

Engaging Children in Conversations during Story Reading

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Abstract: Students may progress slowly or even abandon an assigned reading task due to lack of interest which causes boredom, poor reading comprehension which causes discouragement, and disengagement from the reading material. Various studies have reported that these negative academic moods can be mediated through having meaningful conversations during reading. While interventions such as collaborative reading have been proposed to foster reading motivation in the classroom, very few studies have considered the application of conversational agents as storytelling peers that can scaffold collaborative learning through discussion of the story with the student. In this paper, we describe our conversational agent that can plan various dialogue moves through story content elaboration and exchange of ideas to address motivational factors that hinder the performance of a required reading task. Evaluation of the agent's performance, humanity and affect showed that a child's interest in the conversation and engagement in the story greatly affect his/her response towards the agent. While no positive effect was observed on uninterested and disengaged users, the agent was able to fill-in the knowledge gaps of the interested and engaged users by allowing them to make sense of the texts on their own, thus showing the agent's potential for motivating as well as addressing the reading comprehension issues of children.

Keywords: Story Reading, Conversational Agent, Dialogue Model, Collaborative Learning

1. Introduction

Stories of various genre and content are the means by which children learn about their environment. Through reading, writing and sharing stories, children can communicate information as well as develop their social, emotional, cognitive and language skills. Engaging in storytelling with others, whether adults or peers, also promote the ability for children to make meaning of a particular life situation and relate the events in the story to their individual context and life experiences.

While reading plays a vital role in the development of a child, reading motivation in the classroom continues to be a problem (Gambrell, 1996), which can cause reading development (Deci & Ryan, 1985; Dweck & Elliot, 1983; McCombs, 1989). The reading progress of children are affected by factors such as the lack of interest in the reading material which causes boredom, poor reading comprehension skills which causes discouragement, and disengagement from the reading material which causes task abandonment (Edmunds & Bauserman, 2006; Cambria & Guthrie, 2010). Classroom interventions include the utilization of peer reading and discussion sessions (Pikulski, 1997). Flint (2010) showed that utilizing conversations in reading can be beneficial to remediating reading problems of children. Conversations between an adult and a child play a significant role in the latter's language development and social interaction skills. One way to encourage conversations is during reading and story time, where books can be used as the topic for interaction.

In the field of computing, studies have explored the use of conversational agents in educational applications. AutoTutor (Graesser et al., 1999) is a virtual tutor designed to incorporate discourse patterns and pedagogical strategies of a typical human tutor in teaching students about various concepts by facilitating a turn-based conversation. The participants in the study of Mahmood and Ferneley (2006) suggested that conversational agents be used in the context of elaboration. The study of Doering et al. (2008) identified the features of virtual characters that

influence learning. They found that their participants not only perceive the agents they interacted with as learning companions, but also as social companions.

Conversational agents can be designed to assume various roles depending on the types of tasks they are expected to perform. They are programmed with intelligence to understand and to generate dialogue content. In storytelling sessions with children, a conversational agent can facilitate a dialogue with the reader to define the characters and the setting, rationalize a character's actions, describe and explain the occurrence of story events, imagine the varying sequences of events that may come next, and even relate one's personal experiences to that of the story character.

In this paper, we describe our conversational agent, named CHARM, that has been designed to serve the role of a storytelling peer by engaging in collaborative discussion of a reading material with the human reader. Section 2 gives a short overview of conversational strategies during story reading. Section 3 contains a discussion of the dialogue generation process of CHARM. Section 4 presents the methodology and performance results of CHARM as a conversational agent. We end our paper with a summary of our findings and recommendations for future work.

2. Conversational Strategies in Story Reading

The study of Flint (2010) explored how social interactions inside the classroom could facilitate emergent readers in a collaborative reading approach. Through peer reading, the students were able to cooperatively discuss the reading material to scaffold each other's learning, and together make connections within the text to increase their understanding.

A recent study by Lowry (2016) further expound on the benefits posed by reading a book to a child's language development, which can be enhanced through conversations about the book. Conversations involve the back-and-forth turns between two or more participants. In adult-child conversations, this turn-taking enables the child to be actively engaged, while building vocabulary and reading comprehension skills. Conversations during story reading can help a child understand stories and help him/her become storytellers by providing opportunities for the child to tell his/her own stories. To keep the conversation going, adults can make comments about what the child is interested in, by encouraging the child to initiate an idea, then providing a response based on his/her idea.

