The Development and Evaluation of English Dialogue Companion System

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Abstract

In this paper, we propose the English Dialogue Companion (EDC) system to help elementary school students learn second language, as English. Learners can practice conversation with the EDC system in English. In order to motivate the learners, we design the three learning activities to enhance the environment of English learning, which are the choice of learning companion phase, the conversation phase, and the teaching phase. We also conducted a pilot study to evaluate the EDC system. The results showed the subjects agreed that the system is positive and useful. For the most of learners, we found that the most favorite learning activity is to teach learning companion. In addition, the greater part of learners liked the same gender learning companion. And learners selected the learning companion depended on the learning companion is regards as a classmate or a teacher.

1. Introduction

The 1980s saw a wealth of research into the application of artificial intelligence. In the education domain, Intelligent Tutoring Systems (ITS) is one of the important topics. Like ITS conference (http://gdac.dinfo.uqam.ca/its2008/index.html), aims at developing a simulated tutor who has an expert-like expertise to teach a student respectively. Chan proposed the Learning Companion Systems (LCS) and extended the role of ITS [1]. A Learning Companion System does not only play the computer-simulated tutor role, but is a computer-simulated student. Compared with ITS, LCS provide the learning function further for learners: the difference of learning strategy, the opportunity of reflection, team work and so on [1][2].

For the beginners of the second language learners, it is difficult to speak non-native language. Thus, chatbot (or dialogue system) that simulates the human interaction can provide the learners with the opportunity to oral practice, so that releases the learners' psychological barrier. ELIZA is regarded as the first chatbots and plays an important role in the history of chatbot [3]. ELIZA is a rule-based expert system analyzes the input and responses by rules. A.L.I.C.E is an open-source chatbot based on the Artificial Intelligence Markup Language (AIML) over 10 years [4]. The development of Natural Language Processing, chatbot can be asked to do specific domain, such as Lingubot in commerce [5], Intelligent Medical Query System in medicine [6], and CSIEC in education [7][8]. Specially, Conquest that is a spoken dialogue system query information by microphone [9].

In this paper, we combine the function of the learning companion and the chatbot, and proposed the English Dialogue Companion (EDC) system to help elementary school students learn second language, as English. An elementary school student will have his own learning companion, and chat with him in English by keyboard or microphone. We hope that the EDC system can help them enjoy learning English and practice English. The paper is organized as follows. Section 2 shows the related work. Section 3 describes the design of the EDC system. Section 4 reports the system architecture. We also conducted a pilot study in the section 5. Finally the conclusion and future work are given in the section 6.

2. Related work

A decade of research has now given us the different perception on the performance of Learning Companion, such as traditional learning companion [1][2], animal companions [10], and affective learning companion[11]. The learning companion is mainstay for learners to learn in their learning process. Hietala [12] and Uresti [13] respectively discussed the influence on the different ability (strong or weak expertise) of the learning companion for learners. Hietala found that a learner selected a learning companion depending on the learner's personality. Uresti stated that learners got more learning opportunities with weak learning companion. However,

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little research has been done on similar degree expertise between learners and the learning companion.

The learning companions above almost applied to mathematic and computer science learning domain. In the English learning domain, CSIEC is a chatbot for English dialogue learning [8][9], as a learning companion. Jia [9] divided dialogic content into two types: unrestricted and restricted. The learners who are extroverted, conversational, or speak English well, are suitable for the unrestricted content. By contrast, the learners who are introverted, shy, or speak English poor, are suitable for the restricted content. The most of elementary school students are the beginners in the English learning. Therefore, we have to design specific function to help the learners learn.

There are many learning strategies between learners and learning companions, such as collaborative, compete, and learn by teaching [1][2][10][13][14]. Many research pointed out the approach of learning by teaching helping learners learn deeply [14] [15]. In addition, Kerly [15] revealed that negotiation with chatbot supported the learners reflection based on open leaner models. Chen [10] also reported the positive results of animal companions to motivate children to learn through open learner models. Therefore, we will adopt the approach of learning by teaching and open learner model to help the learners practice English.

In light of these concerns, we propose the EDC system to achieve the two purposes: (a) to figure out the relation between the learning companion selection and the representation of the learning companion in the learners' perception and (b) to design a dialogue companion for elementary school students based on the open learner model and teaching strategy.

