the difference between participants' real dyad scores and (A+B)/2 scores (fluency_diff, originality_diff and elaboration_diff) were also analysed. This was done to explore if there was a correlation between having different levels of peer acceptance, and performing differently alone and as a dyad. The results revealed that, again, there were no significant correlations, r's = -.101, .033 and .055 respectively, all p's > .05.

Discussion

The aim of this study was to investigate children's creative drawing abilities and the effects of collaboration and perceived peer acceptance on their performance. The results revealed that the fluency of children's drawings improved when they collaborated with a peer. However, there was no effect of collaboration on the originality and elaboration of the drawings. Participants were found to draw more elaborately as they got older, and girls were found to perceive themselves as more accepted by their peers compared to boys. The perceived peer acceptance level of children was not found to affect children's creative drawing abilities when they performed alone. However, when they collaborated, dyads' mean PSPCSA scores were found to negatively correlate with their elaboration scores.

Collaboration and Creativity

The results of this study follow a similar pattern with the results of the two previous studies in this thesis. In the previous studies, children benefited from collaboration in terms of telling longer stories, which was considered as the fluency of the stories. However, collaboration did not elicit the lexical diversity of the stories in either of the studies, which was regarded as the elaboration of the stories. In the first study, children's elaboration scores were actually impaired as a result of collaborating, and in the second study, again, the richness of the stories did not improve as a result of collaboration, although it did not worsen either. Taken all together, these results suggest that collaboration can enhance children's ability to produce more ideas, however the uniqueness and the richness of the ideas do not improve as a result of collaborating. The current study also revealed that these results were generalisable across different domains, storytelling and drawing.

Coates and Coates (2006) suggested that children benefited from collaboration in terms of their creative abilities. Working on a task with a classmate might have motivated children to come up with more ideas and produce more drawings. As it was suggested in earlier studies (Gräfenhain et al., 2013; Plötner et al., 2015), children show prosocial behaviour towards their partners when they collaborated and they tend to like them more. Thus, children might have felt responsible to perform better in a dyad. This, however, did not affect how original and elaborate their ideas were.

Fawcett and Garton's study (2005) found that children who had low ability in solving problems benefited from collaborating with a high ability child, as was observed in a post-test where they had to perform a problem solving task alone. The current study did not follow a pre and post-test procedure. Therefore, it is unclear whether collaborating with a peer would affect children's future individual performance. The strength of this study was that the measurements were done within subjects, therefore a better comparison of individual and dyad performance was possible for each participant. However, the fact that there was no post-test limits the study's ability to predict any persisting effect of collaboration on children. Future studies might consider looking at the effects of collaborative drawing on children's future individual drawing. In order to do this, these studies would need to look at the differences between dyad members' solitary performances and create groups such as low-low, low-high and high-high, similar to the Fawcett and Garton study (2005).

Peer Acceptance

Contrary to expectations, the perceived peer acceptance scores were negatively correlated with dyads' elaboration scores. Additionally, there was no effect of perceived peer acceptance on children's fluency and originality scores. It was hypothesised that

children would achieve better results in their dyadic drawings if they felt accepted by their friends. Instead, they might have put more effort into creating more detailed drawings in an attempt to be accepted by their peers.

A previous study revealed a positive effect of collaborating with somebody who is perceived as more popular than oneself (Gommans et al., 2015). The current study evaluated the difference between the dyad members' perceived peer acceptance and looked at the correlation between this value and children's dyad performances. There was no correlation between these two values for any of the creativity scores. However, it is possible that children perceived the other dyad member as more popular than themselves while in fact both of their peer acceptance scores were low. As a result, they might have put more effort into performing better and this might have increased their dyad elaboration scores. It is also possible that perceived peer acceptance did not affect children's collaborative performance. Their collaborative performance might be independent of how they felt among peers.

The results on peer acceptance are important in terms of explaining the predictors of creativity and what makes collaboration a pathway to success for better creative outcomes. Children's perceived peer acceptance levels gave some information about some aspects of their collaborative performance, while not being able to explain others. Future studies might explore this question more in details. For instance, this study collected information regarding children's self-evaluation for peer acceptance, however it did not control for the friendship status of the members of the dyads. Though the participants were chosen from the same classroom to ensure acquaintance, it was not explicitly asked whether the members of the dyads were close friends. As working with a friend was found to positively affect the creative outcome (Jones, 1998; Miell &

MacDonald, 2000), future studies can take friendship into account together with children's perceived peer acceptance.

Drawing and Age

Children are known to get better at drawing as they get older (e.g., Lambert, 2005) and the results of this study supported this for the elaboration scores. The level of details in the drawings improved as the participants got older. This was a somewhat unsurprising finding. As Lambert (2005) suggested, older children were more competent in drawing, which made it easier for them to complete the initial drawing within the time that was given (i.e. 10 minutes). They had more time for details as a result of their more developed motor-cognitive abilities. This resulted with an increase in their elaboration scores on the Picture Completion test. However, getting older did not lead children to come up with more ideas, or more original ideas.

Conclusion

This study found 5- to 7-year-olds benefit from collaborating in some areas of creative drawing regardless of how they perceived themselves in peer groups. Collaborating with a classmate helped children complete more drawings than they individually did, however, it did not make children come up with more original ideas or draw more elaborately. The overall results demonstrated an acceleratory effect of collaboration on children's idea creation albeit these ideas were common. Additionally, when the overall peer acceptance level of the pair was low, they drew more elaborately together.