According to the Hanen Early Language Program (Greenberg & Koohi, 2016), a number of strategies can be employed to establish high quality conversations. Paying attention to the child's words and responding immediately by including these words in a more complete sentence can help the child develop his/her language and grammar. In designing conversational agents, keywords and phrases from the child's response are lifted to determine the content of the agent's response. Instances when a child uses simple words during story reading can also be used as opportunities to introduce more sophisticated words to develop vocabulary skills. Additionally, the cause and effect relationship of events can be established by encouraging the child to think of an explanation for the actions or emotions of a character in the story. Asking questions and making comments to encourage the child to predict what might happen next can develop the child's imagination. Lastly, to develop empathy, the child can be encouraged to put himself in the shoes of a character in the story.

Various studies also determined whether pursuing a dialogue with an agent could promote students' learning. Reeves and Nass (1996) proved with their Media Equation theory that humans are predisposed to interact with machines as if the latter were social beings. The study of Moreno and Mayer (2000) has also proven that lesson explanation in the form of a conversational dialogue with an agent lessens the amount of cognitive effort required in a student to understand educational material.

3. Dialogue Framework

In a story reading session, the participants can talk about various aspects of the story. We used these aspects of the story to classify four types of dialogue content as illustrated in Figure 1. *Cognitive*-based dialogue content focuses on reader's comprehension of story elements, which include the setting, the characters and their actions, and the causal chain of events. *Elaborative*

dialogue focuses on contextualizing character actions and events. *Reflective* dialogue content focuses on the relevance of the story to the reader’s life. Finally, *affective* dialogue content, which is currently not included in our scope, looks at the emotional effect of the story on the reader.

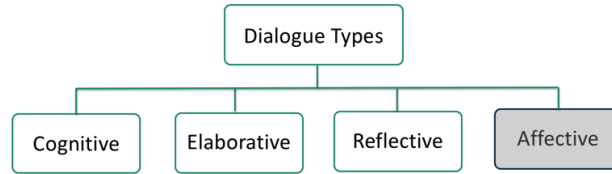


Figure 1. Types of Dialogue Content

CHARM uses a dialogue model, summarized in Listing 1, to understand the reader’s input statement and to generate its response to the statement. An example conversation that revolves around the story *The Hundred Dresses* written by Eleanor Estes is illustrated in Listing 2. A story world graph model has been defined to represent scenes in the story by connecting story elements, namely, characters, locations and items, together to create an event. The agent traverses the story world graph to find the necessary knowledge it needs in formulating responses.

Scenes are defined as groups of events which represent portions of a narrative to move the story forward, establish characters’ arcs or cause and effect, reveal consequences of earlier events, and make the story easier to follow (McNulty, n.d.). Within each scene, a *time* attribute is used to group all events and to identify their temporal order. An event is a time-bound incident that occurs within a scene. It can be executed by a single or multiple characters, and can occur in a single or multiple locations. Events are used to represent entities performing actions and affecting the state of other entities in the story world as the story progresses.

Listing 1. Dialogue Model of CHARM

1. Reader poses a statement in the form of an assertion or a question about the story.
2. Agent generates a response to the reader’s statement using any of the following dialogue moves – direct answer, feedback, prompt, pump, hint and elaborate.
3. User gives a response to the question raised by the agent.
4. Agent collaborates with the user to improve his/her response to his/her question posed in #1.

Listing 2. Example conversation between the user and the agent

User:	Why did the students not notice Wanda?
Charm:	I think the students did not notice Wanda because of what Wanda has. What causes a person to not notice someone? Can you tell me? (<i>Prompt</i>)
User:	Because Wanda has muddy shoes.
Charm:	I don't think that's the answer. Let's try again! I think the reason why the students did not notice Wanda has something to do with what Wanda has. How does that affect the students' actions? (<i>Pump</i>)
User:	Because Wanda has no friends.
Charm:	Maybe you’re right. I think the students did not notice Wanda because Wanda has no friends. How come the girls bullied Wanda? (<i>Direct Question</i>)

When formulating a response, the agent needs to ensure that it will not inadvertently generate a response containing story details still unknown to the user. Thus, the agent tracks the “executed” scenes. A scene is said to be “executed” when the reader reaches (or has read) the corresponding story text being modeled by the scene in the system’s interface.

