



## Human-to-Human Storytelling: Towards Enhancing Man-Machine Interaction through Intelligent Conversational Agents

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**Abstract:** Recent innovative practices in man-machine interaction can be achieved through intelligent conversations in the form of stories and storytelling between the human users and the conversational agent. Doing so calls for two major steps: text understanding and text generation. The current study focuses on the first as it aims to provide a description of interactional moves and strategies between teacher and students within the context of human-to-human storytelling. Storytelling sessions in reading classes at different grade levels were audio recorded, transcribed, and analyzed using Graesser, Person and Huber (GPH) scheme (1992). Results reveal that the pattern of exchanges between teachers and students during storytelling sessions is almost exclusively Question and Answer while the strategies employed are those that reveal activating, prompting, hinting, feedbacking, and evaluating. This will help inform human-machine interaction specifically involving intelligent conversational agents in a storytelling context. This is envisioned to later help in the development of AI-based platforms and paradigms within and outside the classroom not only for storytelling purposes, but also for reading and other language-related pedagogical needs.

**Key Words:** conversational agents; storytelling; discourse processing

### 1. INTRODUCTION

Conversational agents are virtual agents—intelligent characters designed to mimic human capabilities and attributes, and to collaborate with human users to help them think better during the performance of specific tasks. They utilize various means of communication, from written to verbal to non-verbal, in order to “engage (their human users) in dialogues, and negotiate and coordinate the transfer of information” (Coen, 1995). As such, they have found applications in various domains to cater to the needs of different users, from booking air tickets, to facilitating activities in a learning environment and recommending various products

and services in commercial applications. The rising popularity of virtual agents is the result of calls for technological innovations that leverage AI with conversational interfaces to provide human users with more convenient ways to interact with AI systems<sup>1</sup>.

Currently, computers can already simulate many aspects of discourse comprehension, generation, and interaction with computer tutors that can hold conversations in natural language to help children learn subject matters. When people engage in conversations, they naturally use stories as a

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<sup>1</sup> Atos IT Challenge 2018: Chatbots and AI (<https://www.atositchallenge.net/2018-theme-chatbots-ai/>)



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medium for sharing their daily life experiences and events. Embodying chatbots with capabilities to understand and generate story text can enable them to enrich their conversations with their human users, using storytelling strategies to elicit further details regarding a user's needs. In the educational domain, chatbots can be used to share stories with children to encourage the latter to express their ideas while developing their language and literacy skills.

Studies on virtual agent research in literacy education have already covered various aspects under the social dimension and cognitive dimension. Under the first dimension, there are those studies that focused on learning strategies, content area, and learning styles and similar topics while those that are under the social dimension include those that look at intercultural communication, socially-desirable traits, and emotional storytelling.

Overall, the majority of the previous studies show that the presence of a pedagogical agent improves performance results. Moreover, although computers are often regarded merely as a tool to perform tasks, computer users actually tend to expect computers to be like social entities (Lee & Nass, 2003). For instance, a number of researchers have observed that children become highly engaged with virtual tutors and appear to interact with a virtual tutor as if it were a real teacher and appear motivated to work hard to please it

## 2. METHODOLOGY

### 2.1 Objectives

This study aims to provide a description of interactional moves and strategies between teacher and students within the context of human-to-human storytelling. This will help inform human-machine interaction specifically involving intelligent conversational agents in a storytelling context. This research is envisioned to later help in the development of AI-based platforms and paradigms within and outside the classroom not only for storytelling purposes, but also for reading and other language-related pedagogical needs.

### 2.2 Participants

Our investigation was set in a classroom setting during storytelling sessions. Observational data were gathered from five (5) primary grade

school classrooms in a private sectarian institution in Manila. Two (2) classes were from the first grade, another two from the second grade, and one (1) from the third grade. The average classroom size for all five classes is 26 students. Each grade level, regardless of class, was assigned with the same English teacher, hence, the study involved the participation of a total of three (3) teachers, all with specialization in English education, and are Tagalog-English bilingual. The two teachers handling the first and third grades, respectively, have been teaching in the said school for more than two years, while the teacher for the second grade at the time of the data gathering had a year of teaching experience.

### 2.3 Instruments

The observation sessions relied upon audio recording using a Sony Digital Voice Recorder ICD-UX560 with 44.1 kHz sampling rate alongside taking field notes. Other materials for consideration were storytelling texts (alongside the text type in parenthesis) used by the English teacher.