CHAPTER FIVE

General Discussion

The aim of this thesis was to examine the creativity of young children across social and contextual factors, cultures and domains. To measure creativity, three different approaches were used. Across three studies, children's creativity was measured by independent judges (CAT), by assessing linguistic components and by using a standardised divergent thinking scale (TTCT Figural). Figure 13 gives an illustration of the components of this research. The results of these three studies will be discussed in terms of the effects of collaboration, touchscreen devices and culture on young children's creativity.

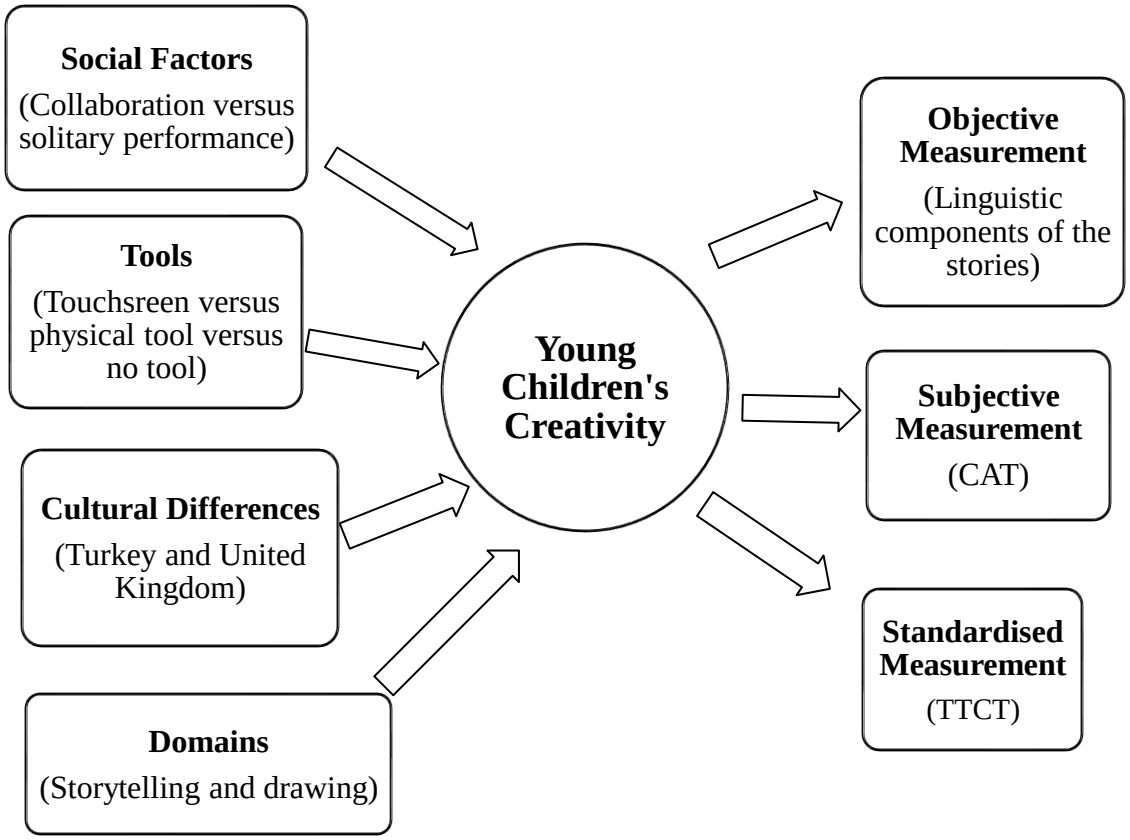

Figure 13. The factors that impact young children's creativity and the ways children's creativity was measured. The four elements on the left represent the factors that affect creativity and the three elements on the right represent the ways in which young children's creativity was measured.

5.1 Overview of the Studies and the Main Findings

In this thesis, three experimental studies were reported. In the first study (Chapter Two), the effects of different tools and peer collaboration on young children's creative storytelling were measured. In two sessions and three tasks in each session, children told creative stories. The three tasks involved telling a story with physical storytelling cubes, the mobile app version of the same storytelling cubes, and without using a tool. The two sessions involved telling these stories alone or with a classmate. The results of this study revealed that technology had no effect on children's creativity, and this result was consistent both for the subjective (i.e., CAT, Amabile, 1982) and objective (i.e., linguistic) measurements of creativity. In addition, children told longer and more creative stories without a tool, both when alone and with a friend. The length of the stories and the overall creativity of the stories were positively correlated for all three tasks. Collaboration led to longer stories, but the dyad stories were significantly less lexically diverse. Moreover, collaboration did not affect the general creativity of the stories. Another result was that the type of storytelling tool (or the absence of a tool) did not affect the contribution levels of the children to the dyad stories. In other words, the type of tool did not determine the dominance of a dyad member or the equal sharing of the task. Finally, children's favourite story was the one they told without using a tool, both when they were alone and collaborating with a friend.