3.1 Generating Answers to the Reader’s Questions

Before CHARM can determine its response type, it first classifies the reader’s input statement according to five (5) speech acts: *simple WH question*, *regular WH question*, *assertion to a question*,

regular assertion and *short response*. Inputs that start with “who” and “where” are considered as *simple* questions which can be answered using the story world graph. Inputs that start with “what” and “why”, on the other hand, are considered as *regular* questions as they require the agent to extract a number of elements from the story world graph in order to formulate a response. Inputs containing 3 or less words are considered as *short responses*. The reader’s answer to a question posed by the agent is referred to as an *assertion*, and is used to assess the reader’s understanding of the story. A *regular assertion* is a statement made by the reader that is outside the scope of the agent’s question.

CHARM’s response to a *simple WH question* contains an *assert* dialogue move and a *follow-up question*. The *assert* dialogue is the agent’s response to the question that is sourced directly from the story word graph. The *follow-up question* move focuses on initiating or maintaining a discussion with the user by asking a question. *Follow-up questions* focus on exploring why characters do certain actions in the story or feel certain emotions, and encourage the child to think of an explanation for the actions and emotions of a character in the story (Greenberg & Koohi, 2016). Consider the reader’s input statement – “Who is Wanda’s teacher?”. The agent’s response would be “Wanda’s teacher is Miss Mason.” (assert dialogue) followed by “Do you think they’re close to each other?” (follow-up question).

Because the agent’s main focus is to collaborate with the reader, it does not focus on evaluating the correctness of the reader’s *assertion to a question*. Instead, the agent responds with a short feedback which can be one of three types: *positive* short feedback such as “I think so too.”; *neutral* feedback like “Okay” and “I see.”; and *negative* feedback such as “I don’t think that’s the answer. Let’s try getting the right answer together.” Short feedbacks mostly include parts of the reader’s original statement in accordance to a strategy that proposes using the reader’s words in a more complete sentence to develop his/her language and grammar (Greenberg & Koohi, 2016).

