The Effect of Social Cognition and Emotional Experience on Performance During a Narrative Storytelling Task

by

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Abstract

This study explored how emotional expression and emotion understanding contribute to performance on a storytelling task. Given the cognitive nature of a storytelling task, it was hypothesized that negative emotions would inhibit performance, while understanding of the story character’s emotions would facilitate performance, and that these two variables would interact, to demonstrate a moderated relationship with the outcome variable. Six to nine year-olds engaged in a storytelling task, during which they were prompted to tell a story about a wordless picture book, and then identify the story character’s emotions. Automatic facial expression coding software, Emotient, recorded the emotions experienced during this task. The results demonstrated that anger and frustration negatively predicted performance, while emotion understanding positively predicted performance. The interaction between anger and frustration, and emotion understanding, was not statistically significant. The implications of this study will inform research in oral language fluency, social cognitive development, and self-regulation of emotion.
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Chapter 1
Introduction

1. Introduction

1.1 Background

The function of emotions in humans has been disputed for many years. Philosophers have thought of emotions as both involuntary, mercurial “Passions of the soul” (Descartes, 1699) and passive states induced by the thoughts of the experiencer (Keltner, Oatley, & Jenkins, 2014). Recently, many theorists have accepted the functional significance of emotions to direct attention, guide judgment and aid in storage and retrieval of memories (Clore & Palmer, 2009). Researchers in education and cognitive science have since been exploring the ways in which emotions can be utilized to facilitate children’s cognitive development and learning, as it is currently suggested that emotions aid and influence cognition in a way that is both functional to survival and meaningful to our unique experience.

Human beings are capable of using emotion to navigate relationships among one another and within our environment. This ability starts developing from birth, as infants recognize and produce expressions of emotion early in their development. Their ability to understand the emotions of their primary care givers and express their own emotions has a facilitative effect on their ability to meet goals of satiation and attachment. In their first 5 months of life, children can distinguish between emotional expressions of happiness, sadness, anger, surprise and fear (Barrera & Maurer, 1981; Bornstein & Ateberry, 2003; Montague & Walker-Andrews, 2001). During this time, infants are also able to produce the facial expressions that they recognize in others, and are able to express their preferences and desires. This early recognition and differentiation of emotional expressions is characterized by a superficial understanding of emotion. At this time, infants understand emotions as a consequence of the environment, but do not understand that internal states underlie facial expressions, or that emotions are used as a social communication tool.

Children begin to understand the mental states that underlie facial expressions between three to four years of age (Wellman, Cross, & Watson, 2001). During this time, children start to learn the
relationship between thoughts and feelings. They begin to understand that feelings can emerge spontaneously, or can come from thoughts, and that feelings can be altered by thoughts (Flavell, Flavell & Green, 2001). During this time, children also develop the ability to understand other people’s mental states, and to infer their perspectives based on their unique view of the environment (Carruthers & Smith, 1996). This ability to infer others’ mental states is known as Theory of Mind (ToM), which is a construct connected to both the child’s cognitive and emotional abilities.

Cognition and emotion are believed to bi-directionally influence one another. Emotions can shape thoughts by structuring perception and directing attention. In this way, emotions affect the way information is encoded, processed, and retrieved from memory. This process allows an affective response to be integrated with the conceptual understanding of a situation or event (Clore & Palmer, 2009). The influence of emotion on cognition is evident when the emotional valence of a situation affects how events are thought about and interpreted. In turn, cognition can shape emotion by restructuring the cognitive appraisal that is produced following an emotional event. This indicates that the way in which an emotional event is thought about, can alter the emotional reaction that follows the event (Webb, Miles, & Sheeran, 2012). Understanding this reciprocal relationship of cognition and emotion is valuable for gaining a deep insight into how children’s emotional engagement in learning can help shape their comprehension of abstract concepts.

Previous research has demonstrated that the scope and intensity with which children attend to information in a classroom can be affected by emotions. The intensity of emotions, regardless of their valence, can affect attentional focus and affect academic achievement (Pekrun & Linnenbrink-Garcia, 2014). Emotions with negative valence such as fear and anxiety narrow the scope of attention (Eysenk, Derakshan, Santos, & Calvo, 2007), while emotions with positive valence, such as happiness, can broaden attention (Huntsinger, 2013). While attention can be directed by emotions, the quality of the information that is encoded, and the ability to retrieve information from long term memory is also affected by emotions. Research in social cognition has demonstrated that memory for events that are emotionally salient tends to be more robust (Talmi, 2013). This is due to the complexity emotional content generates, as emotions provide an additional mental connection to aid in memory retrieval.
The interaction of cognition and emotion is demonstrated in children’s emerging ability to read. Children learn to read first by acquiring knowledge in letter recognition, letter-sound association and phonemic awareness before they develop fluency and comprehension of text (Oakhill, Cain, & Bryant 2003). These early decoding skills are foundational for further developing textual comprehension skills. They must use these skills to develop a conceptual understanding of a story, by creating a “situation model” to facilitate reading comprehension. A situation model is a recreation of a character’s environment in the mind of the reader, which includes representation of the character’s thoughts and emotions. A situation model is created by activating previous knowledge, accounting for the individual experiences of the characters, and utilizing working memory to effectively store this information and incorporate new details of the story as they are presented (Kintsch & van Dijk, 1978). Situation models that include inferences about characters’ thoughts, goals, and intentions help facilitate reading comprehension (Mani & Heuttig, 2012), as they allow for efficient classification and interpretation of information pertaining to the characters. This ability to mentally represent the character’s environment is grounded in the child’s ability to understand a story characters’ thoughts and emotions. Previous research has shown that children’s emotion comprehension significantly contributes to the ability to create an elaborate situation model of a story (Astington & Peskin, 2004). This occurs because emotion comprehension facilitates deeper processing of characters’ cognitive and affective states, which helps efficiently interpret details about the character and the plot.

Narrative stories allow children to experience a new environment from the protagonist’s perspective, which engages them in the thoughts and emotions of the characters and storylines of their favourite books (Alexander, Miller, & Hengst, 2001). Information that is presented in narrative form captures the interest of children from a very young age. This affinity for narrative stories is characterized by the ease and distinction with which children process narratives (Oatley, 1992). Narratives allow children to understand their own emotions by experiencing them through the characters in the stories they read. Fiction that is characterized by complex and detailed descriptions of characters’ perspectives allows children to be transported into the mind of the protagonist to experience a new environment. Previous research has found that children who read more fiction demonstrate a more sophisticated understanding of jealousy, empathy and theory of mind than children who do not have the same experience reading fiction (Aldrich et al., 2011; Mar, Tackett, & Moore, 2010; Mar, Oatley, & Peterson, 2009). This suggests that
experiences with complex characters and diverse environments allow children to engage in sophisticated reasoning about others’ minds and emotions through reading.

This social cognitive skill of understanding story characters could facilitate the ease with which some children comprehend and produce narratives. Children who easily integrate social cognitive information into their situation model of a story likely use cues about the character to efficiently chunk and process information. This could reduce perceived task difficulty and feelings of fear or anxiety that could inhibit oral language and reading performance.

The contribution of emotions to academic achievement has been previously studied, as researchers have found that intense emotions can differentially affect achievement, based on valence, appraisal and task difficulty. The prevalence of studies on the effect of emotions in education have been increasing, as advances in computer science now allow researchers to track student’s emotions in real time. This novel methodology eliminates previously encountered constraints, as researchers do not need to rely on children’s metacognitive abilities, or working memory, to measure emotions.

1.1.1 The Current Study

This study examined the role of emotions in the context of oral language fluency and storytelling ability. The emotional experience of children, as well as the child’s understanding of others’ emotions was examined to determine the contribution of these constructs to narrative storytelling ability.

The theoretical rationale guiding this research is grounded in cognitive theories of emotions. Experiencing an emotion involves an instant cognitive appraisal, which is then used to direct the individual to take an appropriate action. This reciprocal process between cognition and emotion differentiates emotions as a more complex construct than a physiological reaction to the environment (Oatley & Johnson- Laird, 2014). Further, the appraisal of one’s emotions determines the valence and intensity of the emotion that is experienced (Siemer, Mauss & Gross, 2007). This process allows thoughts to restructure emotions, so the appropriate actions can be taken (Webb et al., 2012). If a task is outside the scope of the child’s perceived ability, an appraisal of fear or anger, in anticipation of failure, could narrow the child’s attentional focus and have a negative effect on performance, as a result.
A negative appraisal and the resulting emotions could inhibit cognitive functioning and impair task performance on a narrative storytelling task. While experiencing emotions of this type and intensity, children are not able to attend to the most salient aspects of the plot, the characters and the theme of the story. This type of narrative task is cognitively demanding as it requires a child to hold aspects of the story in working memory, while constructing a coherent, grammatically sound narrative. Considering these cognitive demands, children must allocate all necessary cognitive resources to perform to the best of their ability. Interruptions that stem from the child’s emotional experience could be detrimental to their performance. If negative emotions narrow the scope of attention significantly, the result could be an increase in grammatical mistakes or a decrease in the understanding of the plot of the story.

Understanding of the story character’s emotions was examined as a possible contributor to the task appraisal and emotional experience of the participant. The social cognitive content of stories could contribute to the emotions children experience while they engage in a storytelling task. While some may easily integrate cues about the character’s thoughts and feelings, into their understanding of the story, it is possible that some children experience negative emotions as a result of these social cognitive cues. Those children who can efficiently integrate social cognitive cues into their understanding of the story could use these cues to chunk and process information. Children who struggle to interpret social cognitive cues could interpret the task difficulty as above their ability threshold, and experience negative emotions, which would narrow attention, as a result.

### 1.2 Research Questions & Hypotheses

There are three research questions guiding this study:

**RQ₁:** Can emotional expression, detected in real time by *Emotient* software, predict performance on a narrative story telling task?

**RQ₂:** Does understanding of a story characters’ thoughts and emotions predict performance on a narrative story telling task?

**RQ₃:** How does emotion understanding contribute to the relationship between emotional expression and performance on a narrative story telling task?
In examining these research questions, the following hypotheses are expected to emerge:

H₁: Emotional expression that indicates high intensity in emotions with negative valence, such as anger, frustration and confusion, will be negatively related to storytelling. This would indicate that children who experience more negative emotions will have low storytelling performance scores.

H₂: Understanding of story character’s thoughts, intentions and emotions, is positively related to storytelling performance. This would indicate the children who demonstrate higher scores on emotion understanding variables, will demonstrate higher performance scores on a narrative story telling task.

H₃: Understanding of the story character’s emotions moderates the relationship between emotional expression and storytelling. A moderated relationship between emotion and storytelling ability would indicate that there is a significant interaction between the predictor, emotional expression, and moderator, emotion understanding on the outcome variable, storytelling ability. This interaction between the moderator and the independent variable would indicate that at different levels of emotion understanding the relationship between emotional expression and storytelling ability changes. The hypothesized direction of these relationships is that at low levels of emotion understanding, the relationship between emotional expression and storytelling performance would be statistically significant. At high levels of emotion understanding, however, the relationship between emotional expression and storytelling would not be significant. It is expected that low levels of emotions understanding make a child highly susceptible to negative appraisal of the situation, leading to negative emotions and impaired performance. At high levels of emotion understanding, however, children are less likely to appraise the situation as negative and are less susceptible to the attentional narrowing and impaired memory that is hypothesized to be a result of negative emotions.

1.2.1 Rationale

Previous research has established that emotions of high intensity and negative valence can impact performance on an academic task, such as reading (Gernsbacher, Goldsmith & Robertson, 1992). This research has been well established in adult literature, as self-report tools are often used to prompt adults to retrospectively recount their emotional experience. When these
methods are utilized with children, there are inherent threats to validity, which undermine the applicability of these results. Many measures of the emotions children experience rely on working memory and retrospective accounts of emotions experienced during a task. This type of retrospective account is highly demanding for children, as their memory is more fallible to misinformation and errors of attribution (Bruck & Melnyk, 2011). In addition, children often lack the metacognitive awareness, which allows them to identify their internal states and emotions. Considering these methodological limitations, the advances in technology that afford real time measurement of facial expressions, while engaging in a cognitive task, add value to research on the effect of emotions in the classroom.

This study utilized technological advances to measure children’s emotional expression in real-time, to make meaningful inferences regarding the effect of emotional expression on a cognitive task. It was hypothesized that the emotions a child experiences while constructing a narrative story would contribute to their ability to produce a quality narrative from a wordless picture book. The child’s emotional expression during this narrative story telling task, was expected to contribute significantly to the child’s performance if the emotional expressions indicate that the child is experiencing negatively valenced emotions, such as frustration, fear, confusion, or anger.