The second study (Chapter Three) was a replication of the first study in a different culture. In this study, the data was collected from Turkish children. The results of this study, again, revealed no effect of the type of tool (physical cubes versus mobile app) on the length and general creativity of children's stories both when alone and with a friend. Not using a tool resulted in longer stories compared to using the app. Dyads told longer and more creative stories than did singletons. The length of the stories and the overall creativity of the stories was positively correlated for all three tasks. There was no effect of collaboration or different tasks (cubes, app and control) on the lexical diversity of the stories. There was again no effect of different tasks on the one-sidedness of the dyad stories (i.e., whether one child dominated the story, or they contributed equally). Finally, Turkish children chose the stories they told with the app as their best stories both in the solitary and dyad conditions.

The first two studies demonstrated that technological versus non-technological devices did not create a difference in children's creativity scores, when measured linguistically or subjectively. Collaboration, however, had some mixed effects across tasks and cultures. Therefore, one of the aims of the final study was to unpick the underlying factors that make peer collaboration impactful on children's creativity. The third study (Chapter Four) looked at a new variable which was not considered in the previous studies, which is the perceived peer acceptance of the children. In addition, to get a broader picture of different types of creativity, the final study looked at creativity in a different domain - drawing. There were two sessions overall - solitary and dyad sessions. In the solitary session, 5- to 7-year-old children completed the TTCT-Figural Picture Completion task on their own. Afterwards, they completed the PSPCSA Peer Acceptance subtest. In the dyad session, children completed the Picture Completion task with a classmate. In terms of the effects of collaboration, children were found to score

higher in terms of fluency of the drawings, which means that they came up with more drawings that were valid when they collaborated. However, the collaborative drawings were not more original or elaborate compared to the solitary ones. Another interesting finding was that perceived peer acceptance scores of the dyads had a negative correlation with their elaboration scores. This means that when the overall PSPCSA score was low for the dyad, they performed significantly better as a team in terms of elaboration. Finally, as children got older their drawings became more elaborate.

5.2 Contributions to the Existing Literature

The contributions of this thesis to the existing literature will be discussed in terms of collaboration, touchscreen devices and culture. Afterwards, the contributions to the existing creativity literature will be discussed.

5.2.1 Collaboration increases fluency

The results of these studies contribute to our understanding of how and in which ways collaboration affects creativity. Children's solitary and dyad performances were compared to gain a better understanding of how collaboration contributed to creativity. A consistent result from all three studies was that collaboration always resulted in better fluency scores compared to solitary performance. This means that children came up with longer stories when they collaborated regardless of which country they were from, and they completed more drawings when they performed as a dyad. This finding is in line with a brainstorming study (Buchanan & Lindgren, 1973). The results of this study also underlined that more ideas were created when participants brainstormed as a group compared to solitary work.

The increase in children's fluency scores could be due to different interests and knowledge of children in a dyad as suggested by Ferguson-Patrick (2007). Two children working collaboratively on a shared work (telling a story or drawing) can bring their individual knowledge and abilities to the collaborative work which in turn results in more ideas. In addition, children were allowed to talk to each other during the collaboration process in all three studies. Dialogue has been found to improve creative outcomes when working collaboratively (Cremin et al., 2015). Talking to each other and discussing ideas to come up with the best one might have helped children to create longer stories and more drawings as a dyad.

Collaboration is a fundamental human activity (Tomasello & Hamann, 2012) and its effect on the fluency of children's creative production is important especially for school environments. Schools rely heavily on peer collaboration as children often work in pairs or small groups (Azmitia, 1988). Encouraging children in schools to participate in collaborative creative activities could be beneficial if the educators expect children to come up with more ideas.

When the other components of creativity were assessed, the effects became more complex. In the storytelling studies (Study 1 and Study 2), while collaboration did not have an impact on the elaboration of Turkish children's stories, it led to less elaborate stories for the UK children. In Study 3, collaboration did not have an impact on elaboration. In terms of the overall creativity of the stories which was assessed by independent judges in the first two studies, UK children's overall creativity was not affected by collaboration while Turkish children came up with more creative stories in dyads. In terms of the originality of the ideas, the results of the third study revealed that there was no effect of collaboration on the originality scores. In sum, collaboration did not support elaboration or originality in any of the studies. When combined with the

results regarding fluency, it can be suggested that children come up with more ideas when they collaborate, however, they do not create more original or elaborate ideas. The increase in the number of ideas do not lead to an increase in the uniqueness of these ideas.

Another important contribution of this thesis within the final study is that when measuring the effects of collaboration, participants' social abilities were considered. By looking at their perceived peer acceptance scores, a better understanding of children's willingness to participate in a collaborative activity was ensured. Surprisingly, children performed more elaborately in dyads when they felt less accepted by their friends. This could be due to wanting to be accepted by others by performing well in a collaborative setting. Further studies are required in different domains of creativity before jumping to a conclusion about the positive effects of not feeling accepted by others. However, one possibility is that children attempt to fix the problem of not feeling accepted by their peers by performing better in a joint task.

When solitary and collaborative performance are compared in a between-subjects design, the results can be susceptible to individual differences. One of the strengths of this thesis is that all participants in each study performed both individually and in a pair. This minimised the effects of individual differences. Additionally, it was possible to see how individuals performed differently alone and in a pair. In order to compare individuals' solitary and dyad performances, the solitary performances of the dyad members were averaged and compared to their actual dyad performance. It is suggested that this is an effective way of evaluating the effects of collaboration while capturing the individual contributions of dyad members.