3.2 Formulating Questions that Encourage Collaboration

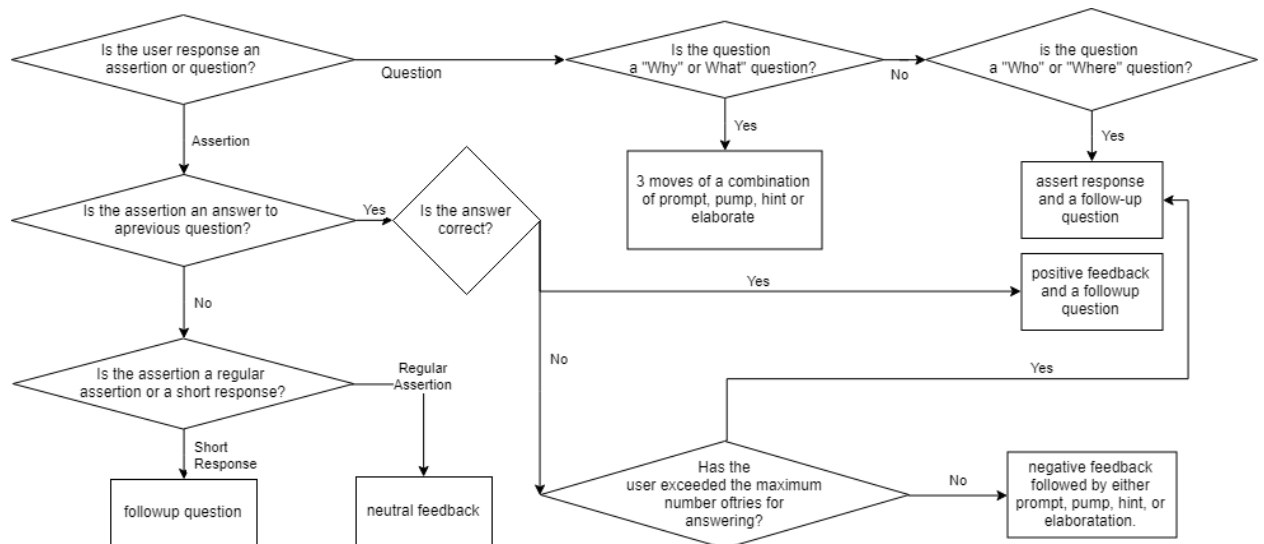


Figure 2. Learning Process of CHARM

Questions formulated through the dialogue moves employed by the agent focus on a learning strategy that aims to achieve the learning goal of assessing the recall of story elements and the comprehension of story events by readers, as illustrated in Figure 2.

The Mental Model and Proposition Theories (Gunning, 1996) posit that asking questions can be used as a means to get students to think of information regarding elements in the story which can lead to better comprehension. Thus, CHARM does not answer *regular WH questions* directly. Instead, it formulates a response that is designed specifically to draw out the experiences and knowledge that the reader has regarding the topics covered in the story (Greenberg & Koohi, 2016). A number of dialogue moves, namely *prompt*, *pump*, *hint*, *elaborate*, aimed at formulating responses to probe into the actions, desires and emotional states of the story characters, is utilized for this purpose.

Through the question circles strategy (Tofade et al., 2013) of encouraging learning by asking questions, the agent constructs *subject matter questions* to elicit answers for story content, combined with *personal response* and *external reality questions*. Prompts are used to connect the story to the reader's life, e.g., "*Do you know anyone who has been bullied before?*", and a question encouraging the user to supply the details, e.g., "*Can you tell me what happened?*"

Pumps are designed to spur a discussion between the user and the agent through questions that encourage the user to see story events in the light of real-world scenarios. To develop a child's empathy, the Hanen Early Language Program (Greenberg & Koochi, 2016) proposed the use of questions that encourage the child to put himself/herself in the shoes of the story character, e.g., "*Wanda is an outcast. How does that affect her actions?*"

Elaboration plays an integral role in encouraging collaboration through discussion. The agent provides additional information from the story to make the reader understand the causal relationships between events in hopes of scaffolding the reader to derive the answer. Questions that ask the reader to provide more details are used since studies (Duffy, Shinjo, & Myers, 1990; Pressley et al., 1987) have shown that readers only generate their own elaborations when prompted by questions.

CHARM can also lead the reader to the answer by supplying lexical clues for words used in the narrative, for example, "*The description for the dress Cecile wears has the definition pleasing by delicacy or grace; not imposing. What do you think is this word describing Cecile's dress?*" Knowing the meaning of words used in the narrative is important in story comprehension. Thus, the agent can generate word definitions that it sourced from WordNet (Felbaum, 1998), e.g., "*The meaning of the word dress is a one-piece garment for a woman; has skirt and bodice.*"

4. Validation

Ten children who are 10 to 16 years old participated in a story reading session with CHARM. All participants are students with varying reading habits and proficiency levels in comprehending English text. Of the 10 participants, only three (3) claimed that they read books for their enjoyment.

Prior to interacting with the conversational agent, each participant is given an oral briefing on the guidelines for interaction, summarized in Listing 3. The participant is also provided with a written handout of the guidelines to read, and is allowed to seek clarifications regarding these. Each interaction with the agent lasted for 45 minutes to an hour. Ethical considerations were also explained, specifically, participants were allowed to withdraw from the study anytime and for whatever reason.