3. The design of English Dialogue Companion

The main idea of the EDC system combines Learning Companion with chatbot. In other words, it is a learning companion who can talk with a second language learner in English, and the expertise of the learning companion is equal to the learner, as an elementary school student. Thus, the design of the EDC system must fit learners for English practice. In the interaction of the English Dialogue Companion, we design three learning activities to enhance learners' second language learning, which are the choice of learning companion phase, the conversation phase and the teaching phase. In the Figure 1, it describes the system flow chart between a learner and a learning companion. Firstly, the learner chooses two animated figure to represent his learning companion and himself in the choice of learning companion phase. Secondly,

the learner can have a conversation with the learning companion in the conversation phase. Thirdly, the learner can add new vocabulary to teach his learning companion in the teaching phase.
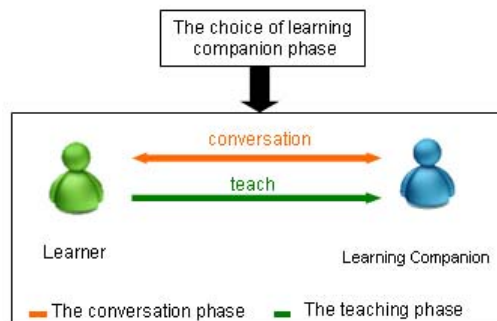

Figure 1. The system flow chart of between a learner and a learning companion.

3.1 The choice of learning companion phase

In the beginning of the using EDC system, the leaner has to choose a figure to represent his own learning companion. There are a figure who wears a mortarboard, a diligent boy, and a sweet and beautiful girl. In order to motivate learners to learn English well, we would like to figure out what kind of companion personality attracts the elementary school student mostly. In addition, we would like to know what the learners regard the learning companion as when the learning companion's expertise is equal to a student. Besides, a learner also needs to choose a figure to represent himself.

3.2 The conversation phase

After choosing the favorite learning companion, the learner can practice English conversation with learning companion by keyboard or microphone. To avoid that the elementary school students are too young or too shy to chat about anything, we design an interaction area and a blackboard to make more opportunities for learners to speak English with their own learning companion (see the Figure 2). The learner can choose a picture from interaction area, and the system will show the picture on the learner's own blackboard. Then the learner can create a description or a question about the picture to chat with his learning companion. Similarly, learning companion can show a picture on the learning companion's blackboard to create a dialogic opportunity in order to chat with the learner.

Figure 2. An illustration of the interface of conversation phase

3.3 The teaching phase

As Uresti [14] pointed out that student learned more when he taught his learning companion. Therefore, we apply the same strategy in the EDC system. The learner can add new pictures to teach the learning companion new vocabulary. When the learner presses the add button in the conversation interface, it will turn the conversation phase into the teaching phase (see Figure 3). Then the learner can choose the picture he added to show on his own blackboard, and then can teach the learning companion by reading the vocabulary. According to the open learner model [16], we design a mistake-made strategy to make the learning companion speak wrong pronounce two times in order to help the learner self-assessment and reflection about this new vocabulary.
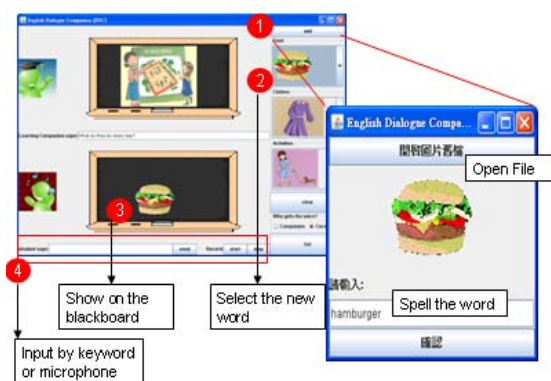

Figure 3. An illustration of the interface of conversation phase

4. System architecture

Figure 4 shows the system architecture of the EDC system, it is composed of input module, dialogue manager, and output module. In the input, learners can interact with the EDC system in three ways, including sentences, utterance, and graphical action. Therefore, learners can input by keyboard or microphone. Utterance will turn into sentences by speech recognizer. Then, the input will be processing by the dialogue manager.

The dialogue manager contains semantic analysis, response generation, spontaneous sentence generation, and mistake-made generation, as follows:

- **Semantic Analysis:** The input will be analyzed by semantic analysis module and stored in the discourse history.
- **Response Generation:** Response generation generates response from corpus according to the result of semantic analysis module.
- **Spontaneous Sentence Generation:** Spontaneous sentence generation automatically generates a sentence from corpus when the learning companion gets the preaudience.
- **Mistake-made Generation:** Mistake-made generation generates wrong response in the teaching phase.

In the output, the EDC system can interact with learners in three ways, including sentences, utterance, and graphical action. Therefore, learners will get the message from the sentences, utterance, and the learning companion's blackboard. Utterance is generated by the TTS engine. TTS engine will transform the text into speech.
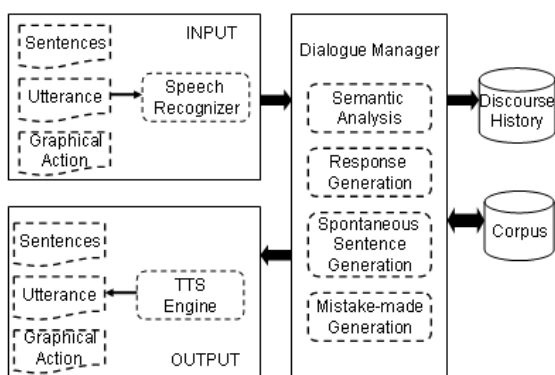
Figure 4. The system architecture of English Dialogue Companion (EDC)