Following the cognitive theory of emotions would indicate that the emotions experienced during a task are a result of the child’s appraisal of the situation. If the presence and intensity of negative emotions is related to impaired performance on a narrative story telling task, then the reason for this appraisal should follow the presence of a fear-inducing situation. The reason for this appraisal could be the child’s understanding of the story character’s emotions. Children who are able to easily understand the emotions of the story’s protagonist will likely be able to put themselves in the character’s mind to create an elaborate situation model of the events of the story. Information regarding the protagonist’s mental state, such as his or her perspective, intentions, goals and beliefs, is not explicitly portrayed in the pictures, and can only be deduced by using top-down cognitive processes. Children who do not have a strong understanding of these social-cognitive concepts, could be inhibited by emotion information and unable to construct a comprehensive understanding of the environment portrayed in the book, from the unique perspective of the protagonist. This study will explore the role of these constructs to examine the independent contributions of, and interaction between emotions and social-cognitive understanding on performance on a narrative story telling task. This research has important
applications in education, as children’s learning can be highly differentiated based on their appraisal of the learning environment.
Chapter 2
Literature Review

2 Literature Review

2.1 Understanding Emotions

Starting from the first months of life, children develop the ability to express and interpret the emotions of the people in their environment. In this context, understanding and displaying emotions have a facilitative effect on development, as infants’ smiles elicit positive responses and infants’ cries meet needs of curiosity or attachment. By two to three months of age infants are able to discriminate happy, sad and surprised faces (Barrera & Maurer, 1981) and by four months of age, infants can discriminate and respond meaningfully to expressions of anger presented using multiple modalities (Montague & Walker-Andrews, 2001). By five months of age, fearful expressions can be discriminated from smiling expressions in different people and in the same person expressing the emotion to varying degrees (Bornstein & Ateberry, 2003). This indicates that early in their development, children inhabit a developmental preparedness to interpret and express facial expressions, which facilitates their development by helping them meet basic needs.

Children are exposed to information containing emotionally charged stimuli within their environment from early in their lives. The processing of emotional stimuli from facial expressions begins early in their development, but maintains a gradual developmental trajectory. Starting at four years of age children demonstrate superficial understanding of the differences between facial expressions. Batty and Taylor (2006) used electroencephalogram (EEG) to measure infant’s perception and recognition of emotions. This measure records the amplitude and duration of activity in the brain, in response to target stimuli. The researchers showed children and adolescents between four and 15 years of age, pictures of facial expressions and recorded the resultant areas of activation. The results demonstrated that a developmental progression occurs for children’s recognition of facial expressions. The visual processing areas of the brain demonstrated high amplitude activity in four to seven year olds, which decreased steadily from age eight to 15. This result can be accounted for by children’s increased acuity in visual processing, as the brain requires fewer resources to recognize visual stimuli with increased...
exposure. In children between the ages eight and 15, emotional sensitivity increased. The ERPs demonstrated when older children processed emotions were characterized by latent activity in a frontal-occipital area of the brain that is activated during top-down, deductive reasoning. This pattern of processing emotions reached adult levels during adolescent years (Batty & Taylor, 2006). This indicates that as children grow older, they increasingly integrate emotional information into their environmental schemata, and use top-down processes to integrate new information into their understanding of the people in their environment.

By the time children reach school age, they use information from facial expressions for social referencing and communication. Their ability to both decode facial expressions and understand the underlying social reference contributes to their comfort level in social situations. Battaglia et al. (2004) found that children in grades two and three could identify emotions from facial expressions with 72 per cent accuracy. Success on this task was predicted by individual differences in children’s personality traits, such as the tendency to be shy or socially anxious (Battaglia et al., 2004). The authors suggested that understanding social referencing improves with increased exposure to social interactions, of which shy or withdrawn children might not actively seek out. This highlights the importance of early and diverse social interactions, which allow children to understand how emotions are manifested and communicated in others.

This understanding of emotions as a social communication tool requires the ability to understand the distinct perspectives of others, based on their independent interpretations of the environment. The ability to represent others’ independent mental states is known as Theory of Mind (ToM), and is referred to as the ability to see the world through another person’s eyes. ToM incorporates understanding others’ thoughts, intentions, beliefs, and emotions based on independent perspectives of the environment (Caruthers & Smith, 1996). This ability is tested with the false belief task, in which the child witnesses a change within a character’s environment, leading the character to hold a false belief about the location of an object or the contents of a box. In this task, children are asked how the character will act, and they are assessed based on their ability to predict that the character will act based on the false belief he or she holds, instead of acting on the knowledge the child has (Wimmer & Perner, 1983). At three to four years of age children demonstrate this understanding, as they begin to attribute representational states, such as intentions and beliefs to other people, even if they are distinct from their own representational
states (Wellman, Cross, & Watson, 2001). This demonstrates that the ability for children to understand others’ minds follows a developmental trajectory.

While understanding of other’s mental states includes the explicit identification of a character’s false belief, this does not necessarily indicate mental state understanding at different levels. Following the onset of ToM, children’s understanding of other’s emotions still remains superficial, as children demonstrate an increasingly sophisticated understanding of emotions, but lack the ability to connect emotions and resulting beliefs. At three years of age children begin to use emotion words to describe both their own internal states and the internal states of people other than themselves, such as their caregivers, pretend objects (Wellman, Harris, Banerjee & Sinclair, 1995), and imaginary characters in the books they read (Reilly, Klima & Belugi, 1990). This level of understanding of others’ emotions, however, does not necessarily indicate an understanding of how emotions are related to thoughts and mental states.

Although four and five year olds can predict a character’s actions in the false belief task, they fail to correctly attribute the correct emotions to the person holding the false belief (Harris, 2008). Bender, Pons, Harris, and de Rosnay (2011) found that between the ages of five and seven, children’s performance on the standard false belief task improved significantly, however they did not demonstrate a significant improvement in their understanding of belief-based emotions. This effect is persistent and robust when children attribute belief-based emotions to both themselves and to others. In this study, children were asked a standard false belief question, such as, “what do you think is in this [M&M’s] box?” and a belief based emotion question, such as, “how do you feel about eating what is in this box”. After finding out that the M&M’s box contained beads, five to seven-year-old children correctly stated that they previously held a false belief about what was in the box. They did not correctly identify their previous belief-based emotion, as they were likely to state that they previously held a negative emotion when they anticipated eating M&Ms from the box. It is possible that when belief-based emotions are involved in a story, they intrude upon children’s ability to predict a character’s behavior. Children demonstrated differential understanding of belief-based emotions and false beliefs, such that their current emotions occluded their perception of their previously held emotions (Bender, Pons, Harris & de Rosnay, 2011). This finding follows from the increased complexity that belief-based emotions ascribe to a cognitive task. To accurately state a previously held belief, children need to set aside their current knowledge of the situation. On the other hand, accurately stating a
previously held emotion, requires inhibiting their knowledge of the affective characteristics of the situation and ignoring their current emotional appraisal, to access previously held emotional appraisal and affective state.

This difficulty with understanding the affective component of mental states, could be explained by children’s limited understanding that emotions are preceded by, and are a product of thoughts. Between the ages of five and eight, children begin to understand that thoughts and emotions are related. At this age, children understand that thoughts can change emotions, and that spontaneous emotions that are not related to an environmental trigger, result from a change in thoughts (Flavell, Flavell & Greene, 2001). Children do not attribute emotions to past thoughts in an adult-like way until they are approximately seven years old (Lagatutta & Wellman, 2001).

Beyond seven years of age, children begin to make this association, as they appreciate how positive thoughts change the valence of emotions (Bamford & Lagatutta, 2010). Lagatutta, Elrod & Kramer (2016) investigated children’s understanding of how thoughts and emotions are related, and influence decision making. In this experimental paradigm, children were asked to make predictions about story characters’ emotions, based on their anticipation of future events. The author investigated whether children could indicate that a person who anticipates a positive event would feel happy, and make a decision to approach a situation, whereas a person who anticipates a negative event would feel scared or worried, and would make avoidant decisions. Eight to 10 year olds performed significantly better than four to seven year olds on this task, which indicates that at about eight years old, children begin to understand that thoughts and emotions are related concepts, which interact to inform decision making (Lagatutta, Elrod & Kramer 2016).

As children become proficient in understanding emotions in others and expressing emotions themselves, they begin to use emotions as a social communication tool. This ability stems from an understanding of how emotions shape interactions with others, which develops in middle childhood (Sallquist, Eisenberg, Spinrad, Eggum, & Gaerter, 2009). Throughout infancy, children’s emotional expressions are relatively uninhibited. In the years following school entry, however, children’s overall emotional expression declines and the intensity of both positive and negative emotions they experience declines (Sallquist et al., 2009). The authors of this study suggested that school age is a time at which children’s opportunities for socialization become more frequent and more diverse. This allows children in grades one to three to become aware of
the social facilitation of their emotional expressions, and of the cultural norms that are present within their society. With this new knowledge, they begin to inhibit expressions of emotions they think will be undesirable in social situations. This suggests that as children develop, they not only become more proficient at recognizing emotions in others, but understand that the emotions they express to others can shape their social interactions. This could motivate children to regulate their emotions and use emotional language that facilitates the type of social interaction they desire.

As children learn to navigate their social world, their communicative abilities become increasingly important. The ability of children to communicate their emotions and express their social desires is related to the ease with which they navigate social situations. Beck, Kumschick, Eid, and Klann-Delius (2012) found that children who have more proficient receptive and expressive language skills also scored higher on a number of dimensions of emotional competence. Children who demonstrate more emotional competence demonstrate more efficacious use of language in social situations, which might require that they clearly explain their desires, or use a comforting tone to talk to a peer in distress (Saarni, 1999). This suggests that children who are more proficient in their understanding of emotions, are more proficient at using language as a communicative tool.

Previous research has established a relationship between social cognitive variables, such as theory of mind, emotion understanding and language ability. As children begin to understand the mental states and emotions of others, they become more comfortable talking not only about themselves and their experiences, but the internal states and emotions of others (Astington & Jenkins, 1999). In a meta-analysis of 104 studies, including a total sample size of over 900 three to seven year olds, the relationship between language ability and theory of mind was moderate to strong. This study found that when the results of all these studies were analyzed together, language ability accounted for 18 per cent of the total variance in the development of theory of mind (Milligan, Astington, & Dack, 2007). This indicates that a significant portion of a child’s ability to understand other’s minds, is attributed to their linguistic representation of others’ thoughts, intentions and emotions.

The diversity of social interactions that children engage in allow them to deepen their conceptual understanding of others’ emotion states. Mothers who talk explicitly about mental state
attributions are more likely to have children who demonstrate a sophisticated understanding of theory of mind. These mothers give children the opportunity to understand that others can have distinct perspectives, and provide their children with examples of the necessary lexicon to talk about mental states (Taumoepeau & Ruffman, 2008). As children acquire and use mental state and emotion verbs, their understanding of others’ mental states improves (Astington & Flippova, 2005). This suggests that learning the labels for emotions and providing children with rich, diverse opportunities to understand how these labels relate to others’ emotions, facilitates emotional and mental state understanding, and allows children to interact proficiently within their social environment.

2.1.1 Understanding emotions through narratives

Starting from a young age, children demonstrate an affinity for narratives, as they develop an emotional attachment to the characters and plot lines in the stories they read and hear in their home (Alexander, Miller & Hengst, 2001). A narrative is a depiction of events involving the intentions and goal-directed actions of an independent agent, that follow a logical structure and real-world experience. Narratives are an efficient way to expose children to diverse emotions and perspectives. Drawing their attention to the thoughts and feelings of story characters, and providing supportive scaffolding to interpret these distinct experiences facilitates comprehension of the story and of the social cognitive aspects of the character’s experience (Walker, Gopnik & Ganea, 2015). This suggests that, especially for children who experience limited social interaction, reading and storytelling can be an important aspect of social cognitive development, as narratives allow children to engage in the complex cognitive representations that are involved in understanding how thoughts and emotions interact to inform social interactions.

The tripartite theory of mental representation emphasizes the multiple levels of representation at which readers encode text into their memory to create a situation model of the events in a story (Kintsch & van Dijk, 1978). This theory differentiates between the superficial and the textbase representation of information presented in a story. The superficial level includes the surface structure, in which the reader encodes all words in their exact order into memory to derive understanding from the story. The textbase representation incorporates deeper processing of information, as the reader encodes the meaning of concepts and ideas presented in the story, in addition to the perspective and emotions of the characters. This deeper level of processing
facilitates longer lasting memory and allows the reader to use the information presented in the
text for inferencing, elaboration or problem solving. Children’s abilities to deeply process
information at this level allows them to create an elaborate situation model of the story, and the
character’s experiences within the environment of the story.