While looking at the effects of collaboration, previous studies found that when the members of the dyads were friends, they performed better compared to non-friends (Miell & MacDonald, 2000; Vass, 2002). However, in this thesis it was not known whether dyad members were close friends, or friends at all. They were all chosen from the same classroom to ensure that they at least knew each other, however they were not asked to nominate a friend to collaborate with. This was a deliberate decision to avoid any negative feelings that might be caused to some students due to not being nominated as a close friend by their classmates. Similarly, the same child could be a close friend of more than one children, or one child could have multiple close friends which would cause issues in recruiting. Future studies may benefit from pairing close friends providing this concern can be addressed.

This thesis exhibits a detailed picture of the effects of collaboration on children's creativity. Collaboration does not manifest itself as a simple phenomenon and it is clear that while some aspects of creativity benefit from teamwork, other aspects are either not affected or negatively affected. In particular, collaboration supported the fluency aspect of creativity across cultures and domains. While not affecting the elaboration for Turkish children's storytelling, it affected elaboration negatively for British children. Collaborating did not affect the originality or elaboration of children's drawing.

5.2.2 Touchscreen use does not affect children's creativity, but tools may limit it

The first two studies in this thesis contributed to the emerging literature on the effects of touchscreen devices on children's cognitive abilities. The first two studies revealed that using a touchscreen device, by itself, did not have an impact on children's

creative storytelling abilities. One important contribution of these studies to the literature is that as long as the same activity is done in the same way, using a tablet or a physical version of a storytelling game did not create any difference. This result follows some other studies such as Allen and colleagues' work on children's iPad use for word learning and symbolic understanding (Allen et al., 2015); or Robinson and Brewer's study on individuals' ability to solve the Tower of Hanoi tasks on a touchscreen versus in 3D version (Robinson & Brewer, 2016). This thesis also confirms that using a touchscreen device does not make a difference compared to its non-digital counterpart in the context of creativity.

While there was no difference between using the touchscreen or the physical tool, using a tool was found to have a negative effect compared to telling a free-form story. In the first study, British children produced less creative stories (measured by CAT) when they used the cubes or the app compared to their free-form stories. They also told shorter stories. In the second study, there was no effect of the type of task on Turkish children's CAT scores, however children performed better when they told a free-form story compared to telling a story by using the touchscreen device. These results might mean that children create better stories when they are not restricted by using a tool. Although it seems sensible to think that using a tool might facilitate telling stories, it might actually restrict children's free imagination. The number of the cubes, and the width of the topics that are covered by different pictures may not be enough for the creative minds of 5- to 7-year-olds. Similarly, using a tool might distract children rather than supporting them. While telling a free-form story on the spot is more natural for children (Broström, 2002) integrating different pictures into their stories might be challenging.

The results also suggested that touchscreen devices neither facilitated nor inhibited children's ability to share the workload between them in the case of collaboration. This finding is important in terms of the debate about the positive or negative effects of technological devices on children's social abilities (Falloon, 2013; Plowman & McPake, 2013). Families and schools invest in touchscreen devices to give children better opportunities at home and in school environments (Falloon, 2013; Marsh et al., 2015; Plowman, 2014; Rideout, 2017). However, this thesis revealed that although using technological devices did not seem to make children more isolated or less likely to work on a task together, they also did not seem to improve their cooperation. Therefore, the idea of touchscreen devices supporting or inhibiting children's social abilities should be addressed more carefully. Future studies can look into different social and cognitive abilities of children and how touchscreen devices affect these abilities to establish a better understanding of the effects of these devices. Moreover, different types of tasks can be used on touchscreen devices to eliminate the confounding effect of the specific task that was used in this thesis. It might be that the tool that was used in this thesis was specifically restricting children's creativity while some other apps on touchscreen devices may have different effects.

5.2.3 Collaboration benefits Turkish children's creative storytelling more than British children

By comparing the results from British and Turkish children, this thesis gathered information about the effects of culture on children's creativity. The comparison of the results of Study 1 and Study 2 revealed that while some of the results replicated across cultures, some others showed differences.

The CAT results across the two cultures revealed that Turkish children benefited from collaboration while British children were not affected. This means that Turkish children performed more creatively when they collaborated. This result might support the notion that Eastern cultures value working in harmony more than the Western cultures (Markus & Kitayama, 1991) and as a result they perform better collaboratively.

When the fluency scores were evaluated both in Turkish and British samples, the dyad stories had higher scores in both cultures. This means that in both cultures children created longer stories when they performed with a peer as opposed to when they were alone. However, the results were different for the elaboration scores. When children from the UK collaborated, the elaboration scores of the dyad stories were significantly worse than the solitary results. One explanation is that children might have repeated each other more when they collaborated which in turn might have resulted in less lexical diversity. The other explanation, which is not exclusive of the first explanation, is that children from the UK may have performed worse when they collaborated as a result of the individualist aspect of their culture. This theory becomes more interesting when the results from the UK sample are compared to the results from the Turkish sample. Turkish children performed similarly when alone and with a peer, which means that collaboration did not have a negative effect on them. It can be suggested that as British culture is more individualistic (Nisbett et al., 2001), children created richer stories when they were working alone. However, interestingly, repeating each other can actually be a sign of accepting each other's ideas. As collaboration requires prosocial behaviour and taking each other's ideas on board (Gräfenhain et al., 2013; Tomasello, 2014), repeating each other's words might be a sign of better collaboration practise. Future studies can look into the results by analysing the reasons for the decrease in children's elaboration

performance to find out whether it is due to dyad members repeating each other's utterances or their own.