Listing 3. Guidelines in interacting with CHARM (summarized version)

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1. If you are going to ask questions to CHARM, limit your questions to "who", "where", "what" and "why" only.
 2. CHARM cannot understand which character you are referring to if you do not mention the character's name. For example, CHARM will understand you if you ask "*What is the color of Wanda's dress?*", but not if your question is "*What is the color of her dress?*"
 3. While CHARM can understand short responses such as "*okay*" and "*I agree*", CHARM will only know that you already know the correct answer if you give the complete answer.
 4. CHARM will understand you better if you talk to her in complete sentences. Make sure your sentences end with a proper punctuation mark: questions must end with a question mark (?), and sentences must end with a period (.).
 5. CHARM will know which character or place you are referring to if you observe proper capitalization of names.
 6. CHARM reads the story at the same time as you. So, CHARM will not know the answer to your question if you and CHARM have not reached that part of the story where the answer to your question is given.
 7. If you do not want to talk to CHARM anymore, just type "*I don't want to talk anymore.*"
 8. If there is a word in the story that you do not understand, you can ask CHARM for the meaning of the word. For example, you can say "*What is the meaning of shuffle?*"

A debriefing session was also conducted to solicit feedback regarding the student's perception of CHARM's abilities as a conversational agent, and if the agent has helped address the causes of reading problems, such as frustration from poor reading comprehension and lack of interest.

4.1 Test Results

The participants evaluated CHARM along three quality attributes – performance, humanity and affect – using a four-point scale – 4 for always evident in the interaction, 3 for usually evident in the interaction, 2 for sometimes evident in the interaction, and 1 for never evident in the interaction. Table 1 shows the average evaluation ratings received by CHARM.

Table 1

Evaluation scores on CHARM's quality attributes

Quality Attribute	Rating
Performance	3.22
Humanity	2.76
Affect	3.19

The performance attribute is used to measure the agent's ability to handle unexpected input (Klüwer, 2011) and to avoid inappropriate utterances (Morrissey & Kirakowski, 2013). This is reflected through CHARM's utilization of the story world graph in formulating responses that probe and explain character actions and motivations, and raising questions that encourage the participant to relate story events to real-life situations. As seen in Table 1, CHARM received an average rating of 3.22. Table 2 gives a detailed breakdown of the items used to measure the performance attribute.

Table 2

CHARM's evaluation scores for the Performance quality attribute

Evaluation Item	Rating
1. CHARM can explain to me why characters do certain things in the story.	3.44
2. CHARM can explain to me why certain events occur in the story.	3.11
3. CHARM allows me to understand the locations mentioned in the story.	2.44
4. CHARM allows me to understand the items mentioned in the story.	3.33
5. CHARM allows me to relate the things happening in the story to my life.	3.11
6. CHARM understands what I am saying.	3.33
7. CHARM is easy to talk to about the story.	3.38
8. CHARM knows what the story is about.	3.63

The first two items in Table 2 highlight CHARM's ability to rationalize character actions and occurrences of events. 70% of the participants responded that CHARM can always explain the story content clearly and can answer questions regarding specific characters. However, one participant encountered difficulty in fully understanding all of the agent's responses, while another claimed that CHARM never explained to her why characters do certain things in the story because "CHARM kept asking questions". There were instances when CHARM did not know the answer to why an event occurred, thus the score of 3.11. Story-related information modeled in the graph was limited, and so the agent could not formulate an answer for every question raised by the reader and instead throws the question back for the reader to answer.

Items 3 - 4 in Table 2 highlight CHARM's ability to explain locations and objects mentioned in the story and received mixed feedback. 30% of the respondents claimed they were not given any opportunity to discuss the locations, while 20% of the respondents acknowledged their reliance on CHARM'S responses regarding locations and objects to understand the story.

To increase their understanding of the story, CHARM should be able to formulate responses that give readers the opportunity to find the relevance of story events to their everyday life. In this

aspect, CHARM received an average score of 3.11, as seen in Item 5 of Table 2. Two participants commented that CHARM would always relate the story to real-world scenarios, specifically when the agent asked how a person can be late for school. One participant thought that she may be able to use the learnings she gained from reading the story in her daily life thanks to the agent's responses.

A key factor in maintaining the participant's interest in the conversation is the agent's ability to understand user inputs and the ease of communicating with the agent. Items 6 - 7 focus on these two aspects. One participant remarked that even when she misspelled words in her inputs, CHARM still managed to understand her. While most participants found CHARM easy to talk to, giving the agent an evaluation score of 3.38, one participant remarked that the responses contain grammar errors, such as "*How come Maddie waited Wanda? What do you think is the reason?*". Out of the 236 statements generated by the agent, 14.41% contained grammar errors while 2.12% contained lapses. Responses with lapses are those which have missing information that affect their readability and coherence, e.g., "*What is something that could make you? Maybe that also made Peggy be popular.*" The grammatical errors were caused by the lack of grammar rules for processing multi-word verbs, such as "*wait for*". Lapses were caused by the incorrect part-of-speech tag returned by WordNet, and thus the incorrect rule being used by the surface text generator in generating the textual response.