Children’s ability to create a situation model by mentally representing objects and characters,
allows the processing of important aspects of information presented in stories. Situation models
incorporate details from multiple sensory modalities to create a mentally simulated visual
account of the environment, that is similar to what would be witnessed in person. Situation
models are constantly updated with successive information presented within the story, that
accounts for the individual experiences of the characters. Situation models that include
inferences about characters’ thoughts, goals, and intentions, allow the story and the experience of
the characters to be efficiently processed, and improve recall for contextual and individual details
of the story (Zwaan & Radvansky, 1998). The ease with which adults construct a situation model
while reading is characterized by their ability to see the environment from the perspective of the
protagonist. This includes experiencing the environment as the protagonist would, by simulating
the spatial and temporal relationships the protagonist experiences to the physical space. This
process facilitates the enjoyment adults feel while reading and allows the text to be efficiently
processed, by accounting for new information and improving the ease of recall.

Children demonstrate a parallel ability to mentally represent the environment presented within a
narrative. They draw causal inferences from details of the story that are not explicitly presented
within the text, and they update their situation models with newly presented information based
on the plausibility of the events in the story (Casteel, 1993). Rall and Harris (2000) looked at
whether three and four-year-old children mentally represent the first person perspective of the
story’s protagonist. Children in this study heard a story about a familiar character. The authors
used deictic verbs to represent a movement toward the protagonist that was either consistent or
inconsistent with the protagonist’s perspective. The children who heard deictic verbs that were
inconsistent with the protagonist’s perspective (i.e. “Little Red Riding Hood was sitting in her
bedroom when her mother went in”), demonstrated poorer recall for these sentences, and tended
to replace inconsistent verbs with verbs that were consistent to the protagonist’s perspective.
These results demonstrated that three and four-year-old children experientially represented the
protagonist’s perspective to build and update their situation model of the story. When hearing
verbs that described the scene as it was related to the protagonist’s perspective, rather than the third person perspective of a narrator or onlooker, they demonstrated significantly stronger recall for story events. The authors suggested that a dual process could explain these findings, such that children empathically identify with the character and are driven to do so by the pragmatic cues of the story (Rall & Harris, 2000). This explanation suggests that in addition to the linguistic cues inherent in the story, children’s ability to mentally represent the story from the protagonist’s perspective is related to the ease with which they identify with the story character.

An environment that provides frequent and quality exposure of reading and storytelling to children encourages children’s interest in narratives. Parents who encourage storytelling in the home can provide children with a protective buffer to other risk factors that might be present in the home. Rowe (2012) found that children’s use of narrative language was predicted by parent’s use of narratives in the home. This finding was translated across diverse groups of socio-economic status (SES). High SES parents were more likely to have a large number of books in the home and were more likely to read stories with their children frequently, which predicted children’s language ability. Children of low SES parents, demonstrated similar results to the high SES children, only if their parents engaged in frequent story telling in the home (Rowe, 2012). This suggests that the narrative structure of a story is an integral part of language development in children, and parents who engage in more narrative speech prepare their children to use a narrative linguistic structure, which is advantageous to early language development.

Producing a narrative requires a child to identify and express the basic elements of a story, such as; a setting, a theme and a protagonist with a certain goal, whose progress towards that goal is either impeded or facilitated by the events depicted in the story (Oatley, 1992). The child must integrate the perspectives of multiple characters, which could be different from his or her own, and understand the emotions experienced and goal directed actions employed by the characters. Measuring narrative competence provides insight into children’s spontaneous ability to understand these aspects of a story and to use this information to explicitly construct a coherent structure of events. This ability is indicative of the linguistic, cognitive and affective abilities the child possesses.

Children’s narratives become more complex, detailed and elaborate as they get older. Aldrich et al (2011) found that with age, children’s narratives contained more “story book” type language
and more evaluative devices, which elude to the thoughts and internal states of the character in the narrative. Children who took the character’s perspective into account, by using language to convey their feelings, thoughts, and perceptions used more evaluative language, and provided more rich descriptions of the character’s emotions. O’Neill and Shultis (2007) demonstrated that this ability to ‘step into the mind’ of characters, begins at age three and becomes adult-like by age 5. In this study, children were able to track the location of an object when it was moved only in the character’s thoughts and not in the participant’s actual environment. Three year olds required a cue regarding the relative location of the object, while five year olds matched the location of an object to the location that was estimated in the character’s thoughts (O’Neill & Shultis, 2007). This research is the first to indicate that by five years of age children have the ability, not only to take the perspectives of the characters in the stories they read, but to step into the minds of these characters, and understand how the character’s thoughts interact with their shared environment.

Since children’s understanding of belief based emotions develops following their understanding of mental states, they demonstrate this limited understanding in their comprehension of story characters’ emotions that are derived from beliefs. Ronfard & Harris (2014) investigated children’s understanding of thoughts and emotions using the story of Little Red Riding Hood. Children between the ages of three and six, heard a story about Little Red Riding Hood, during which a wolf eats her grandmother and waits for Little Red Riding Hood to visit her grandmother’s house so he can eat her too. At four successive points in the story, children were asked a knowledge question (i.e. “does Little Red Riding Hood know the wolf is at her grandmother’s house”) and an emotion question (i.e “How does Little Red Riding Hood feel right now”). At all four points, children were able to identify what Little Red Riding Hood knew, but their attributions of her knowledge did not match their attributions of her emotions. This indicates that children’s answers about the character’s thoughts and feelings were incongruent, as they were likely to say that Little Red Riding Hood did not know that the wolf was waiting for her at her grandmother’s house, and that she feels scared. This effect was exaggerated as Little Red Riding Hood moved closer to her grandmother’s house. The authors suggested that as the character saw the protagonist move closer in spatial location to the fear inducing situation, the emotional salience became more pronounced and the participants were more likely to misattribute their own perceived fear to Little Red Riding Hood. To correctly identify Little Red
Riding Hood’s belief-based emotion, children are required to inhibit their prepotent appraisal of a fear-invoking situation. This suggests that as the cognitive demands of understanding story character’s belief-based emotions increases, children’s ability to make these social cognitive inferences is inhibited.

The functional nature of the emotions children experience while reading narratives help them understand the properties and relationships contained within the emotional experiences of the characters. Reading about characters setting goals, constructing intentions and experiencing emotions when the environment challenges or facilitates their motives, facilitates the development of social cognitive structures that allow children to understand how people relate to each other. Astington and Peskin (2004) showed that even in the absence of lexical labels, children’s literature promoted conceptual understanding of emotional concepts, as reading allows children to make sense of the environment and construct an interpretation of a story’s plot. Through this process, children acquire a deeper understanding of internal concepts of emotions, including the environmental causes, the relationship between thoughts and feelings and the role of emotions in social contexts.

Narratives recruit multiple elements of the social cognitive components of the brain to incorporate emotional information into normal reading activities. Neural imaging research has demonstrated that comprehension of information presented in narrative format shows differential activation from lexical and syntax processing (Mar, 2004) and that this information is processed in areas of the brain associated with emotional arousal (Ferstl, Rinck & von Cramon, 2005). Patterns of neural activation during narrative comprehension and production are diffuse throughout the prefrontal and temporal regions, and specifically, in the medial prefrontal cortex, which is also activated during theory of mind tasks (Mar, 2004). Speer, Reynolds, Swallow and Zacks (2009) used neuroimaging to demonstrate that readers understand a story by simulating the environment in the story through a situation model in the mind. This situation model is constantly updated following a change in the narrative. The areas of activation in the brain are congruent with activation patterns in the brain that would occur if the participant were observing pictures or videos of a comparable scene unfolding (Speer et al., 2009). This demonstrates that the patterns of neural activation while mentally stimulating a character’s environment, are similar to the patterns activation that would be evident if one was witnessing the event in real time. This suggests that the social cognitive structures in the brain are connected to language
structures, which facilitate meaningful understanding and interaction between human beings.

Reading, exploring picture books and watching videos that depict character’s interacting within a typical social environment could be an advantageous place for children to develop these social cognitive skills. Previous research has demonstrated that number of literary stories read to children daily predict theory of mind ability (Mar, Tackett & Moore, 2010). The same relationship was not statistically significant for children who watching more television or movies. Literary fiction is considered distinct in its classification from other forms of popular media by its rich depictions of character’s traits and perspectives and the situational contexts in which characters develop these traits. This research suggests that specific types of reading material can facilitate the ability in children to build accurate situation models of character’s environments so they develop a comprehensive understanding of the diverse environments that contribute to thoughts and emotions. Considering this distinction, it is possible that reading rich and diverse text provides a context in which children are granted opportunities to understand the perspectives and unique environmental contexts of others.

2.2 Universal Emotions

The experience of emotions is a universal norm, that is experienced across cultures. Darwin’s early work on emotions was grounded in his observation of how animals relate to each other, how people from other societies behaved, and the development of his own children. He observed that among these groups, there were universal habits that were displayed in response to environmental triggers, suggesting a motivational antecedent that comes from a person’s internal state (Sariff & Tracey, 2011). From this theory, the encoding and decoding hypotheses were derived, to explain the universal experience of emotion. The encoding hypothesis states that the experience of an emotion should be associated with a universal expression across cultures. The decoding hypothesis states that these expressions should be recognized in the same way across cultures (Ekman, Sorenson, & Friesen, 1969; Izard, 1972). This initial work helped shape the research on universal emotions in the years following.

Ekman and Friesen (1969) began their research using photos depicting six basic emotions, anger, disgust, fear, happiness, sadness and surprise. They surveyed people from eight countries around the world, including Western, individualistic nations, such as the United States, and Eastern,
collectivist nations, such as Japan (Ekman & Friesen, 1969, 1971). They found that among the participants they surveyed, concordance rates were between 80 and 90 per cent, which is significantly above the concordance rates that would be produced from responding correctly by chance. Further research has demonstrated that people with differing political, religious and cultural backgrounds agree on how to label a set of universal emotions. In addition, the agreement of universal emotions transcends cultural exposure to emotion labels in the media.

Ekman, Friesen & Sorensen (1969) replicated this design using an oral narrative to describe the emotion photos, and asked study participants to match the photo to the story that was told. They did not find any significant differences in the emotion labels given to facial expressions in both eastern and western participants. Ekman, Friesen & Sorensen (1969) also asked participants to produce an emotional expression to match the story of one of the six emotions they portrayed. The videos of participants were coded by university students in the United States. The results demonstrated that both the university students and the participant’s identifications of the six emotions were accurate 80 to 90 per cent of the time, which replicated the findings of an earlier study. This study was also replicated with participants from a pre-literate culture in New Guinea, most of whom had never been exposed to emotion labels portrayed in American media (Ekman & Freisen, 1971). This evidence demonstrates the theory of universal emotions, that are experienced and recognized similarly across cultures.

Critics of this theory have noted that Ekman & Friesen’s work contained some threats to the internal validity of the results. In their initial paradigm, participants chose the emotion they used to describe the photo or narrative they were presented with, from a list that was administered by the researchers. To combat this criticism, this paradigm was replicated with a sample of participants in the United States and India, who were asked to produce an emotion word to match a photo of an emotional expression (Haidt and Keltner, 1999). These authors found that there was not a significant difference between the participants from the United States and India, and the results replicated previous findings, as the emotion labels produced described the pictured emotion significantly above the rate of chance.

The universal theory of emotions across cultures does not discount the cultural variation that exists in the intensity with which emotions are expressed and the values that are placed on emotions. In a Western, individualistic culture such as the United States, emotional expression is valued. A person in the West who is uninhibited in their expression of emotions is thought of as
a “genuine” person. In Eastern, collectivist cultures, on the other hand, expression an emotion is not valued if it disrupts social harmony. University students from Japan are more likely to inhibit negative emotions, such as disgust, fear and anger, to avoid disrupting social harmony, and are less likely to demonstrate displays of happiness or individual pride, to avoid bringing attention to individual accomplishments (Safdar, Friedlmeier, Matsumoto, Yoo, Kwantes, Kakai et al., 2009). This study found that while Japanese students inhibited their expressions more than Canadian and American students, after being exposed to negative stimuli, Japanese students demonstrated subtle expressions of disgust and anger, before they were able to consciously inhibit their expression. This suggests that while these two cultures may differentially report the intensity with which they experience emotion, there are underlying similarities in their experiences. Mauss, Butler, Roberts and Chu (2010) had Japanese and American university students engage in a cognitive task, such as counting backwards by three’s. In the middle of the experiment, a research assistant entered the room and rudely interrupted the participant, disrupting their performance on the task. While Japanese participants rated their experience of anger and frustration significant lower than American students, their physiological response to the interruption was not significantly different. This suggests that while emotions might be interpreted differently based on cultural values, the underlying experience is very similar across cultures.

These similarities of emotional experience across cultures are evident early in child development. This early differentiation of emotions mimics other basic processes in development, which suggest that this ability is universally experienced across all cultures (Keltner, Oatley & Jenkins, 2013). Facial expressions could also be thought of as a universal norm, due to their automatic and involuntary processing (Dimberg, Thunberg & Grunedal, 2002). When participants are shown emotional stimuli and explicitly instructed to inhibit overt reactions to these stimuli, subtle characteristics facial expressions still emerge, before the participant has a chance to consciously inhibit their expression (Kappas, Bherer & Theriault 2000). This suggests that both the expression and recognition of facial expressions is experienced similarly across cultures, early in development, and occurs without conscious thought or control.