Turkey has traditionally been considered an Eastern country (Suh et al., 1998; Triandis, 1993). However, later studies argued that Turkey's culture was not straightforwardly Eastern or Western (Goregenli, 1997; Yetim, 2003). They argued that although Turkish culture was closer to Eastern culture, it held Westerner values too. This might be the reason for observing both similarities and differences between the results from Turkish and British children.

The overall creativity of the stories in the first two studies were rated by independent judges. While the raters for the first study were chosen from the UK, the raters of the second study were chosen from Turkey. Together with the effects of culture on children's storytelling abilities, the cultural differences between the raters should also be considered. The factors that make a story judged as creative might differ for judges from different cultures. Future studies might consider requesting feedback from the judges in terms of the criteria they used for evaluating the creativity of the stories. This feedback can further unpick the differences between the judgements in different cultures..

5.2.4 Creativity can be better measured by taking multiple approaches

Gathering information about young children's creativity was at the core of this thesis. To achieve this challenging aim, different approaches were taken in terms of the definition and measurement of creativity.

5.2.4.1 Domain-specificity of creativity. It has been suggested that creativity is a domain-specific ability and that an individual's success in one type of creativity does

not guarantee their creativity in another domain (Baer, 1994, 2012; Paletz & Peng, 2008). For instance, the ability to write a poem does not mean one has the ability to draw creatively. However, it has also been suggested that different domains of creativity can be inter-translatable. For example, it is possible to pinpoint which musical piece inspired which painting even when the evaluators are not experts in either of the areas (Ranjan et al., 2013). Based on these theories, two domains of creativity were considered in this thesis: storytelling and drawing. While storytelling depended on children's verbal abilities, drawing depended on different abilities such as motor skills and visual awareness.

Evaluating creativity in a domain-specific approach allows researchers to gain a better understanding of factors that affect specific domains of creativity. However, gathering results that can be generalised across domains allows researchers to be more confident about the reliability of the results. For instance, it is plausible to state based on the results of the three studies that regardless of the domain, collaboration helps children achieve higher fluency scores. Moreover, collaboration does not contribute to the elaboration scores of children across domains. These findings also support the idea that different domains of creativity should not necessarily be interpreted exclusively (Ranjan et al., 2013) and that generalisable results can be gathered across different domains.

This thesis followed a domain-specific approach to creativity and evaluated children's creativity in two distinct domains. This approach strengthened the generalisability of the findings in terms of the effects of collaboration on children's creative abilities. For instance, collaboration resulted in more ideas both for storytelling and drawing. This consistent result in two distinct domains provide a more convincing effect of collaboration on fluency. It is crucial to recognise that evaluating only one type

of creative ability and reaching overall results regarding children's creative abilities can be misleading.

5.2.4.2 Different measurement techniques complement each other. There has been a long debate on various measurement techniques and how and why one is better or worse than the other (Baer, 1993; Guilford, 1966; Piffer, 2012; Yamamoto, 1966). This thesis used three different approaches to measure the creativity of young children. The first two studies combined objective and subjective measurement. The third study used a standardised measurement technique, the TTCT Figural. Therefore, this thesis drew a somewhat more detailed picture of creativity.

An important contribution of this thesis was that the objective measurement technique that was used in the first two studies was an innovative approach to measuring creativity. Using the length and the lexical diversity of the stories as a determiner for the fluency and the elaboration of the stories respectively made an objective measurement of creativity possible. Although this approach did not wholly capture creativity on its own, it served as a useful complementary measurement. We propose that as suggested by Lubart et al. (2010), a more holistic approach is necessary where different measurement techniques complement each other. Additionally, this innovative way to measure children's storytelling ability may allow future researchers to examine children's daily creative actions without the necessity to use a standardised test. Evaluating the creative value of children's daily activities rather than their performance on a time-bound and standardised test that is unnatural for them to complete may allow researchers to capture real-life creativity better.

An interesting finding that was consistent in both Studies 1 and 2 was that the length of the stories (i.e., fluency scores) was positively correlated with the overall

creativity of the stories, according to the CAT scores. Looking at the relationship between the CAT and a divergent thinking measure follows the idea of Lubart et al.'s (2010) study. It can be suggested that the fluency of the stories could be one of the ways to predict the overall creativity of them. This finding also supports Guilford's (1950) theory that people who come up with more ideas tend to come up with more creative ones. Hong and Milgram's (1991) study on lenient and stringent problem-solving tasks also suggested that verbal fluency predicted the originality of children's idea production. It can be argued that children who are willing to stay on task for longer and make more effort producing more ideas tend to come up with more creative stories.

Elaboration scores were not successful determiners of the overall creativity of the stories. Perhaps elaboration is not as strong a determiner of overall creativity as fluency. Another possibility is that the way elaboration was measured in this thesis (i.e., measuring the lexical diversity of the stories) was not a successful way of capturing the richness of the stories. The elaboration of a story may be much more than using different words. Future studies might consider looking at linguistic features of stories in more detail. For instance, the number of adjectives that were used in a story as well as the ratio of novel words to all the words might be a good determiner.