### 2.4 Procedures

In order to identify interactional moves and strategies between teacher and students, we conducted observations of select storytelling sessions in English classes for first, second, and third grade levels. Large-scale classroom context were identified as the data sources due to relative difficulty in locating one-on-one storytelling set-ups.

The observations were conducted in five (5) classes for two days in two separate months. Two different sections were selected for the first and second grades. Only one section however was selected for the third grade due to conflicts with the school calendar, and class availability for observation, which then prompted us to observe that class twice in order to meet the research requirement to have two observations for each grade level. In totality, there were six (6) observation sessions for all primary grade levels—the target demographics given that storytelling is only part of the curriculum within these levels. All sessions were audio recorded while we took field notes. An interview was subsequently conducted with the assistant principal to clarify some details noticed during the visits that helped decide whether we needed additional observation sessions or otherwise.



## 2.5 Data Analysis

While this study aims to characterize teacher-student interaction during a storytelling activity, teacher question generations processes and structures would be central to the analysis given that human-to-human questioning have always been integral not only to storytelling pedagogy, but to guided instruction (e.g. classroom) in general. Observational data were therefore analyzed from a psycholinguistic perspective through the lens of the Graesser, Person and Huber (GPH) scheme (1992). This scheme takes into consideration not only the syntactic and semantic criteria of questions, but also pragmatics in accordance to speech acts.

The GPH looks into three (3) dimensions of question generation quality: content of requested information, question generation mechanisms, and degree of specification. The first dimension is represented by eighteen (18) question content categories which are stratified by length of expected answer, and by reasoning (e.g. causal, goal-oriented, logical, deep). The second dimension, meanwhile, is represented by four (4) mechanisms or motivations in the production of questions in a natural discourse mode. These mechanisms are information-seeking, negotiating, coordinating, and conversation-controlling. The third dimension describes the level of specificity of the requested information.

Lastly, we developed a model characterizing human-to-human interaction during a storytelling activity within a Filipino classroom context. This is to again aid the development of a man-machine interactional system using intelligent conversational agents. The architecture is guided mainly by Graesser, Person and Maglianos's model on collaborative dialog patterns (1995 in Graesser et al., 1999). While the said model was originally designed for one-on-one tutoring purposes, our own model was supplemented with observational data from large-scale classroom contexts due to difficulty in finding one-on-one storytelling

## 3. RESULTS AND DISCUSSION

Our analysis of observation data on interactional moves and strategies between teacher and students in a storytelling class were based on the GPH scheme. This was used to enrich the development of our framework in characterizing a

human-machine interaction during storytelling sessions based on human-to-human interactions as characterized by our data.

### 3.1 General Interactional Patterns

All teachers employed nearly the same approach in storytelling, which is eliciting responses to content questions after each major plot element or part of the story for ideas. Since the storytelling sessions have been observed to be teacher-centered, the overall exchange of ideas is limited to the Q&A format type of eliciting responses. There was hardly any student-student interaction; however, there was always a student reaction/response for every question or statement from the teacher.

In some cases, a teacher re-phrased a question if she thinks the students did not understand the question. For one instance, the third grade teacher supplemented the word "characterize" with "describe" immediately when she asked the students to describe an elephant.

The teachers in all classes did not start right away with the storytelling, but spent some time activating any prior knowledge that the students have on the topic of the story to be discussed. This is typical of human-human storytelling as this would determine what parts of the story could pose problems to the readers (students). These parts are then used as opportunities for the teacher to spend time on in discussing or clarifying with the students. On the other hand, if during this activating time the teacher realizes that majority of the students have related background knowledge with the topic at hand, it is a sign that the teacher could proceed with the storytelling following the typical structure of a narrative (setting, characters, plot).

Typical questions asked during this stage to activate prior knowledge are relating major story elements (e.g. themes, characters) to immediate personal experiences. For example in the third grade class, the teacher initially asked the class to describe an elephant, then related this by asking the class whether they saw an elephant in the zoo during their very recent field trip before they continued with the story of *The Elephant and the Six Blind Men*. Meanwhile, the second grade teacher asked the class what "kind" of movie (as in genre) the students like, and what horror movies they like before introducing their story which was about watching a scary movie.