2.3 Cognitive Theories of Emotion

The cognitive theories of emotional experience differentiate between the occurrence of emotions
as involuntary reactions to the environment and the function of emotions, as both facilitators of thoughts, and the outcome of thoughts. Three cognitive theories of emotion aim to describe the nature and function of emotions by highlighting this bidirectional nature of experience within the cognitive and emotional domains. Schacter and Singer (1962) proposed a two-factor theory of emotions, in which the first factor includes the involuntary physiological arousal that accompanies emotional experience, and the second factor is the appraisal or evaluation ascribed to the emotion. The second factor voluntarily recruits cognitive resources, as we use information from within the environment to determine the source of the emotion, if the source is unknown.

The action readiness theory of emotional processing states that emotions are built from elements that are states of readiness for certain kinds of action (Frijda & Parrot, 2011). Action readiness theories highlight the importance of the motivational state underlying the emotional feelings that lead us toward or away from activation or emotional behaviour. The underlying structure that activates these motivation states are called “ur-emotions”, which prepare us to act in accordance with a set number of modes of interacting with other people, objects and circumstances (Parrot, 2010). Ur-emotions are intentional states that establish or modify the relationship between the person experiencing an emotion, and a target, which could be an object, another person, or a state of the environment. The information contained in these mental structures, act as cognitive schemas, which allow incoming information to be interpreted and used to act according to the ur-emotion underlying this mental structure (Frijda & Parrot, 2011).

The communicative theory of emotion suggests that emotions are cognitive structures that mediate goals and the environmental access to goals. Emotions provide an appraisal of the environment which aid in the selection of actions in a complex and dynamic environment (Oatley & Johnson Laird, 2011). Oatley and Johnson Laird (2011) agree with action readiness theories in that emotions serve a functional purpose to appraise and evaluate the environment and precipitate appropriate action. These theories differ in their label and definition of basic emotions. The communicative theory understands universal, basic emotions as cognitive structures, which allow flexible and appropriate action in the environment, and which do not rely exclusively on a set number of mental models of situations. The action readiness theory, contrasts the communicative theory in its characterization of universal ur-emotion states, all of which are the result of fixed action patterns (Frijda & Parrot, 2011). The evolutionary perspective applied to the communicative theory’s acceptance of basic emotions is that humans
must have evolved from a strain of mammals who were able to handle novel situations that impinged upon their goals and left them unaware of how to proceed. In these situations, such mammals would not have had to search through an infinite number of mental models to determine how to proceed, but would have enlisted resources from an additional cognitive structure, such as emotions, to guide action (Oatley & Johnson Laird, 2011). This theory highlights the social element of communication, as it states that social emotions are related to emotional goals such as affiliation, attachment and assertion and that that humans are uniquely driven to understand and relate to each other, to maximize our emotional experience and increase our chances of success within our environment (Keltner, Oatley & Jenkins, 2014).

2.3.1 The Bidirectional Influence of Emotion on Cognition

The relationship between cognition and emotion is bidirectionally influential, as affect has functionally important characteristics that guide rational thought. Responding to stimuli presented within the environment involves transforming the stimuli to integrate expectations and prior knowledge about the subject through activated knowledge networks. When this occurs, an evaluative judgment is placed upon an event that occurs following the retrieval of previous knowledge and expectations. The information in memory that is activated by these events, and the way these events are subsequently received is affected by the emotional response to the event. In this way, emotions structure perception, direct attention, and affect the information that is encoded or retrieved from memory, by contributing valuable information about affective response to the reconstructed conceptual model of the situation or event (Clore & Palmer, 2009). This is evident in research demonstrating the cognitive outcomes of emotional responses.

Emotional responses can affect attentional focus, as experiencing anxiety narrows attention (Eysenck, Santos, Derakshan & Calvo, 2007) and happiness broadens attention (Huntsinger, 2013). When experiencing negative emotional states, such as anxiety, attention to threat-related stimuli increases, which narrows the focus of attention to maximize the individual’s chances of being successful in a potentially threatening situation (Eysenck et al., 2007). This demonstrates that the emotional information incorporated into this perception of a threatening situation shapes the information that is attended to, and how the individual acts upon this environmental trigger. Positively valenced emotions, on the other hand, broaden the focus of attention and facilitate top-down processing. Happy and optimistic moods are associated with creative thinking on
knowledge driven tasks (Fredrickson, 2001). This is a functional response to a positive stimulus, as broadening attentional focus in non-threatening situations allows an individual to process more details within the environment.

Emotionally salient information also differentially affects the encoding of information in memory. After information is attended to, it must be encoded, processed, stored in working memory, consolidated in long term memory and organized for retrieval. When there is a strong emotional component to an event, the memory for that event is stronger than less emotionally salient information (Talmi, 2013). Talmi’s (2013) mediation theory suggests that the reason emotionally salient stimuli are processed with greater importance is due to the cognitive resources that are recruited during the processing of emotionally charged events. The same intensity of cognitive resourcing is not necessary in the processing of neutral events and these cognitive factors contribute additive and interactive influences on emotional memory. Talmi (2013) proposed that the primary steps in memory storage, before consolidation has occurred, are responsible for the immediate effect of emotion on memory. During memory encoding and retrieval, the involuntary focusing of attention that is influenced by emotion causes a limited amount of information to be encoded, and retrieval of the information is also affected by the emotions that activate related knowledge. This suggests that the emotions felt during these early stages of processing structure the way information is perceived and stored in memory.

In the same way that emotions can structure thoughts, cognition can have an influential and facilitative effect on emotion. The ability to restructure thoughts to change the outcome of emotions is highly valuable. Children who can regulate their emotions effectively experience more favourable outcomes in academic achievement and social relationships (Huntsinger, 2013). Emotion regulation incorporates a number of strategies to restructure thoughts, many of which are targeted toward changing an emotional experience. In an education context, this ability is highly valuable, as children are more prepared to learn when they are happy and engaged (Huntsinger, 2013). In a meta-analysis of effective emotion regulation strategies, “cognitive change” had a larger overall effect on emotion outcomes than attention deployment and response modulation (Webb, Miles & Sheeran, 2012). This demonstrates that to affect emotions, the most reliable method is to actively change the evaluative judgements or appraisals of stimuli, as this restructuring of thoughts allows an individual to reappraise the emotional content of the situation and change their course of action.
2.4 Measuring Emotions

Since emotions have been regarded as a functional construct, there have been many developments in the methods of studying emotions, to determine their effect on various aspects of the human experience. Green, Goldman, and Salovey (1993) used adjective checklists to quickly determine the range of different emotions adults feel while engaging in a task. Alternatively, self-report scales are used to determine the strength of an emotion, by asking participants to rate their experience on an ascending numeric scale. Self-report measures have been developed and validated for specific emotions, such as anger (Spielberger, 1996) and fear (Spielberger, 1983), and for more general positive and negative emotion states (Watson, Clark, & Tellegen, 1988). While these methods have been validated with adult samples, measuring emotional experience in children can be more complicated than these measures afford. Measuring emotions in children requires that the measure is not based on self-report, or demanding upon working memory, as children, at young ages, lack the metacognitive awareness to accurately identify emotions their emotions. In addition, retrospective self-report measures that rely on working memory to identify an emotion felt during a previously completed task, possess inherent threats to the validity of these measures. As previously discussed research has demonstrated that children’s ability to remember a previous affective state is inhibited by their affective state that the time of the test (Lagatutta, Elrod & Kramer 2016; Ronfard & Harris, 2014). These threats to internal validity, that are inherent in the measurement of emotions in children, demonstrate the benefit of measuring emotions using nonintrusive, cognitive measures.

2.4.1 The Facial Action Coding System (FACS)

Ekman and Friesen (1976) pioneered The Facial Action Coding System (FACS) to code and measure the occurrence of facial expressions in children and adults. Ekman & Friesen (1976) used the theory of emotions as universally recognized and experienced constructs, to derive a coding scheme to classify facial expression of emotion. The FACS describes facial expressions as discrete combinations of muscular movement in the face. Ekman & Friesen studied how each muscle in the face moved to form combinations that were recognized as facial expressions of emotion. Each element of individual facial expressions was labelled with a numbered Action Unit (AU), that roughly corresponds to the activating facial muscle and human raters individually code movement on each numbered action unit. From these identified AUs,
combinations of musculature movement that combine to produce facial expressions of emotion were identified. Research on the FACS has established differences in voluntary and involuntary emotional responses in facial expressions. For example, involuntary expressions of anger have been characterized by tightening around the buccinator muscles surrounding the mouth and the frontalis muscles that furrow the brow. Feigned expressions of anger demonstrate a different profile in the facial muscles, as the tightening of the buccinator muscles surrounding the mouth is often not present or significantly attenuated (Dimberg, Thunberg, & Grunedal, 2002; Kappas, Bherer, & Thériault, 2000). These properties, which allow the FACS to code the involuntary manifestations of emotions in facial expressions, highlight this measure’s important application to the study of emotions. Since this instrument was developed it has been empirically validated and widely applied to the behavioural and cognitive sciences (Ekman & Rosenberg, 2005).

2.4.2 Real-Time FACS Processing

The FACS was validated across cultures (Eckman, Sorensen & Friesen, 1969; Ekman & Friesen, 1971) and widely used to measure facial expressions. A limitation that is inherent in this system is the time required of multiple human coders, to classify facial expressions. In addition, facial expressions tend to be extremely short, lasting only a few seconds, and making their coding by human raters, vulnerable to error (Bachorowski & Owren, 2001; Ekman, 1993). Advances in computer science have afforded the development of programs that can address this limitation, with their ability to read emotional expression, in real-time. Eckman and Friesen’s FACS has been adapted to replace human raters with intelligent technology that can recognize movement in the original AUs Eckman and Friesen identified.

This online, computer-assisted system is beneficial for both research and classroom activities, as these programs do not rely on student’s self-reported ratings of the emotions the experience while learning. Coding the emotions students experience is based on input from the musculature movement of the face. The software utilizes this input and compares the coded facial expressions to human ratings of facial expressions (Bartlett et al., 2009). Online learning programs and intelligent tutoring systems that utilize this interactive technology have the ability to identify student’s emotions, and accommodate the task the student is working on to meet the demands of their affective response and improve their learning experience (Sazzad, AlZoubi, Calvo, & D’Mello, 2011). This development allows researchers to use facial coding software to non-
intrusively identify the emotions students experience while completing academic tasks. This measure of emotions can be used to gain a comprehensive understanding of how emotions contribute to and influence academic achievement.
Chapter 3
Method

3  Method

3.1  Participants

Invitations to participate in this study were sent to students in grades one, two and three at eight elementary schools within the Thames Valley District School board (TVDSB) and the London District Catholic School Board (LDCSB) in London, Ontario. A complete list of all participating schools is provided in Table 1. Within eight schools, 934 invitations were sent out, 232 consent forms were returned and 212 children participated in this study.

Table 1.
Distribution of participating boards, schools and students

<table>
<thead>
<tr>
<th>Board</th>
<th>School</th>
<th>Grade</th>
<th>Consent forms distributed</th>
<th>Consent forms returned</th>
<th>Participants (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVDSB</td>
<td>Laurie Hawkins</td>
<td>3</td>
<td>20</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>TVDSB</td>
<td>J.P. Robarts</td>
<td>1</td>
<td>20</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>TVDSB</td>
<td>Stoney Creek</td>
<td>1, 2 &amp; 3</td>
<td>340</td>
<td>82</td>
<td>72</td>
</tr>
<tr>
<td>LDCSB</td>
<td>St. Catherine of Siena</td>
<td>1, 2 &amp; 3</td>
<td>230</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>LDCSB</td>
<td>Notre Dame</td>
<td>2/3 split</td>
<td>23</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>LDCSB</td>
<td>St. Joseph's</td>
<td>1, 2 &amp; 3</td>
<td>131</td>
<td>48</td>
<td>46</td>
</tr>
<tr>
<td>LDCSB</td>
<td>St. Paul</td>
<td>1, 2 &amp; 3</td>
<td>70</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>LDCSB</td>
<td>Monsignor Morrison</td>
<td>1, 2 &amp; 3</td>
<td>100</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>934</td>
<td>232</td>
<td>212</td>
</tr>
</tbody>
</table>

3.2  Measures

A Demographic Questionnaire was sent home with consent forms for parents to complete. The short nine-item survey was used to measure parent-reports about the child, the family environment, and family attitudes towards language and reading. Parents were asked to report the child’s age, grade, teacher and first language in the first set of questions pertaining to the child.
The next set of questions, pertaining to the family environment, included questions regarding the number of people living in the household, the number of siblings the child has and the highest education attained by both parents. Family attitudes towards reading were measured using items that asked parents how often they read to their child, their child’s proficiency in reading and the child’s motivation to read. Parents were asked to rate these items on a five-point Likert scale, ranging from very low (1) to very high (5). A copy of the demographic questionnaire that was sent to parents is included in Appendix E.