Using the CAT to measure the creativity of the stories was important for two reasons. First, as using story cubes to tell a story is not a standardised measurement, asking judges to measure the overall creative outcome made this technique more reliable. Second, as it was suggested by Amabile (1982), the CAT provided a more ecologically valid measurement of creativity compared to a standardised measure. The correlation between the fluency scores and CAT scores suggested that these two measurements did indeed complement each other. This is also an important finding in terms of the criticism that one aspect of creativity is not enough to conclude that the

idea or the product is creative overall (Baer, 1993; Piffer, 2012). As Lubart and colleagues (2010) suggested, using different types of creativity measurement provides a richer perspective.

While there is not one overarching description of creativity and a single way of measuring this overarching ability, it is valuable to discuss different ways of measuring different types of creative activity. To recapture what has been argued throughout this thesis, creativity is a concept that is domain and context specific. Due to this domain and context specificity, it is crucial to readdress that different domains and different contexts call for different measurement techniques. Standardised measures have been used frequently in childhood and adult creativity research. The standardised measures, such as the TTCT, serve time-bound, tightly-structured and automatized screening for some aspects of creativity, though there is a tendency to accept the results of these measures as the only predictor of creativity. Due to the very nature of these measures, the results of this type of measuring can be superficial. For instance, the fact that these tests are time-bound can underestimate one's ability to produce original and appropriate ideas. This is especially true when the participants are young children. Moreover, success in one creative domain does not guarantee the same level of creative achievement in other areas. Therefore, labelling an individual as "creative" or "not creative" based on their performance, for instance, on a drawing test is misleading. Another issue is that standardised measures often punish abstract ideas as they are more challenging to interpret using strict rules. However, an abstract idea can be both original and appropriate. In order to capture such instances, Consensual Assessment Technique is suggested to be more accurate, as it introduces subjective judgement and expert knowledge into creativity measurement.

CAT provides the opportunity to consult multiple experts' opinion on the creative value of a product. What makes a product creative need not be defined within certain rules and is judged by the experts' subjective criteria within a specific domain. This approach makes CAT a more appropriate measure as it takes into account context and domain specificity. It allows more opportunity for abstract ideas to be considered creative. Additionally, as there are no rules or time constraints during the creative production, the creators have more room for flexibility and deep thinking. Overall, for the purposes of measuring everyday creative activity such as storytelling or free-form drawing, CAT is suggested to be a better measurement technique compared to standardised measures. Additionally, using multiple approaches to determine the creative value of a product has been the main suggestion of this thesis. By combining subjective and objective measurements in a way that values context and domain specificity, researchers can obtain more reliable and generalisable results.

In terms of the weaknesses of the studies, while measuring creativity, this thesis only focused on the outcome product. A qualitative approach together with the quantitative technique could produce a broader understanding. For instance, while children were collaborating, the various strategies that they used remain undiscovered. Future studies could benefit from taking a mixed methods approach and complement quantitative measurement with qualitative observations. The fact that the sessions were video-recorded means future research can identify different collaboration strategies used by the dyads. For instance, it can be observed whether children built on each other's ideas or tried to impose their own ideas on each other could provide an insight into different ways of collaborating with a partner.

5.3 Implications and Future Directions

The findings of this thesis contribute to various research areas including young children's touchscreen use and collaboration, and how these may impact their creativity. In terms of collaboration, this thesis enhanced our understanding of the benefits and shortcomings of collaboration on children's creativity. This can provide useful information for parents and educators. While teamwork and collaboration is key to the education system as we know it (Azmitia, 1988), teachers may reconsider their expectations from children's collaborative work. While it is plausible to expect more ideas from collaborative activities, as it was found repeatedly in our studies, perhaps expecting more original ideas may not always be realistic. However, more studies in the area are needed to unpick what aspects of collaboration support or inhibit children's originality in collaborative activities.

In this thesis, the effects of collaboration were evaluated in terms of the outcomes of the collaborative activity. However, it is equally important to evaluate the process of collaborating. Children follow different techniques and strategies while collaborating. It would therefore be interesting to concentrate on the collaborative act as well the outcome. Further studies may follow a mixed method approach where different styles of collaboration are evaluated as well as comparing the outcomes of different collaboration styles. Discovering the different ways in which children collaborate or attend to a mutual work without actually collaborating might be useful for educators. Two children working on the same task may not always mean they are collaborating. One of the best ways of differentiating between collaborative work and attending to the same task without sharing responsibilities is by carefully investigating children's behaviour patterns while working together.

The results regarding the null effects of technology use on children's creativity and collaboration is also important for parents and educators. As it has been stated various times in this thesis, parents and schools invest large amounts of money into touchscreen devices (Falloon, 2013; Plowman, 2014). Our studies revealed that there was no benefit gained from using a touchscreen device. However, it is equally important to stress that there was no hindrance caused by technology use either. This thesis does not aim to support one side in the *effects of touchscreen devices on children* debate. Rather, it provides scientific evidence that the type of activity is more influential on children's creativity than different types of aids such as physical toys and touchscreen devices. It is also important to note that this thesis did not compare different activities on touchscreen devices. Therefore, future studies may consider comparing different creativity activities on touchscreen devices to understand if one type of activity on a touchscreen device is better than the other.

5.4. Conclusion

In summary, this thesis provides valuable information on 5- to 7-year-old children's creative and collaborative abilities. It underlines that collaborative activity results in more ideas, although these ideas are not necessarily more original or elaborate. It also suggests that using touchscreen devices do not contribute to or inhibit children's creativity. Culture may have slight effects on children's collaborative creativity, however in general children from Turkey and the UK perform similarly. These results enhance our understanding about young children's creativity.