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### 3.2 Questioning Linguistic Patterns

Code switching (CS) is a very prominent linguistic feature throughout all observed storytelling discourse. This is not surprising since CS has long been part of the learning and instructional experience within Philippine classrooms. Apart from anecdotes, it has been evident based on nationwide and localized surveys since two decades ago (Gonzalez & Bautista, 1986) that CS is seen as an effective if not an essential communicative technique in the Philippines among teachers and students alike. This is despite enforcing rigid English-only policies for the longest time even until the period when empirical scrutiny of code-switching has formalized and its pedagogical implications have been further understood much quite recently (cf. Borlongan et al., 2012; Martin, 2006, Bautista, 2004). Most common patterns of CS observed in the target classes are what we would classify as *clarificational intersentential* CS, and a *descriptive intrasentential* CS. It should of course be noted that the teachers' type of CS techniques are not limited to these. Examples of intersentential CS for clarification are below:

It's a great wall! *Isa itong dambuhalang dingding!*  
Are all of us correct? *Tama kaming lahat?*

In the first excerpt, the teacher first read the original English story describing an elephant, then extended it with her Tagalog translation. In the second, the teacher translated the blind men's reaction to the Wise Man who told them their descriptions of an elephant are all correct. Meanwhile an example of intrasentential CS for description is below:

*Sabi niya* [he said], "*it's not a fan!*"

In this excerpt, the teacher translated a portion of the original text narrating how one blind man contested another man's claim of holding a huge fan upon touching an elephant's ear. This same pattern could be observed in other parts of storytelling sessions especially either when going back to the text after the teacher asks questions or provides side comments, or to emphasize shifts in dialog.

Sometimes, one could wonder if the tendency to code-switch was always done to aid the students and/or to assist the teacher in the lesson delivery since there were instances when the teacher's language at the onset of one interaction is Tagalog and not English which is the target language for the subject. When a teacher's question is in Tagalog, the student's response will also be in Tagalog, but if the teacher's question is in English, most of the students' responses are also in English with a few exceptions. In the latter cases, it could be assumed that the code switching encouraged the students to have better participation during the storytelling sessions.

### 3.3 Teacher Questioning Strategies

All teachers added some affective questions. Affective questions are those that target the values, feelings, motivation, and attitude of the students. Based on existing literature, stories that discuss the values, feelings, motivation, and attitudes, which are similar or related to what the students hold, make them more appealing and interesting to the students, and the task of reading more enjoyable. Some affective questions include, *Why did Annie refuse to fight back even if her younger sister was challenging her? Would you share your baon with a hungry classmate even if he is not your friend?*

Both third and second grade classes had more affective questions as compared to the first grade class given that the third grade story tackled truthfulness, while the second grade story tackled fear. With these particular classes, it is likely that the stories for the second and third grades allowed the teacher to ask more affective questions because aside from the nature of the topics (truthfulness and fear), the story used in first grade is too short to have many affective questions.

There were no other tasks involved apart from listening through their respective storybook (or viewing audiovisual stories), and discussing their contents. In other cases, a storytelling session is followed by a writing or a speaking task which is still related to the story discussed. For these classes, however, the storytelling is the end of the lesson itself.

### 3.4 Human-to-Human Classroom Storytelling Interactional Model

Based on the aforementioned data, we have developed a model describing teacher-student interaction during storytelling in a Filipino classroom context. The architecture is mainly shaped by Gaesser et al.'s (1995 in Gaesser et al., 1999) model on collaborative dialog patterns, while enriched with question generation principles based on the GPH scheme (Gaesser et al., 1992). The Human-to-Human Classroom Storytelling Interactional Model is illustrated in Figure 1 below.

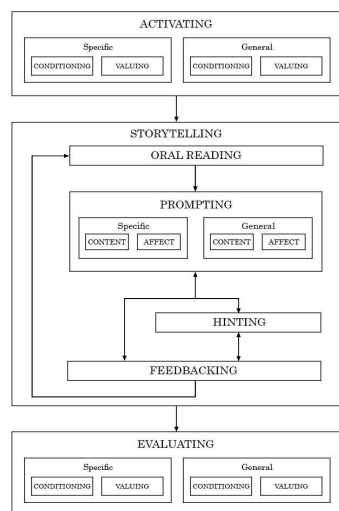


Fig. 1. Human-to-Human Classroom Storytelling Interactional Model

Our model slightly deviates from Gaesser and colleagues' original dialog moves, which comprises of feedback (positive, negative, neutral), pumping, prompting, hinting, elaborating, splicing/correcting, summarizing, and requestioning. Given that classroom storytelling is normally done in the earlier schooling years, interactional structures for storytelling activities are simplified primarily due to time constraints, and consideration for students' common developmental level. We therefore plot three (3) main phases, namely *activating*, *storytelling*, and *evaluating* representing what we call the interactional *macro-structure*, which contain interactional *micro-structures*. Both structures are elaborated in the subsequent discussion.