*Emotional Expression* was measured using facial expression coding software, *Emotient* ([imotionsglobal.com](http://imotionsglobal.com)). This software was developed based on Ekman & Friesen’s (1976) Facial Action Coding System (FACS), which describes facial expressions as universally recognized, discrete combinations of muscular movement in the face. Ekman & Friesen labelled each element of a facial expression with a numbered Action Unit (AU), that roughly corresponds to the activating facial muscle. *Emotient* software uses the FACS to automatically code emotions indicated by facial expressions, in real time. This software measures musculature movement in the face using movement indicators at 19 of Ekman and Friesen’s AUs (Table 2). In addition, *Emotient* provides evidence values that indicate the presence of nine discrete emotions, joy, anger, surprise, fear, contempt, disgust, sadness, confusion, and frustration. These evidence values represent the probability that the emotional expression displayed on the participant’s face would be coded as the same emotion by a human rater. The mean values for each of the 19 individual AUs, and evidence values for the nine discrete emotions were computed and used as individual independent variables, to measure emotional expression during the task.

**Table 2.**

Individual Action Units (AUs), incorporated muscles and description of facial expression.

<table>
<thead>
<tr>
<th>Action Unit (AU)</th>
<th>Facial Muscle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Frontalis, pars medialis</em></td>
<td>Inner Brow Raiser</td>
</tr>
<tr>
<td>2</td>
<td><em>Frontalis, pars lateralis</em></td>
<td>Outer Brow Raiser</td>
</tr>
<tr>
<td>4</td>
<td><em>Corrugator supercilli, Depressor supercilli</em></td>
<td>Brow Lowerer</td>
</tr>
<tr>
<td>5</td>
<td><em>Levator palpebrae superioris</em></td>
<td>Upper Lid Raiser</td>
</tr>
<tr>
<td>6</td>
<td><em>Orbicularis oculi, pars orbitalis</em></td>
<td>Cheek Raiser</td>
</tr>
<tr>
<td>7</td>
<td><em>Orbicularis oculi, pars palpebralis</em></td>
<td>Lid Raiser</td>
</tr>
<tr>
<td>9</td>
<td><em>Levator labii superioris alaquaem nasi</em></td>
<td>Nose Wrinkler</td>
</tr>
<tr>
<td>No.</td>
<td>Muscle Name</td>
<td>Action</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>10</td>
<td><em>Levator labii superioris</em></td>
<td>Upper Lip Raiser</td>
</tr>
<tr>
<td>12</td>
<td><em>Zygomaticus major</em></td>
<td>Lip Corner Puller</td>
</tr>
<tr>
<td>14</td>
<td><em>Buccinator</em></td>
<td>Dimpler</td>
</tr>
<tr>
<td>15</td>
<td><em>Depressor anguli oris (Triangularis)</em></td>
<td>Lip Corner Depressor</td>
</tr>
<tr>
<td>17</td>
<td><em>Mentalis</em></td>
<td>Chin Raiser</td>
</tr>
<tr>
<td>18</td>
<td><em>Incisivii labii superioris and Incisivii labii inferioris</em></td>
<td>Lip Puckerer</td>
</tr>
<tr>
<td>20</td>
<td><em>Risorius w/platysma</em></td>
<td>Lip Stretcher</td>
</tr>
<tr>
<td>23</td>
<td><em>Orbicularis oris</em></td>
<td>Lip Tightener</td>
</tr>
<tr>
<td>24</td>
<td><em>Orbicularis oris</em></td>
<td>Lip Pressor</td>
</tr>
<tr>
<td>25</td>
<td><em>Depressor labii inferioris or relaxation of Mentalis, or Orbicularis oris</em></td>
<td>Lips Parted</td>
</tr>
<tr>
<td>26</td>
<td><em>Masseter, relaxed Temporalis and internal Pterygoid</em></td>
<td>Jaw Drop</td>
</tr>
<tr>
<td>28</td>
<td><em>Orbicularis oris</em></td>
<td>Lip Suck</td>
</tr>
<tr>
<td>43</td>
<td><em>Relaxation of Levator palpebrae superioris; Orbicularis oculi, pars palpebralis</em></td>
<td>Eyes closed</td>
</tr>
</tbody>
</table>

*Storytelling ability* was measured by prompting children to tell a story using the wordless picture book “Frog where are you?” (Mayer, 1969). This picture book is about a boy, his pet dog and their search for their pet frog, which escapes at the beginning of the book. The storyline depicts the frog escaping, without the knowledge of the boy and the dog, and the events surrounding the five search episodes they engage in to find their frog. During their search episodes, they boy and the dog encounter a number of obstacles that interfere with their search for their frog. The resolution of the book indicates that the boy and the dog find their frog with a mate and a clutch of baby frogs, and the boy takes one of the baby frogs home with him as his new pet frog.

This type of storytelling task provides a rich context for the measurement of oral language fluency using children’s narratives. Since the picture book does not contain any words, children are required to spontaneously formulate a story about the events depicted in the book, which involves identifying temporally sequenced events, and making inferences about the characters’ thoughts, feelings and goals, while maintaining appropriate verbal and syntax relations to construct of cohesive narrative.
All narratives were transcribed and coded to form a composite score for storytelling ability. Narratives were transcribed using the CHAT format from the Child Language Data Exchange System (CHILDES). This transcription format accounts for pauses, intonation and punctuation markers in speech (MacWhitney, 2000). Six raters who were blind to the hypothesis of the study were trained on the CHAT transcription format and a coding scheme adapted from Reilly, Losh, Bellugi, and Wulfeck (2004) to assign a competence score to all participant narratives. All narratives were randomly assigned and coded by two raters. An interrater reliability score was generated to measure the degree of agreement among raters. All pairs of raters scored above $K=0.8$ in a Cohen’s Kappa analysis. Narratives were analyzed using individual scores for length, morphological errors, syntax diversity, narrative structure, and evaluative devices. These variables are individually explained in the following section on narrative coding procedures. A composite score accounting for all five of these variables was formulated to represent an overall score of narrative competence.

*Emotion Understanding* was measured to determine the child’s understanding of the story characters’ emotions. Participants were provided with stickers depicting the emotions happy, sad, afraid, surprised, and angry. These stickers represented facial expressions corresponding to five of the seven basic emotions. Although contempt and disgust are considered basic emotions, they were not included, as they were not salient emotions in the target book. Participants were shown seven separate instances in the book in which the protagonist acted in a way that revealed an emotional state. Participants were asked to place the appropriate sticker on the page to demonstrate the emotion the character was feeling. Answers were coded as one (1) for a correct answer, and zero (0) for an incorrect answer. Participant’s answers were coded and a composite score was generated to represent their overall performance on this measure.

*Vocabulary* was measured using the NIH Toolbox Picture Vocabulary Test (TPVT) (Gershon et al., 2013). This measure of receptive vocabulary asks children to identify one picture, from an array of four pictures that corresponds to a target word presented orally by the researcher. Age adjusted scale scores were analyzed to identify participants who performed two standard deviations or more below the mean, as this indicates a high probability of a presenting language difficulty (Slotkin et al., 2012). Unadjusted scale scores were used as a raw score of the participant’s performance compared to a nationally normed, age-related sample, which was used to analyze this variable as a control measure.
3.3 Procedure

This study received approval from The University of Toronto’s Ethics Review Committee prior to the collection of data (Appendix A). The Principal Investigator provided teachers with consent packages to send home with students. Each package contained an invitation letter (Appendix B), which provided parents with information about the study, a consent form (Appendix C) through which parents could provide proxy consent for their children’s participation, and a short survey for parents to complete (Appendix E). Following parental consent, the child provided individual assent to participate (Appendix D). During the assent procedure, the researcher explained the purpose of the study, and what the child’s involvement would entail, in developmentally appropriate language.

This study consisted of one 20-minute session, in the participant’s school, during school hours. First the child completed the TPVT on the computer. Next, the child went through a warm up activity, in which the researcher asked the child to tell a story about a single picture. The picture used for the warm-up activity was from a book by the same author as the target book (Mayer, 1969). This picture contained the same characters as the target book, but a different emotional tone, as this picture depicted a frog biting another frog and the protagonist and his dog observing the event, demonstrating fear and terror on their faces. The purpose of this activity was to allow the child to become familiar with the procedure of looking at a picture and telling a fictitious story about the events that could possibly be occurring in the picture.

Following the warm-up activity, the researcher familiarized the child to the book and introduced the storytelling task. The child was allowed to look through the pages of the book prior to engaging in the storytelling task. This familiarization phase, in which the child was asked to look through the book before telling a story, was included to allow the child to become familiar with the episodic and thematic content of the story. If the child attempted to begin the storytelling task without becoming familiar with the pictures, the researcher would repeat the instructions again, and ask the child to look through the pictures first. The researcher asked the child to complete the task by stating, “I am going to show you a book about a boy, a dog and a frog. First, I want you to look through the pictures, then I want you to tell me a story to go along with the pictures when you look through them again.” The instructions were deliberately kept vague to limit the constraints on the task and to encourage the child to tell a story using spontaneous thoughts and
interpretations of the content in the picture book. When the child prompted the researcher that he or she was ready, the researcher began audio recording the child’s story.

Following the narrative task, the researcher explained the instructions for the emotion understanding task. The researcher introduced the child to a set of six stickers depicting emoticon-type facial expressions of five of the seven basic emotions. The researcher showed the child specific pages of the book and asked the child to place a sticker on the page that matched the emotion the protagonist was feeling. When the study was completed the researcher thanked each child and provided positive feedback about the story the child told.

### 3.3.1 Narrative Coding Procedure

The coding procedure used to evaluate the transcribed narratives utilized a rubric that was adapted from Rielly, Losh, Bellugia and Wulfeck (2004). This coding scheme generated a score for storytelling ability that considered the linguistic structure, demonstration of thematic understanding and the use of evaluation. Individual scores for seven categories including, story length, morphological errors, syntax diversity, narrative structure, and evaluative devices were generated to analyze the separate contribution of these components to narrative competence.

*Overall story length* was measured to account for the varying lengths of children’s narratives. Story length was coded as the number of propositions in each narrative. Each proposition corresponded to one event, which incorporated a verb and its surrounding argument. This method measures the number of clauses used in a story, which accounts for the complexity of sentences and the efficiency with which the child uses words in sentences. To control for story length, the number of propositions was used as a denominator in more detailed measurements of sentence complexity.

*Morphological Errors* were tallied and summed to indicate the total number of morphological errors in each story. Categories of morphological errors include; errors in number marking, pronouns, prepositions, verb auxiliaries, verb tenses, and noun plurals. The frequency of morphological errors was divided by the total number of propositions in the narrative to control for story length.

*Syntax Diversity* was used to measure the child’s use of complex syntax and the diversity of sentences in each narrative. Use of complex syntax was tallied and summed from five categories,
including the number of coordinate sentences, adverb clauses, verb complements, relative clauses and passive sentences. The frequency of complex sentences was counted and divided by the total number of propositions in the narrative.

Narrative Structure was used to evaluate the participant’s identification of both the story components and the theme. Each participant was given a score for story components ranging from 0-8. Participants received one point if they referred to the setting of the story, one point if they referred to the frog escaping, up to five points for referring to each of the five search episodes, and one point for referring to the resolution of the story. Each participant was also given a score for theme, ranging from 0-4. Two points were administered for references to the two thematic devices within this story and up to two additional points were given depending on the number of times these thematic devices were reiterated throughout the narrative.

Evaluative devices were coded to measure the child’s use of interpretational tools used to build suspense or establish the point of the story. Evaluative statements highlight the narrator’s interpretation of the events in the story, and use hooks or typical story grammar to hold the listener’s attention. Specific types of evaluative devices that were coded were cognitive inferences, social engagement devices, intensifiers, and references to affective states. The frequency of evaluative devices was divided by the number of propositions to control for story length.
Chapter 4
Results

4 Results

4.1 Sample Characteristics

The participants in this study consisted of 212 children between the ages of six and nine years old \([M=96.55 \text{ months (8 years)}, SD=10.15]\). This sample included children in grades one \((n=56)\), two \((n=66)\) and three \((n=90)\) and was represented by 44.8% \((n=95)\) males and 55.2% \((n=117)\) females. Parents reported that 89.6% \((n=190)\) of children in this sample spoke English as their first language, while 10.4% \((n=22)\) reported a language other than English as the child’s first language. The majority of parents in this sample had obtained a university degree, as 55.4% \((n=117)\) of mothers and 43% \((n=89)\) of fathers in this sample reported obtaining an undergraduate degree or higher. One mother and five fathers did not report their education level.