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Appendix A

Pilot Study

Before starting the actual data collection, a pilot study was conducted. There were several reasons for conducting a pilot study. First, the cubes that were used in this study have not been used for a scientific study before. Therefore, it was necessary to gather information about the feasibility of the tool as a measure of creative storytelling. Another reason was that a decision making was needed in terms of the age group of the participants. The storytelling literature suggests that children are able to tell well-structured stories at the age of 5 to 6 years (Broström, 2002). However, it was crucial to find out whether children at this age group would also be able to understand and follow the rules of the storytelling game, or the experiment as a whole. Finally, the scripts that were created for the experimental procedure were needed to be tested on children. It was important to find out whether the scripts were age-appropriate, and they were fully understood by children.

In order to address all these concerns, a pilot study was conducted. The pilot study was administered in a local museum in South Yorkshire. Fourteen children participated in the study. Their parents or caregivers were approached by the experimenter and were asked for permission for their children to take part in the pilot study, and following the verbal consent they were given a consent form. The average age of the participants was 6 years and 1 month. Four of the participants completed the solitary version while 10 participants (5 dyads) completed the dyad version. The pilot study results revealed that although children were able to tell stories at the age of 5 years, they were not able to stay on task and follow the requirements of the experiment compared to 6-year-olds. Therefore, the age group for the study was decided as 6- to 7-year olds who are the Year 2 students in infant schools.

Appendix B

Additional Information about Child's Access to Different Technological Devices

Do you have any of these technological devices at your home? (You may choose more than one)

☐ Desktop computer

☐ Laptop

☐ Tablet

☐ Smart phone

☐ Electronic toys

When you think about yesterday, did your child spend time using any of these devices? If they did, please write down the amount of time they spent with these devices (You can choose more than one)

☐ Desktop computer (duration:_____)

☐ Laptop (duration:_____)

☐ Tablet (duration:_____)

☐ Smart phone (duration:_____)

☐ Electronic toys (duration:_____)

Appendix C

Counterbalancing of task and session orders

	Order of the tasks	Solitary / dyad
1	Cubes – app - control	Solitary
2	Cubes – control - app	Solitary
3	App – cubes - control	Solitary
4	App – control - cubes	Solitary
5	Control – cubes - app	Solitary
6	Control – app - cubes	Solitary
7	Cubes – app - control	Dyad
8	Cubes – control - app	Dyad
9	App – cubes - control	Dyad
10	App – control - cubes	Dyad
11	Control – cubes - app	Dyad
12	Control – app - cubes	Dyad

Appendix D

The instructions for the app task and the control task (English)

App task:

"Today we are going to tell stories. Do you like telling stories? To be able to tell stories, I brought a tablet with me and there is a game on this tablet. The game is called Story Cubes. As you can see, there are nine cubes here and each cube has different pictures on each side. When you press this button, it will help you roll the cubes. The aim of the game is to roll the cubes and tell a story by combining the pictures that are faced up. Your story can be as long as you want it to be. It can be funny, sad or completely nonsensical. As long as you combine the pictures together it does not matter. You can start with 'Once upon a time' and when you think your story is over, you can say 'The end'. Do you have any questions before starting?"

Control task:

"Today we are going to tell stories. Do you like telling stories? I want you to tell me a story about whatever you want. It can be about anything you like. Your story can be as long as you want it to be. It can be funny, sad or completely nonsensical. The important thing is that, your story should be an original one, something that you have never heard of before. You can start with 'Once upon a time' and when you think your story is over, you can say 'The end'. Do you have any questions before starting?"

Appendix E

A solitary story transcribed in CHAT format (English)

@Begin

@Languages: eng

@Participants: CH Child

@ID: eng|0101SH13_cubes|CH|||||Child|||

*CH: there was a bee but his tail was funny and it was a magnet.

*CH: and it picked up a fish and it had a wiggly tail.

*CH: it swam under water and found an apple.

*CH: the apple had a dice in.

*CH: the spots of the dice had an eye on.

*CH: and the eye was bright like a light, it popped a light out.

*CH: and when you plugged the light in, a hat would come out and it came tumbling down.

@End

Appendix F

A dyad story transcribed in CHAT format (English)

@Begin

@Languages: eng

@Participants: EL 0102EL05 Child, HH 0101HH06 Child

@ID: eng|0102EL05_app|EL|||||Child|||

@ID: eng|0101HH06_app|HH|||||Child|||

*HH: there was a camp .

*EL: and the team were telling ghost stories and it was before bed time .

*HH: and suddenly their phones died .

*EL: and their light bulb switched off .

*HH: and a rainbow appeared .

*EL: it started raining fish .

*HH: then the fish went learning .

*EL: and then a nasty bug came along .

*HH: then this thingymajiggy@n appeared in the darkness .

*EL: straight in front of the tent a castle appeared .

*HH: a bridge appeared .

*EL: a fountain appeared .

*HH: a phone appeared .

*EL: and a fishy swam in the fountain .

*HH: and a light bulb .

*EL: and the torch switched back on .

*HH: and a magnifier appeared .

*EL: and inside the castle they slowly crept in and saw a sign with an on .

*EL: inside they saw a pyramid .