### 3.4.1 Interactional Macro-Structure

The interactional macro-structure pertains to the overall architecture of the model containing

the three main phases, *activating*, *storytelling*, and *evaluating*.

The *activating* phase is the pre-storytelling activity in a typical classroom set-up. This is where the motivation and unlocking of difficulties are conducted by the teacher. Questions hence are normally given to *condition* the students regarding the story by providing context (e.g. asking about personal experiences, daily routines) or directly introducing the text to them. The teacher can also have this portion to incite emotions or frame of thoughts regarding the upcoming story through *valuing*. Both sub-components can be in question or non-question forms depending on the activity or interaction the teacher deems appropriate.

The second or the *storytelling* phase is where *oral reading* of the story occurs. This phase can be applied to both actual teacher read-aloud, or through prerecorded digital agents (e.g. videos, AI). The text is not typically uninterrupted from beginning to end since it is highly important to guide early learners across narratives given their relative length and complexity compared to other learning content. Depending on the students' level storytelling interaction, mainly characterized by questions, is conducted. This involves three sub-phases, namely *prompting*, *hinting*, and *feedbacking*. A cycle occurs involving these micro-structures and the oral reading sub-phase as the storytelling progresses.

The third and final phase or the *evaluating* phase is where the teacher concludes the entire storytelling lesson after ending the story. Similar to activating, question-generation is encouraged for conditioning and valuing. The former is to prime students for discussions or activities beyond the storytelling proper, hence the purpose to 'condition.' The latter is to further process opinion and emotions towards the story upon the end of the storytelling activity. The teacher can also use this opportunity to help students connect and reflect what they shared during the activating phase based on their preconceptions or schema.

### 3.4.2 Interactional Micro-Structures

The interactional micro-structures meanwhile pertain to the sub-components within certain sub-phases across our model; these are mainly concerned with question generation patterns, processes, and types. In order to elaborate on these, we discuss the components of *prompting*, a sub-phase of *storytelling*, where question generation and



questioning interaction are the richest and most frequent.

The first sub-phase or *prompting* is where the teacher question-generation takes place—the teacher provides interactional context in the form of questions based on the storytelling text. As a scaffolding strategy, this initiates the process for students to gradually absorb and process story information. This is followed by the second sub-phase or *hinting*, where the teacher assists the students in case there is communication breakdown or if the students find it difficult to answer the prompt. This is normally manifested through silence in a typical classroom setting. From the term itself, hints are provided through stative memory clues or leading questions. This can be bypassed if the said problems were not present, and hence from prompting, the interaction can head directly to *feedbacking*. Lastly, feedbacking is when the teacher back-channels upon student response by acknowledgement through positive (e.g. *that's right; exactly*), negative (e.g. *not quite*), or neutral forms (e.g. *uh-huh; does anyone have a different answer*). This is also where the teacher can help nurture building of concepts by expanding on the answer (sometimes through the help of the class), or by providing follow-up questions based on previous prompts. Once the interaction satisfies the teacher prompt, oral reading may resume. A back-and-forth movement across prompting, hinting, and feedbacking represents the micro-structural flow of question-generation and question-answering. This can persist before resumption of the reading aloud phase until there are evidences that learning objectives are being met through the questions. The cycle within this interactional micro-structure would continue until the end of the story.

#### 4. CONCLUSIONS

The current study aimed to provide a description of interactional moves and strategies between teacher and students within the context of human-to-human storytelling. Results reveal that the pattern of exchanges between teachers and students during storytelling sessions is almost exclusively Question and Answer while the strategies employed are those that reveal activating, prompting, hinting, feedbacking, and evaluating. This will help inform human-machine interaction specifically

involving intelligent conversational agents in a storytelling context.

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