Finally, for agents to appear intelligent, they must exhibit an understanding of the story itself. While 90% of the participants found CHARM to possess sufficient knowledge about the story and can answer any of the questions they raise, thus giving the agent an evaluation score of 3.63, one participant claimed that the agent was never able to explain story-related information since it kept "*asking questions*" and the questions it was asking did not contain any substantial information. Since some of the agent's responses were lengthy (≈ 20 - 35 words long), the participants who did not obtain anything from the agent's responses might have ignored the agent's lengthier responses—the responses containing portions of the answer to the question. Because of this, they missed the information contained within the responses.

A study by Moreno and Mayer (2000) showed that learners find a virtual agent more useful if it possesses some humane attributes and behavior. This can be measured through the agent's ability to behave like a storytelling peer, and if can facilitate a turn-based conversation. Among the three attributes of an agent, CHARM received the lowest rating in the humanity aspect, with an average score of 2.76. Table 3 gives a detailed breakdown of the items used to assess humanity.

Table 3

CHARM's evaluation scores for the Humanity quality attribute

Evaluation Item	Rating
CHARM lets me know it is my turn to talk or to ask questions.	3.13
I can talk to CHARM just like how I would talk to a classmate or a friend.	2.38

While participants found CHARM "easy to talk to", the agent lacked the pleasantness of conversing with a classmate or a friend due to the use of English language, which the participants do not use when talking to their human friends. Furthermore, one participant found the experience of conversing with a virtual agent very different from having a face-to-face conversation. On the other hand, the participants believed they were having a real conversation since the dialogue was not one-sided, and the agent often asked for their inputs and responded to their insights and ideas.

Affect sought to measure the agent's ability to make the reading task enjoyable to children and the children's enjoyment after talking to the agent. CHARM received an average score of 3.19 in the affect attribute. Table 4 gives a detailed breakdown of the items used to assess affect. Mixed feedback were received because of the varying reading habits of the participants. One participant claimed that the agent made the reading task fun by asking event-related questions. Another participant who enjoys reading admitted that having someone to help her understand more about the story increased her enjoyment in the reading task.

Table 4

CHARM's evaluation scores for the Affect quality attribute

Evaluation Item	Rating
CHARM makes reading a fun activity for me.	3.38
I like talking to CHARM.	3.00

As a conversational agent, most participants enjoyed talking to CHARM since they felt that they were talking to a friend. As a storytelling peer, one participant found the dialogue with the agent enabled her to know the answers to story-relation questions. Despite finding the idea of conversational agents “cool”, a participant still prefers the experience of talking to a real person. When asked about the role that they perceived the agent to be portraying, the younger participants (aged 10 to 12 years old) said CHARM served the role of a teacher who “asked so many questions”, while the older participants (13 to 16 years old) treated the agent as a friend.

4.2 Participants' Response to the Conversational Agent

A key observation during the validation process was the initial hesitation and the lack of eagerness among the participants to perform the reading task. Most of the participants admitted that they only read stories for their academic requirements. While the novelty of talking to a virtual peer piqued the interest of some participants, they skimmed the narrative for character names in order to answer CHARM's “who” questions, and responded with “*I don't know.*” when the agent fielded “why” questions. A couple of the participants became disappointed and even frustrated when the agent not only did not give a direct answer to the student's question, and instead asked the students to think of the answer on their own. This is illustrated in Listing 4.

Listing 4. A disengaged participant responding to the conversational agent's questions

Charm: I think the reason why Bill Byron notice Wanda has something to do with Bill Byron's seat. Can you tell me about Bill Byron's seat?
 User: what do you think?
 Charm: What do you think?
 User: I am asking you. WHAT DO YOU THINK???