4.1.1 Characteristics of the Family

To obtain a comprehensive account of the child’s home environment and parent attitudes towards reading, parents were asked to answer questions in the demographic questionnaire that addressed these variables. Parents indicated that 42% \((n=89)\) of participants in this sample live in a four-person household and 30% \((n=65)\) of participants live in a five-person household. The majority of participants in this sample live with at least one sibling, as parents reported that 48.6% \((n=103)\) of participants live with one sibling, and 26% \((n=56)\) live with two siblings.

To measure general attitudes towards reading and children’s exposure to reading in the home environment, parents answered questions about the amount their child reads in the home, and rated their child’s reading ability and motivation to read. Of the parents sampled, 77.4% \((n=164)\) reported reading with their child three or more days per week, 45.3% \((n=96)\) reported their child’s reading ability as “average” and 47.2% \((n=100)\) reported their child’s motivation to read as “average” (Figure 1). Parent reported reading ability and motivation to read demonstrated a significant positive correlation, of moderate strength \((r=0.57, p<0.01)\). The number of days per week parents reported reading with their child was significantly correlated with their motivation to read \((r=0.15, p=.03)\).
4.1.2 Vocabulary

Vocabulary was measured with cognitive measures from the National Institute of Health (NIH) Toolbox. Scores for this variable are set on a normal curve with a mean of 100 and standard deviation of 15. A score that is more than two standard deviations below the mean could indicate cognitive deficits in vocabulary. Two participants were removed from the sample because their scores did not meet this criterion, which could indicate a cognitive delay or learning disability that inhibited their ability to successfully perform the task (Slotkin et al., 2012). The mean vocabulary score for all age groups was 89.5 ($SD= 4.85$). Mean vocabulary scores were highest among the nine year olds and lowest among six year olds (Table 3).

Table 3.

<table>
<thead>
<tr>
<th>Age</th>
<th>ToolBox Picture Vocabulary Test Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>85.45</td>
<td>2.76</td>
</tr>
<tr>
<td>7</td>
<td>87.89</td>
<td>3.85</td>
</tr>
<tr>
<td>8</td>
<td>91.20</td>
<td>4.12</td>
</tr>
<tr>
<td>9</td>
<td>93.41</td>
<td>3.64</td>
</tr>
</tbody>
</table>
4.1.3 Excluded Cases

Two participants were eliminated from the final analysis because their vocabulary scores on the TPVT were greater than two standard deviations below the unadjusted mean score. NIH Toolbox scoring guidelines indicate that scores below this cutoff could reflect cognitive difficulties (Slotkin et al., 2012), which would impede upon the participant’s ability to successfully complete the storytelling task. An additional 29 participants were eliminated from the final sample, due to a technological malfunction, which corrupted 29 of the videos that were being used to measure emotional expression with the Emotient software.

4.2 Emotions and Storytelling Ability

To test the first hypothesis, that the emotions children display while they engage in a story telling task predict the quality of the narrative they produce, an initial correlation analysis was run to identify the related predictors. The independent variable of emotional expression initially produced 19 data points for the individual AUs and nine emotion scores. The discrete emotion scores that were used in this analysis are indicated as ‘evidence values’, by the Emotient software. These scores are standardized integers ranging from 3 to -3 and are produced by the Emotient software, and included in the output for each participant. This software has been validated through many trials, during which the output from the emotion software was compared to the FACS ratings of a human rater (Bartlett et al., 2009). These evidence values represent probabilities that a human rater would rate the emotion in the same way (iMotions, 2014). The video data was cut to only include periods after the participant turned the page of the book and was looking at the book on the screen, before continuing to orally produce the narrative. Since this automatic FACS software measures musculature movement in the face, this was done to reduce any factors that would confounding this analysis, as a result of the child moving his or her mouth to speak. The mean of each of the emotions during the storytelling task was found by taking the average score across all frames during the storytelling task.

The mean of each of the emotions was used in the correlation matrix to identify the relationships between the emotions and the outcome variable. The correlation analysis identified two correlated emotions and two correlated AUs to the outcome variable, storytelling ability (Figure
2). Anger ($r = -0.16, p < .05$) and frustration ($r = -0.15, p < .05$) were negatively related to storytelling ability, which indicates that participants who demonstrated high levels of these emotions during the story telling task, told narratives of lower quality (Figure 3).

**Figure 2**
Correlation matrix of all Emotient discrete emotions, and the outcome variable, storytelling ability.

<table>
<thead>
<tr>
<th>Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storytelling</td>
</tr>
<tr>
<td>Storytelling</td>
</tr>
<tr>
<td>Anger</td>
</tr>
<tr>
<td>Frustration</td>
</tr>
<tr>
<td>Joy</td>
</tr>
<tr>
<td>Surprise</td>
</tr>
<tr>
<td>Fear</td>
</tr>
<tr>
<td>Contempt</td>
</tr>
<tr>
<td>Disgust</td>
</tr>
<tr>
<td>Sadness</td>
</tr>
<tr>
<td>Confusion</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

The correlated AUs indicated that movement in AU1, the inner brow raiser ($r = 0.17, p < .05$) and AU2, the outer brow raiser ($r = 0.152, p < .05$) positively predicted performance on the story telling task. Medial and lateral movement in the frontalis muscle, which is directly above the eyes on the forehead of the skull, is therefore related to performance on a storytelling task. The correlations presented in Table 4 represent the independent variables that are significantly related to the outcome variable, storytelling ability.

### 4.3 Emotion Understanding

To test the second hypothesis, that understanding the story character’s emotions would contribute to performance on a narrative task, a linear regression analysis was utilized. Before the analysis was conducted, the assumptions required for linear modeling were checked. A histogram of error distribution revealed that all errors were normally distributed. The Durbin Watson statistic was 2.04, which indicates that the standard errors residuals were independent from one another. Tolerance statistics were below one, and Variance Inflation Factor (VIF) values were below 2.5, which indicates that the parameters of this linear model were not compromised by multicollinearity. The Casewise Diagnostics identified two cases that were influential outliers, as the standardized residuals for each of these cases were greater than 3. The
final analyses were run with and without these two cases. There were no differences found in the two sets of results, so these two cases remained in the final sample to retain power.

Correlations and scatterplots among all predictors and the outcome variable, were used to check the assumption of linearity. The relationship between emotion understanding and storytelling performance was statistically significant ($r = 0.185$, $p = .01$). The relationship was positive, which indicates that an increase in emotion understanding is related to an increase in narrative competence. The relationship between emotion understanding and AU1 (inner brow raiser) was significant ($r = 0.21$, $p = .01$) and the relationship between emotion understanding and AU2 (outer brow raiser) was significant ($r = 0.181$, $p = .02$). This indicates that movement in the frontalis muscle, involved in the inner and outer brow raise, is positively related to emotion understanding. Emotion understanding was not significantly related to the Emotient discrete emotions frustration ($r = .012$, $p = .87$) and anger ($r = -0.008$, $p = .92$). All correlations are depicted in Figure 3.

**Figure 3**

Correlation matrix of related predictors to the outcome variable.

<table>
<thead>
<tr>
<th></th>
<th>Anger</th>
<th>Frustration</th>
<th>Inner Brow</th>
<th>Outer Brow</th>
<th>Emotion Understanding</th>
<th>Storytelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>1</td>
<td>.778**</td>
<td>-0.002</td>
<td>0.024</td>
<td>0.012</td>
<td>-.164*</td>
</tr>
<tr>
<td>Frustration</td>
<td>.778**</td>
<td>1</td>
<td>-0.057</td>
<td>0.013</td>
<td>-0.008</td>
<td>-.147*</td>
</tr>
<tr>
<td>Inner Brow</td>
<td>-0.002</td>
<td>-0.057</td>
<td>1</td>
<td>.901**</td>
<td>.210**</td>
<td>.170*</td>
</tr>
<tr>
<td>Outer Brow</td>
<td>0.024</td>
<td>0.013</td>
<td>.901**</td>
<td>1</td>
<td>.181*</td>
<td>.152*</td>
</tr>
<tr>
<td>Emotion</td>
<td>0.012</td>
<td>-0.008</td>
<td>.210**</td>
<td>.181*</td>
<td>1</td>
<td>.185*</td>
</tr>
<tr>
<td>Understanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storytelling</td>
<td>-.164*</td>
<td>-.147*</td>
<td>.170*</td>
<td>.152*</td>
<td>.185*</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Due to the high correlations between the frustration and anger variables these scores were condensed into an individual factor, to avoid the effects of multicollinearity on the linear model. The frustration and anger variables were condensed using Principal Axis Factor analysis, which identifies the common variance underlying the observed variables. The analysis produces a
statistical estimate of the relationship between the underlying, latent variable, and the observed variables. A one-factor solution was generated using Principal Axis Factoring, which accounted for 89% of the variance in the initial solution. The regression method was used to extract factor scores for each participant. This method adjusts the factor loadings to account for the initial correlation between the variable and factor score, for each participant. This factor score was included in the regression model to represent both the anger and frustration variables.

Following a check of all assumptions, a hierarchical regression analysis was conducted to determine the contribution of each of the predictors to the outcome variable. Vocabulary ability was included as the first step in of all analyses, to hold this variable constant. A significant model with the discrete emotions factor score as the second step, and emotion understanding as the third step, accounted for 12% of the variance in storytelling performance, $F(1, 177)= 4.47$, $p= 0.04$, Adjusted $R^2= 0.12$. This result indicates that emotion understanding predicted a significant portion of the variance within the construct of storytelling ability, over and above the contribution of discrete emotion scores for anger and frustration. The model fit statistics are displayed in Figure 4 and the parameter estimates for each of the predictors in the model are displayed in Figure 5.

**Figure 4**

Model fit statistics for the hierarchical regression analysis ($n=181$).

<table>
<thead>
<tr>
<th>Model</th>
<th>$R$</th>
<th>$R^2$</th>
<th>Adjusted $R^2$</th>
<th>Std. Error of the Estimate</th>
<th>Change Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$R^2$ Change</td>
</tr>
<tr>
<td>1</td>
<td>.284a</td>
<td>0.08</td>
<td>0.08</td>
<td>0.51</td>
<td>0.08</td>
</tr>
<tr>
<td>2</td>
<td>.330b</td>
<td>0.11</td>
<td>0.10</td>
<td>0.50</td>
<td>0.03</td>
</tr>
<tr>
<td>3</td>
<td>.362c</td>
<td>0.13</td>
<td>0.12</td>
<td>0.50</td>
<td>0.02</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), TPVT unadjusted scale score
b Predictors: (Constant), TPVT unadjusted scale score, Anger and Frustration Factor Score
c Predictors: (Constant), TPVT unadjusted scale score, Anger and Frustration Factor Score, Emotion Understanding Composite Score
d Dependent Variable: Storytelling composite score
**4.4 Emotions and Emotion Understanding**

To test the third hypothesis, that understanding of story character’s emotions moderates the relationship between emotions experienced during a narrative task and performance on a narrative task, a linear regression analysis was conducted with an interaction term included in the model to examine the effect of the predictor on the outcome variable at varying levels of the moderator. A check of assumptions revealed that errors were normally distributed, and independent. The moderation model was created using The Andrew Hays PROCESS program in SPSS program. This embedded software centred all variables and computed the interaction term to include in the linear model (Field, 2013).

A model, which included the discrete emotions anger and frustration as the predictor, storytelling performance as the outcome variable and emotion understanding as the moderator, was constructed. The analysis revealed that the overall moderated model was not significant, $F(3, 177)= 2.51$, $p= 0.06$, $R^2= 0.67$. The interaction term comprised of the moderator and the predictor on the outcome variable was not significant, $t= 0.75$, $p= 0.45$. The coefficients, confidence intervals, standard error for the standardized coefficients, and t-scores are displayed in Figure 6. These results of the moderation analysis are depicted graphically in Figure 5.
Figure 6
Coefficients, confidence intervals, standard errors, and significance values for the moderated model.

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>SE B</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.90</td>
<td>0.04</td>
<td>48.66</td>
<td>0.00</td>
</tr>
<tr>
<td>[1.82, 1.98]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotion Understanding (Centred)</td>
<td>0.75</td>
<td>0.03</td>
<td>2.20</td>
<td>0.03</td>
</tr>
<tr>
<td>[0.01, 0.14]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger &amp; Frustration Factor (Centred)</td>
<td>-0.91</td>
<td>0.04</td>
<td>-2.20</td>
<td>0.04</td>
</tr>
<tr>
<td>[-0.18, -0.003]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotion Understand x Anger Frustration (Centred)</td>
<td>0.04</td>
<td>0.05</td>
<td>0.75</td>
<td>0.45</td>
</tr>
<tr>
<td>[-0.60, 0.13]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7
Graph of the relationship between the predictor, Anger & Frustration, at low, mean and high levels of the moderator, emotion understanding, on the outcome variable, storytelling ability.
Chapter 5
Discussion

5 Discussion

5.1 Summary of Findings

This study used Emotient technology to explore whether children’s emotions during a storytelling task affect their overall performance. In addition, this study examined whether children’s understanding of a story character’s emotions was related to the child’s emotional experience and the child’s overall performance on a storytelling task. In an examination of each of the individual emotions and AUs, two individual emotions and two AUs were related to storytelling performance. Anger and frustration were negatively related to storytelling performance, such that increases in mean intensity scores for these emotions were associated with decreases in storytelling scores. Movement in the inner (AU1) and outer (AU2) brow was positively related to storytelling ability, such that increases in the mean scores of these variables were related to increases in storytelling scores.

