Introducing Alexa for E-learning

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ABSTRACT

E-learning is becoming popular as it provides learners the flexibility, targeted resources across the internet, personalized guidance, and immediate feedback during learning. However, lack of social interaction, an indispensable component in developing some skills, has been a pain point in e-learning. We propose using Alexa, a voice-controlled Intelligent Personal Assistants (IPA), in e-learning to provide in-person practice to achieve some desired learning goals. With Alexa enabled learning experiences, learners are able to practice with other students (one role of Alexa) or receive immediate feedback from teachers (another role of Alexa) in an e-learning environment. We propose a configuration driven conversation engine, which can support instructional designers to create diverse in-person practice opportunities in e-learning. We demonstrate that learning designers can create an Alexa activity with a few configuration steps. We also share results on the effectiveness of an Alexa activity with formative assessment evaluation in real world applications.

Author Keywords

Social Interaction; Intelligent Personal Assistant

CCS Concepts

•Human-centered computing → *User models; User studies;* **Personal digital assistants; •Applied computing** → **Interactive learning environments; E-learning;**

INTRODUCTION AND RELATED WORK

With the expansion of technology-driven tools and learner's desire to learn on their own schedule and pace, e-learning has become an indispensable medium for learning everything at any time. E-learning not only provides flexibility in choosing learning locations and setting learning schedules, but can also provide personalized guidance and immediate feedback. One of the major challenges in adopting e-learning is the lack of social interaction, addressed by Rahman et al. [3]. Wei et al. [4] also addressed that learner and instructor interaction is indispensable in knowledge acquisition and cognitive development process. With social interactions, learners can communicate with instructors and other learners to exchange and share knowledge. Meanwhile, they can construct new knowledge and reorganize prior knowledge from the interaction activity.

Meanwhile, smart speakers, such as Amazon Echo and its associated IPA Alexa, are helping make our life easier in several ways. They can take voice commands and perform corresponding tasks, such as playing music, shopping, ordering dinner, and answering questions by searching on internet. Alexa has been considered as an assistant in second language learning proposed by Dizon et al. [1] and even considered to offer help in classroom proposed by Dousay et al. [2] by setting learning schedules, sending reminders and looking up information. But an IPA is capable of supporting learning beyond simply executing commands and retrieving information.

In this work, we introduce Alexa for e-learning. We propose a configuration-driven conversation engine which can support Alexa activity development at scale. In each Alexa activity, learners can interact with Alexa to practice skills and receive quality guidance to achieve the desired learning goals. We use the Alexa Skill Kit to develop the conversation engine. The demonstrated Alexa activity has been embedded into a course for learning interviewing skills in a learner centered open navigation online learning system.

APPROACH

Learners can interact with Alexa using any Alexa enabled device. Fig1 shows the Alexa activity workflow. Learners first invoke Alexa and open the intended skill. With voice recognition, Alexa starts to interact with learners for skill practicing. Alexa plays the role of a peer if the learner's behavior is expected, otherwise Alexa changes into the role of a coach/instructor and provides immediate guidance. It simulates the real in-person practice in classroom learning with both learner to learner and learner to teacher interactions. The

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Alexa activity is developed with AWS lambda function. The conversation data is passed to AWS S3 for further analysis. Fig 2 demonstrates the two key components of the Alexa activity. The configuration-driven conversation engine is the code base that can support different conversations with necessary content design. Learning designers can create conversations for a specific learning goal by providing the corresponding learning content.

Figure 1. Alexa activity workflow

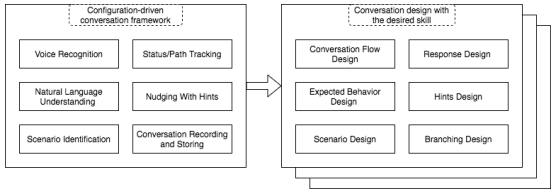

Figure 2. Configuration-driven conversation engine framework

Configuration-driven Conversation Engine: The proposed conversation engine consists of six components. The built-in voice recognition module transcribes human voice into text. Then the built-in Natural Language Understanding (NLU) module parses and analyzes the text. We develop our own keyword matching mechanism to understand the contextualized text. After analyzing the text, the corresponding Alexa activity will be invoked. Within the activity, the proposed framework can support various practice scenarios. Each scenario will be identified based on the keyword matching mechanism. Alexa will respond accordingly with the identification of the skill, scenario and dialogue. We also developed a multi-turn dialogue framework to track the conversation status and trajectory. With knowing the desired learning outcome and the past trajectory, we nudge learners towards the desired outcome with hints and guidance.

Conversation Design: With the proposed conversation engine, learning designers can create an Alexa learning activity by configuring the necessary content. First, designers will configure the overall conversation flow, such as number of turns of the desired dialogue, number of branching scenarios, and number of failures that triggers ending the practice. Then for each branch of the scenario, learning designers are expected to configure the desired behavior from the human learners in the form of keywords to be identified. Alexa's responses to the desired human behavior are also part of the design. For any unexpected behavior from human learners, hints are designed based on the practice trajectory.

EXAMPLE DEMONSTRATION

In this section, we demonstrate the process to create an Alexa activity with the proposed configuration-driven conversation engine. The desired learning outcome of this activity is to develop an interviewing skill of how to ask follow up questions as an interviewer. We also share the effectiveness analysis of this Alexa learning activity.

Configure the overall conversation flow: There are two separate steps in the conversation flow. First, the interviewer (the human learner) asks the first question. Based on the response of the interviewee (Alexa), interviewer asks a follow-up question to get more information about the experience.

Configure branching and scenarios: Branching scenarios can be designed to support the learning. We demonstrate one scenario, 'dive deep into the question', where the interviewer is expected to ask the right deep diving questions to get more details about the first response from the interviewee.

Configure expected behaviors and responses: Based on the scenario, the follow-up question from the interviewer is expected to be a 'dive deep' question. 'Deep Dive' and its synonyms are the keywords to represent that follow up question. If any of the keywords are matched, Alexa will respond accordingly in the role of an interviewee.

Configure hints and guidance: If none of the keywords are matched, Alexa will change its role into an instructor, offering hints and guidance. Based on the desired conversation path and observed conversation trajectory, Alexa will provide hints accordingly to nudge the interviewer towards the right next step. Different levels of hints are provided based on the number of failed trials on the same question.

Experimental result: We deployed the demonstrated example in a real world application. The desired learning outcome of the application is to develop the right interviewing skill as an interviewer. Experimental result shows around 10% improvement on the first attempt correctness on the following formative assessment with 15 learners.

CONCLUSIONS

In this work, we proposed to introduce Alexa into e-learning to address the big concern, lack of social interactions, of e-learning. We proposed and developed a configuration-driven conversation engine, which can support different learning needs with a few steps of configuring learning content. We demonstrated the process of creating an Alexa enabled learning experience with a simple skill, which is practicing asking follow up question in interviewing.

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