Another group who showed interest in the reading task was disengaged from the conversation. They often terminated the conversation immediately after the agent posed a question, as illustrated in Listing 5. These participants enjoy reading during their free time, and felt that it is no longer necessary to discuss the story with the agent. The only instance they communicated with the agent was to ask for word meanings, e.g., “*What is the meaning of Sapolio?*”.

Listing 5. A participant terminates the conversation when the agent posed a question

User: hi.
 Charm: How come the students did not notice Wanda? What do you think is the reason?
 User: i don't want to talk anymore
 Charm: I see. I'll just be here if you need me.

It was also observed that participants who are engaged in the conversation exhibit varying behaviors. One participant goes back and forth to the story text in order to copy portions of the narrative to answer the agent's question. Still another was motivated enough to think of the answer to the agent's question on his/her own, as illustrated in Listing 6.

Listing 6. A participant terminates the conversation when the agent posed a question

User: Why does not Wanda cry if she gets bullied?
 Charm: Why do you think so?

User: Maybe Wanda does not care.
Charm: I see.

5. Conclusion and Further Work

Children learn skills and mental processes when they engage in social interactions with peers (Vygotsky, 1978). According to Gunning (1996), asking questions taken from past events allow students to train their monitoring skills and force them to think of story-related information are beneficial to their comprehension. Findings from validating our storytelling peer, CHARM, through conversations with children, however, showed mixed results. Interest in the story and engagement in the conversation are key factors in determining how a user would respond to the agent.

Users who were disengaged in the reading task but were interested in conversing with the agent were very eager to ask questions and receive answers to their questions. However, since they only skimmed the narrative for information to construct questions, they became unmotivated when CHARM posed questions. They did not absorb anything from the reading material; thus, they most often ended the conversation when presented with a question they could not answer. Users who were disengaged in the reading task and disinterested in pursuing conversation became frustrated whenever their questions were not answered directly. They expected to receive answers from the agent, and so the disappointment they felt from receiving a question for their question festered to frustration.

Users who already enjoy the activity of reading, or users who were engaged in the reading task and disinterested in pursuing conversation with the agent, did not converse with the agent much because they were absorbing what they were reading. Users who are engaged in the reading task and interested in conversing with the agent were encouraged to go back to previous portions of the narrative, to read story paragraphs more carefully, to discuss and share their ideas, and to think of the answer to their question on their own. Interested and engaged users discussed ideas with the agent when asked questions, while uninterested and disengaged users perceived that the conversation with the agent was pointless since the agent only asked questions without giving feedback on the information they wanted to know.

Students also benefit when asked to bring their everyday experiences into the task of reading to construct their own meaning of the text (Rosenblatt, 1982). Given this, the interaction provided an environment for peer reading to flourish through various dialogue moves that lead readers to an understanding of the answer. The agent scaffolds the reading task by filling in the readers' knowledge gaps and allowing them to make sense of the meaning of the texts on their own, thus showing potential for motivating as well as addressing reading comprehension issues (Murphy et al., 2009).

While CHARM currently employs a number of dialogue moves to formulate its response, findings show that some participants became "frustrated" at being asked further questions when they were already confused. Future studies can explore the use of affective dialogue as a means of addressing the negative mood felt by some readers. The study of (Klein et al., 2002) showed that an agent's response to the frustrations of users can help mediate some of negative feelings associated with interacting with computers by allowing users to manage their own emotional state.

Some users lost their interest in conversing with the agent due to the agent's inability to accept open-ended inputs to "why" questions. Most users tried giving all the answers they could think of before eventually giving up. The agent's capability to respond to answers to questions that are inferential in nature is vital in maintaining user interest. Currently, CHARM verifies user inputs by simply matching these to the assertions in the story world graph. Future studies should look into adding an inference engine to enable CHARM to reason over the knowledge found in the graph, similar to those reported in ConceptNet (Liu & Singh, 2004) and SUMO (Niles & Pease, 2001).

Finally, conducting studies on a larger sample size can lead to more conclusive results regarding the agent's ability to perform as a story reading companion. The reading habits of the participants and the amount of time each participant spent conversing with the agent can also be used for further analysis of the different responses the users have towards a conversational agent that scaffolds learning through collaboration.

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