*EL: just the same as that they saw a globe and a fish and suddenly the clock struck twelve .

*HH: and a phone rang again .

*EL: and then out of the darkness appeared a giant giant footstep .

*HH: eyeball .

*EL: and suddenly there was a weighing scale with an eyeball inside .

*HH: a thing appeared .

*EL: dice rolled .

*HH: he fell asleep .

*EL: and a tent appeared .

*HH: the guy woke up and he was happy .

*EL: because he had his locked castle but little had he known that somebody had a company .

@End

Appendix G

The Instructions for the cubes, app and control tasks (Turkish)

Cubes Task:

Bugün birlikte öyküler anlatacağız. Öykü anlatmayı seviyor musun? Öykülerimizi anlatabilmek için yanımda bir oyun getirdim. Bu oyunun ismi Öykü Küpleri. Gördüğün gibi, burada dokuz tane küp var ve her bir küpün her yüzünde değişik resimler var. Oyunun kuralı küpleri atmak ve üste gelen resimleri birleştirerek bir öykü anlatmak. Öykün istediğin kadar uzun olabilir. Komik, üzücü ya da tamamen saçma olabilir. Küplerdeki resimleri biraraya getirerek öykünü anlattığın sürece bunun hiçbir önemi yok. Öyküne "bir varmış bir yokmuş" diyerek başlayabilirsin ve öykün bittiğinde de "son" diyebilirsin. Başlamadan önce sormak istediğin bir şey var mı?

App Task:

Bugün birlikte öyküler anlatacağız. Öykü anlatmayı seviyor musun? Öykülerimizi anlatabilmek için yanımda bir tablet bilgisayar getirdim ve bu tabletin içinde bir oyun var. Bu oyunun ismi Öykü Küpleri. Gördüğün gibi, burada dokuz tane küp var ve her bir küpün her yüzünde değişik resimler var. Bu tuşa bastığında küpleri atabilirsin. Oyunun kuralı küpleri atmak ve üste gelen resimleri birleştirerek bir öykü anlatmak. Öykün istediğin kadar uzun olabilir. Komik, üzücü ya da tamamen saçma olabilir. Küplerdeki resimleri biraraya getirerek öykünü anlattığın sürece bunun hiçbir önemi yok. Öyküne "bir varmış bir yokmuş" diyerek başlayabilirsin ve öykün bittiğinde de "son" diyebilirsin. Başlamadan önce sormak istediğin bir şey var mı?

Control Task:

“Bugün birlikte öyküler anlatacağız. Öykü anlatmayı seviyor musun? Senden bana herhangi bir konuyla ilgili bir öykü anlatmanı istiyorum. Öykün istediğin her şeyle ilgili olabilir. İstediğin kadar uzun olabilir. Komik, üzücü ya da saçma olabilir. Burada önemli olan kural, öykün orijinal olmalı, daha önce hiçbir yerde duymadığın bir öykü olmalı. . Öyküne “bir varmış bir yokmuş” diyerek başlayabilirsin ve öykün bittiğinde de “son” diyebilirsin. Başlamadan önce sormak istediğin bir şey var mı?

Appendix H

A solitary story transcribed in CHAT format (Turkish)

@Begin

@Languages: tur

@Participants: CH Child

@ID: tur|A01BA11_cubes|CH|||||Child|||

*CH: bir varmış bir yokmuş .

*CH: eski zamanlarda bir tane uzaylı varmış .

*CH: kaleye gitmek istiyormuş .

*CH: orada yangın yanmış fark etmemiş .

*CH: sonra anahtarın kilidini bulmuş .

*CH: anahtarı da bulmuş .

*CH: sonra bir tane şeyin içine girmiş .

*CH: sonra peşinde canavar varmış .

*CH: sonra köprülerden geçmiş .

*CH: ok atmış .

*CH: bitti .

@End

Appendix I

A dyad story transcribed in CHAT format (Turkish)

@Begin

@Languages: tur

@Participants: KS B01KS18 Child , ADK B02ADK20 Child

@ID: tur|B01KS18_control|KS|||||Child|||

@ID: tur|B02ADK20_control|ADK|||||Child|||

*KS: bir varmış bir yokmuş .

*KS: evvel zaman içinde küçük bir ev varmış .

*KS: onun içinde mutlu mesut bir canavar varmış .

*KS: o da çok iyi kalpli canavarmış .

*ADK: gökyüzünde yıldızlar hep onu seviyormuş .

*KS: yıldızlar onu çok seviyormuş ama onlar da oraya uçabiliyormuş .

*ADK: evdeki dinazor çıkmış bir kere dışarı .

*ADK: sonra yıldızlarla konuşmuş .

*KS: sonra küçük bir yılan onları seviyormuş .

*KS: hiç kimseyi ısırmıyormuş o yılan .

*ADK: ve dinazor çok mutluymuş çünkü bir sürü arkadaşı varmış .

*KS: bir de şeker yiyormuş hep o .

*KS: bir de yemeklerini çok seviyormuş .

*ADK: ve bir kere de ormandan bir yere gitmiş başka bir yere gidince

çocuklar görmüş karşısında .

*KS: ama onları korkutmuş .

*ADK: ve çocuklar da kaçmış .

*KS: ben iyi kalpli dinazorum demiş ama o çocuklar duymamış onu .

*ADK: bitti .

@End