The emotion understanding variable was examined in relation to storytelling ability and the related emotional expression variables, anger and frustration. It was hypothesized that a child’s understanding of the story character’s emotions would contribute to the negative emotions that are incurred during a story telling task. Emotion understanding was significantly related to storytelling ability, but was not significantly related to anger and frustration. A hierarchical regression analysis was conducted, to examine the contribution of anger and frustration, and emotion understanding, to storytelling ability. Since anger and frustration were highly correlated, they were condensed into one variable, using principal axis factoring, to avoid the effect of multicollinearity on the linear model. A significant model was generated, with anger and frustration, and emotional understanding as predictors, and vocabulary as a control variable. Emotion understanding significantly predicted storytelling ability, over and above anger and frustration and the control variable.

A moderation analysis was conducted to further examine the relationship between these three variables. It was hypothesized that children who demonstrate sophisticated understanding of a story character’s emotions, would demonstrate differential performance on a storytelling task, to
children who do not demonstrate a strong understanding of the story character’s emotions. It was hypothesized that at high levels of emotion understanding, the relationship between anger and frustration and the outcome variable, storytelling, would not be significant. At low levels of emotion understanding, the relationship between anger and frustration, and the outcome variable, emotion understanding would be significant. A linear regression analysis with an interaction term was conducted. The predictor was the condensed emotion expression variable, which captured anger and frustration. The outcome variable was storytelling ability, and the moderator included in the analysis was emotion understanding. There was a main effect of the predictors on the outcome variable, however, the overall model was not significant, and the effect of the interaction term on the outcome variable was not significant. This indicates that anger and frustration do not differentially affect performance on a storytelling task, at varying levels of emotion understanding.

5.2 The Effect of Anger and Frustration on Storytelling

To address the first hypothesis, that children’s emotional expressions would be related to their ability to tell a high quality narrative, all of the nine discrete emotions that are produced by Emotient software were explored in relation to the outcome variable in a correlation matrix. Two emotions, fear and anger were significantly related to storytelling ability (p<.05). These relationships were both negative, which indicated that as the scores for these two emotions increased, performance on the narrative storytelling task decreased. While these relationships are correlational in nature, and do not provide an explanation of any latent constructs, it is worthwhile to discuss their possible meaning.

Constructing a narrative is a task which recruits many cognitive resources. While spontaneously producing coherent sentences, which follow the rules and structure of syntax, the child must hold information about the theme of the story, the plot, and the characters’ motives and environment, while making the story interesting for the listener to hear. Further, children’s situation model of the story is constantly and dynamically updated with new information about the plot and the characters. Previous research on narratives has found that children experience the world as the protagonist would, as they place themselves in the protagonist’s physical world and follow their actions in physical space and time (Fecica & O’Neill, 2010; Harris, 2000; Rall & Harris, 2014).
The cognitive demands involved in this kind of task could lead to increased vulnerability in performance when to peripheral distractions are present, such as those that arise from emotions.

It is likely that the emotions, frustration and anger, arose from a cognitive appraisal of the situation as threatening or fear-inducing (Frijda & Parrot, 2011). This could have occurred if the content of the stimulus, the target book, was over the threshold of difficulty that could be matched by the participant’s ability. When a task induces this kind of negative appraisal, it is not necessarily the task difficulty that leads to negative emotions and impaired performance, but the negative appraisal that comes from the stimulus. It is the participant’s perception of his or her lack of ability to resolve the dissonance that comes with the task demands, that results in a negative appraisal (D’Mello, Lehman, Pekrun, & Graesser, 2014). This negative appraisal is a product of a perceived mismatch between the participant’s ability and the difficulty of the task.

In situations where task difficulty is above a child’s perceived ability, self-regulatory strategies to restructure the cognitive appraisal that follows this negative appraisal could be beneficial to performance on cognitive tasks (Webb, Miles & Sheeran, 2012). This suggests that while the negative relationships between anger and frustration, and storytelling ability, could indicate a negative appraisal of the situation, this relationship could also indicate a lack of the required self-regulatory strategies to overcome such emotions. Theories of emotion regulation highlight the differential goals that are embedded within self-regulation strategies (Gross, 1998; Koole, 2009). The goal orientation of these strategies is to quell the effects of an emotion, however, some strategies attempt to suppress physiological reactions, and some attempt to reappraise the cognitive evaluations that come from the physiological reactions. Antecedent-focused emotion regulation strategies are employed either to direct attention toward favourable aspects of the situation, or away from adverse aspects of the situation. In either case, the goal is to redirect the emotional response that is elicited from the appraisal of an adverse situation, to decrease the effect of performance inhibition (Gross, 1998). In a meta-analysis of the effect of emotion regulation strategies, it was found that cognitive restructuring was the only significant contributor to overall change in performance. Physiological suppression of an emotional response did not significantly alter appraisal, to decrease the inhibitory effects on performance (Webb, Miles & Sheeran, 2012). These results suggest that cognitive restructuring is an important aspect of emotion regulation, as emotions occurs naturally, but are restructured so impairments in performance, as a result of the emotions experienced, are minimized.
The data found in this study suggest that the participants who experienced impairments in performance did not use self-regulation strategies to alter their cognitive appraisal of the task. An alteration in the cognitive appraisal would not necessarily have changed the participant’s intensity scores on the anger and frustration variables. Although their experience of anger and frustration might not have changed, the impairments that were observed in their performance indicate that cognitive restructuring strategies would have been beneficial for those who felt anger and frustration in response to this task. Self-regulation is currently a salient aspect of educational research, as many researchers have found that these strategies can help students who are susceptible to intense academic emotions (D’Mello, Lehman, Pekrun, & Graesser, 2014). Future research in narrative storytelling with Emotient software should address the potential impact of self-regulation abilities as a contributing factor to performance, and a possible intervention to target students who experience these intense academic emotions but do not possess the restructuring abilities to reframe their appraisals and recover performance.

5.2.1 Individual Action Units (AUs)

The individual action units (AUs) were explored separately to determine the relationship between musculature movement in the face and performance on a storytelling task. The two AUs that were significantly related to storytelling performance were the inner (AU1) and outer (AU2) brow raisers. The brow raisers are controlled by the frontalis muscles, which span from the top of the skull, over the forehead, with the medial margins converging on either side of the top of the nose (Cohen, Ambadar & Ekman, 2005). The inner brow raiser (AU1) is controlled by the frontalis muscle, pars medialis, which indicates that the medial innervation of the frontalis muscle with the facial nerve raises the eyebrows above the corners of the eyes, closest to the bridge of the nose. The outer brow raiser (AU2), is controlled by the frontalis muscle, pars lateralis, which indicates that the lateral innervation of the frontalis muscle with the facial nerve raises the eyebrows at the corners of the eyelids closest to the ears (Cohen, Ambadar & Ekman, 2005).

These two AUs were positively related to performance on a storytelling task, which indicates that movement in these muscles is related to increases in performance. This data was not included in any additional analyses, beyond the initial correlational analysis. The reason this data was not explored further is that a significant movement indicator in only one facial muscle does
not provide enough information to draw meaningful inferences regarding the role of facial expressions in storytelling performance.

There are, however, noteworthy aspects of this relationship, which should be explored further in future research. The positive relationship of the brow raisers to storytelling performance is an interesting aspect of the findings. A separate analysis of the parts of the story where these movements occurred most frequently could be meaningful in detecting what kinds of stimuli participants reacted to. Brow raises could indicate engagement with the story, thought about the meaning of events, or congruence in the participant’s reaction to the emotions the story character is feeling. These questions will be addressed by future research, to possibly determine some of the muscle movement indicators that positively predict performance.

### 5.3 The Effect of Emotion Understanding on Story Telling

To address the second hypothesis, that understanding of the story character’s emotions would be related to performance on a storytelling task, participant’s scores on the emotion understanding variable, and storytelling scores were explored using correlation analyses. The emotion understanding variable was derived from individual item scores on a measure of emotion understanding. The storytelling competence score was derived from a composite score, which accounted for morphological errors, diversity of syntax, comprehension of the theme and the plot, and evaluative devices used. The correlation between these two variables was significant ($p<.05$), which indicates that increases in emotion understanding are related to increases in storytelling competence. An additional hierarchical regression analysis revealed that emotion was a significant predictor of storytelling competence, over and above the predictive ability of vocabulary and emotional expression. This indicates that emotion understanding accounts for a significant increase in the variance attributed to the linear model, when vocabulary and emotional expression are included.

This finding, that children’s understanding of the character’s emotions, predicts comprehension and composition of stories, replicates previous findings with adults and children. Research with adults has found that the degree to which adults are transported into a story, to embody the feelings of the characters and follow the characters through their physical environment, is related to their reading comprehension (Johnson, 2012, Neidenthal, 2007). Developmental research in emotion understanding and language ability has been extensive, as previous research has found
that starting in infancy, 18 month olds who demonstrate sensitivity to emotion cues within their environment, demonstrate earlier and more rapid word learning. Similarly, research with emerging readers has demonstrated that emotion understanding is related to syntax production (Pons et al., 2003). Research in clinical populations has demonstrated that children with language impairments tend to score lower on measures of social cognition than children who experience normal language development (Lindsay & Dockrell, 2000; McCabe & Meller, 2004). This research demonstrates the interconnected nature of language and social cognition, which provided a framework for the design and results found in this study.

The degree to which children understand a story character’s emotions has not yet been analyzed in relation to storytelling competence. Previous research has established that just as in the findings with adult readers, children who transport themselves into the mind of a character, tend to understand the story better and engage with the story more, as they make more inferences about the characters’ actions and beliefs (Aldrich et al., 2001, Oatley, 2016). These findings indicate that emotion variables beneficially contribute to performance on a cognitive task, such as oral language and reading tasks. These findings suggest that social cognitive variables, such as emotion understanding, would significantly contribute to performance on a cognitive oral language task. The opposite relationship has been established, as previous research has found that language ability predicts emotion understanding in a story (Cutting & Dunn, 1999). The results of this study demonstrate that, in addition, emotion understanding is a predictor of language and literacy.

Emotion understanding contributed a significant portion of the variance in the regression model, when accounting for vocabulary and emotional expression. This finding is meaningful, as it indicates that emotion understanding contributes greater variance to storytelling ability than the emotions the participant experiences. The relationship between these three variables garners additional exploration, as emotion understanding could be a protective factor for children who are more vulnerable to experiencing negative emotion from perceived difficulty. As such, the next hypothesis explored whether emotion understanding is a significant protective factor for children who experience negative emotions during a storytelling task.
5.4 Emotion Understanding as a Moderator

The third hypothesis explored whether emotion understanding would moderate the relationship between emotional expression and storytelling ability. The conceptual rationale behind this proposed model was that when children demonstrate a strong ability to understand the story character’s emotions, they should be better equipped to manage the cognitive interruptions that come from perceived task difficulty and negative emotions, such as anger and frustration. Social-cognitive understanding helps children develop a framework in their minds, of how a character will perceive and act upon situations (Aldrich et al, 2011). Their ability to transport themselves into the mind of the character while they are composing a narrative will likely sustain their performance when they perceive challenges and distractions. This effect would manifest in a moderation model, as differential relationships between emotional expression and storytelling ability, at varying levels of emotion understanding. It was hypothesized, that at low levels of emotion understanding, the negative relationship between emotional expression and storytelling ability would be significant, whereas at high levels of emotion understanding this relationship would disappear. This finding would indicate that emotion understanding serves as a protective factor for the relationship between emotional expression and storytelling ability.

This hypothesis was not supported by the data, as neither the model, nor the interaction term were significant (Figure 5). It is noteworthy, however, that the relationships were in the predicted direction (Figure 6). This indicates that although the results of this study do not support the hypothesized moderated model, the conceptual rationale could still be supported under different measurement parameters. These findings suggest that it could be worthwhile to continue to pursue this research question, despite the results of this model.

5.5 Limitations and Future Directions

A possible limitation to the findings of this study was derived from the scale that was used to measure emotion understanding variable. The paradigm used to measure emotion understanding was not a validated measure, which could have posed a threat to the internal validity of the study. Future research could address this issue, by replicating this design using an alternate measure, or a combination of measures to form a more reliable measurement composite of social cognitive understanding as a multifaceted construct. The reliability of this construct would have been
enriched if additional measures of social cognition, such as theory of mind and perspective taking measures, were included.