5. A pilot study

5.1 Method

We conducted a pilot study to observe the using experience of the elementary school student and to examine the system evaluation of the EDC system. Subjects were 34 fifth grade elementary school students who learned English as a second language. Eighteen subjects were male and sixteen subjects were female. "New Smart! Book 5" which was the subjects' textbook was employed as learning materials. Before the evaluation, we told subjects that Learning Companion is their partners in English learning. They can practice conversation with him. And the subjects were trained to use the EDC system in order to let them familiar with the operation of the EDC system. In the procedure of the evaluation, the subjects were asked to complete three tasks, including to choose their own learning companion, to speak English about the learning materials with their learning companion, and to teach their learning companion new vocabulary. After the evaluation, the subjects were asked to fill out a questionnaire from 1 (strongly disagree) to 6 (strongly agree) in order to figure out their using experience. Moreover, eight subjects who were draw randomly from the original sample were asked to an interview.

5.2 Results and discussion

Table 1 shows the average score of the questionnaire. The result of the questionnaire was divided into four categories to discuss: the learning companion, the aid of English learning, the aid of teaching learning companion, and the system evaluation. The results show that subjects gave very high scores on all items.

Table 1. The average score of the questionnaire.

Categories	Mean	SD
The learning companion	5.51	.82
The aid of English learning	5.46	.97
The aid of teaching learning companion	5.46	.88
The system evaluation	5.27	1.02

The learning companion

According to the result of the questionnaire, it expressed that subjects agreed highly the learning companion (M=5.51, SD= .82). As Figure 5 described, more than half subjects considered the learning companion as their classmates, 24% subjects considered the learning companion as their teacher, another subjects considered the learning companion as their family. Therefore, the greater part of the relation between the learners and the learning companion are peer interaction and apprenticeship [1]. In the choice of learning companion phrase, we found that subjects selected the same gender of the learning companion if they treated it like their classmates. And they selected the figure who wears a mortarboard if they treated the learning companion like their teacher. Therefore, the learners' choice of the learning companion related to the role the learners regarded as.

The aid of English learning

In the result of questionnaire, subjects expressed that they enjoy practicing English conversation with the learning companion because the learning companion as a good friend accompany them and encourage them. Compared with the traditional oral practice by the CD player, the interaction between a learner and a learning companion is not single way, but two-way. Learners understood deeply the relation between the sentences through the response from the learning companion. Therefore, subjects expressed that they would have more confidence to learn English.

The aid of teaching learning companion

Most subjects said that the most favorite activity is the teaching phrase because they liked to play the role of teacher. They felt that they were responsible to teach their learning companion, so they learned new vocabulary more seriously. Through the mistake-made strategy, the subjects would pass three steps. Firstly, subjects needed to spell the correct word. Secondly, subjects had to read the word correctly. Thirdly, subjects needed to listen to the learning companions' pronunciation in order to check whether the learning companion acquired. In the three steps, learners would reflect and self-assess about the new words [15].

The system evaluation

The score of system evaluation is high (*M*=5.27, *SD*= 1.02). Most subjects said that they would like to own the EDC system in the future. In the result of questionnaire, the displayed language the subjects preferred the first language (Chinese) to the second language (English). Some description in English they could not understand exactly because they had not learned them. Therefore, we suggest the displayed language of Learning Companion System should show both languages simultaneously. In addition, the output module showed the expression in three ways, including sentence, utterance and the picture of the blackboard. Subject could not really understand what the learning companion said, but they guessed the possible qmeaning through the sentence or the picture. Thus, we suggest adding the degree of difficulty or ability classification.
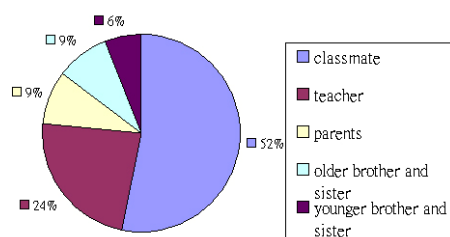

Figure 5. The role of the learning companion

6. Conclusion and Future Work

In this paper, we propose the EDC system to help elementary school students learn second language, as English. We design the three learning activities to enhance the environment of English learning, which are the choice of learning companion phase, the conversation phase, and the teaching phase. Firstly, a learner selects an animated figure as his own learning companion. Secondly, a learner can chat with the EDC system in English by keyboard or microphone. Thirdly, a learner can teach learning companion new vocabulary. We also conducted a pilot study to evaluate the EDC system. The result showed the subjects agreed that the system is positive and useful. For most subjects, we found that the most favorite learning activity is to teach learning companion. In addition, the greater part of learners liked the same gender learning companion. And learners selected the learning companion depended on which learning companion is regards as a classmate or a teacher. In the future work, we will enhance the performance of the speech recognition and the response generation module. In addition, we plan a long-term experiment to evaluate the influence of English learning with learning companion and analyze their conversation.

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