A limitation to the sample that was collected was its homogeneity. The data for this study was collected from a predominantly middle class, English speaking municipality. As such, the ability for these findings to be generalized was compromised, as the sample was not necessarily representative of the population. While there was variability in performance on the outcome variable, a stronger sample of English language learners and children from more diverse economic backgrounds would add ecological validity to the results.

Future directions for this research are in the application of social cognition and self-regulation to oral language fluency and emerging literacy. This study can inform future research on the effect of self-regulatory strategies on children’s abilities to perform on a comparable cognitive task. This study can also inform future research on how social cognition facilitates reading comprehension and inferencing ability. It is possible that children who possess a strong understanding of the social cognitive variables within the books they read, use these cues to facilitate their deep understanding and engagement with a story. This would lead to decreased experiences of negative emotions, such as anger and frustration, and could facilitate enjoyment as well as achievement in reading.

5.6 Conclusions

This study explored how emotional expression and emotion understanding contribute to performance on a storytelling task. Given the highly cognitive nature of a narrative storytelling task, it was hypothesized that negative emotions would inhibit performance, and understanding of the story character’s emotions would facilitate performance. Further, it was hypothesized that these two variables would interact, such that at low levels of emotion understanding the relationship between emotional expression and storytelling ability would be significant, whereas at high levels of emotion understanding, this relationship would not be significant. The first two hypotheses were supported by the data, as the emotions anger and frustration negatively predicted performance, while emotion understanding positively predicted performance. This effect was found over the effect of both vocabulary and the presence of the emotions, anger and frustration. The third hypothesis, was not supported, however the relationships between the predictors in the model were in the hypothesized direction.
The implications of this study will inform research in oral language fluency, social cognitive development, and self-regulation of emotion. The results of this study suggest that further research on how social cognition and self-regulation could improve performance on cognitive tasks, such as a narrative storytelling task, would be beneficial to the field of oral language fluency and literacy. Previous research has found promising results in the examination of the effect of social and emotional learning on emerging readers (Nix, Bierman, Domitrovich & Gill, 2013). The current study used a novel methodology to measure real time emotional experience in children during a storytelling task, which could be used to add value to future research in self-regulation and social emotional learning. This methodological paradigm can be replicated, addressing the limitations within the sample, to further explore the role of social cognition in oral language fluency and emerging literacy.
References


Appendix A

Ethics Approval

PROTOCOL REFERENCE # 32488

January 8, 2016

Dr. Earl Woodruff
DEPT OF APPL. PSYCHOLOGY & HUMAN
DEVEL.
OISE/UT

Ms. Stephanie Buono
DEPT OF APPL. PSYCHOLOGY & HUMAN
DEVEL.
OISE/UT

Dear Dr. Woodruff and Ms. Stephanie Buono,

Re: Your research protocol entitled, "Emotionality & narrative production in developing readers"

ETHICS APPROVAL

Original Approval Date: January 8, 2016
Expiry Date: January 7, 2017
Continuing Review Level: 1

We are writing to advise you that the Social Sciences, Humanities, and Education Research Ethics Board (REB) has granted approval to the above-named research protocol under the REB's delegated review process. Your protocol has been approved for a period of one year and ongoing research under this protocol must be renewed prior to the expiry date.

Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process prior to its implementation. Any adverse or unanticipated events in the research should be reported to the Office of Research Ethics as soon as possible.

Please ensure that you submit an Annual Renewal Form or a Study Completion Report 15 to 30 days prior to the expiry date of your current ethics approval. Note that annual renewals for studies cannot be accepted more than 30 days prior to the date of expiry.

If your research is funded by a third party, please contact the assigned Research Funding Officer in Research Services to ensure that your funds are released.

Best wishes for the successful completion of your research.

Yours sincerely,

Matthew Brower, Ph.D.
REB Co-Chair

Jeffrey Steele, Ph.D.
REB Co-Chair
Appendix B

Invitation Letter to parents

Principal Investigator: Stephanie Buono, M.A. (Candidate) Supervisor: Dr. Earl Woodruff

Dear Parents,

I am a graduate student at the University of Toronto, working under the supervision of Dr. Earl Woodruff. I have been invited into (insert school name) to conduct research for my master’s thesis, on language and literacy development in children. Please see the information below regarding the goals of my study and what your child’s participation will entail. I hope you consider consenting to have your child participate.

What is this study looking at?
This study will look at the emotions children experience while telling stories. The emotions children experience while reading could be an indication of other cognitive abilities that are involved with their ability to understand the independent perspectives and experiences of the characters in the story.

Why is this study important?
This study will provide the field of language and literacy development with a more comprehensive understanding of how parts of children’s emotional development affect their ability to read.

What will my child’s participation entail?
If you consent to allow your child to take part in this study, participation will involve your child engaging in one 15 minute activity on the computer, that will take place during free time at school. First, I will ask your child to complete a 5-minute word pairing activity on the computer. Then I will present a wordless picture book and ask your child to tell me a story about the pictures. During this task, I will collect audio and video recordings of your child. The video recording will be used to analyze the emotions displayed on your child’s face during the task. The software used to conduct this analysis measures the intensity and valence of emotions displayed on the face by tracking musculature movement. It has been widely used in research contexts and does not pose any risks to the safety and security of your child.

What are the risks?
There are no known risks to participating in this study. The picture book presented in the reading task will include ambiguous pictures that do not intend to elicit any negative or intense emotions. If your child feels uncomfortable at any time, he or she is free to withdraw consent to participate, without any penalty from myself, the teacher or Principal of the school.

What are the benefits?
Your child’s participation in this study will help us understand the emotional experience of readers from different ages. This work hopes to eventually identify cognitive and emotional profiles of struggling readers, before they enter school.

How will confidentiality be upheld?
The audio and video recordings collected in this study will be kept confidential, as only the principal investigator and supervisor will have access to them. Neither your name, nor the name of your child will be used or connected with this study. An identification number will be used to identify your child and all results will be reported at the group level. The only circumstance in which confidentiality will be compromised, is if a child discloses personal information regarding abuse or harm to the researcher, that she is required by law to report.

How do I agree to have my child participate?
If you consent to have your child participate in this study, please sign the consent form, and fill out the short survey in the package that was sent home with your child. Please place your signed consent form and filled out survey in the envelope included within this package, seal it, and send it back to school with your child. Please do not write any identifying information on the outside of the envelope.

Thank you for considering having your child participate in this study. I am very grateful to you and your child for giving your time so generously to contribute to my research. If you have any questions about this study, or if you would like any additional information regarding the proceedings or findings of this study, published results or additional research that is being conducted in our lab, please feel free to contact the principal investigator or supervisor.

If you have any questions or concerns regarding your rights as a participant of this study, please contact The University of Toronto, Office of Research Ethics at ethics.review@utoronto.ca or 416-946-3273.

Stephanie Buono, M.A. (Candidate)  Earl Woodruff, Ph.D.

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Appendix C

Consent Form

Principal Investigator: Stephanie Buono, M.A. (Candidate)  Supervisor: Dr. Earl Woodruff

Before agreeing to participate in this study, we encourage you to read the following explanation of the purpose of this study, the procedures, the possible benefits and risks involved in participating in this study, and your right to withdraw your child’s participation at any time.

Background and Purpose of the Research. The purpose of this study is to identify the emotions children demonstrate on their faces while they produce a spoken narrative representation from a picture book. Your child’s participation in this study will help us to gain additional understanding in early cognitive development, emotional development, language acquisition and development of literacy.

During this study, you will be asked to fill out a short demographic questionnaire. Your child will be asked to give assent to participate. If this is achieved, your child will be asked to participate in a computer reading activity. The researcher will present your child with a picture book, on the computer, and will ask your child to tell a story about the events in the picture book. While your child completes this activity, an audio recorder will record his or her voice and facial expression monitoring software (FACET) will monitor the emotional expression displayed on his or her face. The audio files will be transcribed and used to inform our exploration of the content of children’s narratives. The video files will be analyzed within FACET software. Based on musculature movement in the child’s face, the software codes the emotions experienced during the task as one of the seven basic emotions (happy, sad, angry, fearful, surprise, disgust, contempt).

Confidentiality. Your consent to have your child participate in this study is voluntary and can be withdrawn at any time during the study without consequence. If your child wishes to withdraw from the study during his or her session with the researcher, the researcher will terminate the planned procedures and destroy all collected data. Any data collected from you and/or your child will be destroyed and permanently deleted from computers and other storage devices. All of the information collected from you and your child will be kept confidential. Information collected from questionnaires will be anonymous and data collected in your child’s classroom will not be shared with anyone other than the researchers listed below. All text, audio and video data will be saved in the researcher’s lab computer, which can only be accessed by the principal researcher and supervisor. To meet the University of Toronto’s data security and encryption standards, data files will be encrypted using software that has comprehensive functions to protect and secure the data. All physical data collected will be kept in a locked drawer in our lab and will only be accessible to the principle investigator and supervisor. The information collected for this study will be saved for five years before being destroyed, to allow the possibility of follow-up data collection and analysis of trends in your child’s development.

Potential Risks. There are no known risks associated with participating in this study. Your child can choose to terminate your involvement in the study at any point if he or she feels uncomfortable.

Potential Benefits. Your child’s participation in this study will help us to further understand the development of language and literacy and the role of emotional development in emerging readers.

At your request, you can receive a summary report following your participation. This report will summarize research findings and possible recommendations or implications of the importance of real-time emotion identification to students’ reading ability.
You are welcome to contact the researchers with any questions that occur to you during the survey. Please retain a copy of this form for your own records. If you have further questions about this study, you are encouraged to contact the researchers using the contact information given below.

If you have any questions or concerns regarding your rights as a participant of this study, please contact The University of Toronto, Office of Research Ethics at ethics.review@utoronto.ca or 416-946-3273.

I, ________________________________ (name; please print), have read the above information. I freely agree to have my child participate in this study. I understand that I am free to refuse to answer any question and to withdraw my child or myself from participation at any time. I understand that all information collected for the purposes of this study will be kept confidential.

_____ Consent to participation

______________________________  ______________________________
Participant Signature  Date

Principal Investigators

Stephanie Buono, M.A. (Candidate)  Earl Woodruff, Ph.D.

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Appendix D
Child Assent Form

Principal Investigator:
Stephanie Buono, M.A. (Candidate)
The Ontario Institute for Studies in Education at U of T

Supervisor:
Dr. Earl Woodruff
The Ontario Institute for Studies in Education at U of T

Why are we doing this study?
We would like to see how children read picture books and tell stories about what they see. We would like to know how picture books make children feel and how those feelings affect children’s storytelling.

What will happen during this study?
If you and your parent(s) agree to participate in this study, someone will come to your classroom and ask you to look at a book, on the computer, and to tell a story about that book. While you are telling your story, the computer will record your face and help the researcher understand the emotions you are feeling.

What are the good things that will happen if I am part of this study?
If you choose to be part of this study, you will be helping us understand more about how children learn to read. This could help us think of better ways to teach children to read and it could help us think of new ways to help children who have a difficult time learning to read.

What are the bad things that will happen if I participate?
There is nothing bad that can happen to you if you participate. If something in the picture book or a question you are asked makes you feel upset, you can skip it.

Who will know about what I did in this study?
Only the two people involved in this study will see your video and your answers.

Can I decide if I want to be in this study?
Yes. You can choose if you would like to be in this study. If at first you think you would like to be in this study, and then you change your mind, you can stop at any time.

Would you like to participate in this study (please circle)?
Yes  No

Name of child (please print): __________________________

Name of witness (please print): __________________________

Date: __________________________Signature of witness: __________________________
Appendix E

Family Survey

Child’s Date of Birth (MM/DD/YY) ____________ Name of Child’s Teacher ____________

1) How many people currently live in your household? ________________________________

2) How many older siblings does the child participating in this study have? ____________

3) How many younger siblings does the child participating in this study have? ____________

4) What was your child’s first language? ____________________________________________

5) What is the highest level of education attained by the mother of this household?
   a. High school
   b. College diploma
   c. Undergraduate degree
   d. Master’s degree (M.A., M.Sc., M.Ed., MBA)
   e. Doctorate/professional degree (Ph.D., M.D., D.D.S., D.C., J.D.)

6) What is the highest level of education attained by the father of this household?
   a. High school
   b. College diploma
   c. Undergraduate degree
   d. Master’s degree (M.A., M.Sc., M.Ed., MBA)
   e. Doctorate/professional degree (Ph.D., M.D., D.D.S., D.C., J.D.)

7) How many days per week do you read with your child?
   a. None
   b. 1-2
   c. 3-4
   d. 5-6
   e. Everyday

8) Please rate your child’s reading ability at this time:
   a. My child can not read
   b. Below Average
   c. Average
   d. Above Average
   e. Very High

9) Please rate your child’s motivation to read:
   a. Very Low
   b. Below Average
   c. Average
   d. Above Average
   e. Very High