Artificial Intelligence (AI) *Chatbot* as Language Learning Medium: An inquiry

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**Abstract.** In facing industry revolution 4.0, utilizing advanced information and computer technology in educational environment is crucial. One of the advanced computation technologies that can be used for learning, especially language learning, is chatbot. *Chatbot* is a computer program based on artificial intelligence that can carry out conversations through audio or text. This study intends to find out and analyze the types of artificial intelligence in the form of chatbots and the possibility of their use as language learning medium. The data in this study obtained from literature review on chatbot researches, and from observation results on chatbot-based language learning medium developed by the author. The results indicated that chatbots have a high potential to be used as a language learning medium, both as tutor in practicing language, and as independent learning medium. Moreover, research results revealed that language learners are interested in using chatbots because they can be used anytime and anywhere, and they are more confident in learning languages using chatbots than when dealing directly with human tutors.

1. Introduction

The industrial revolution 4.0 has an impact on the urgency of education field to be able to keep up with these developments, which later brought the term Education 4.0 [1, 2, 3]. In embodying Education 4.0, one of the most required ability from educators and educational practitioners is to be able to integrate modern technology in their teaching [3]. The rapid development of smart phone technology, social media, and artificial intelligence (AI), provide challenges for educational practitioners to utilize these technologies in developing advance learning media. In latest decades, artificial intelligence utilization to develop applications is massively conducted, and its products used in almost every aspects of our life. This type of communication which occurs through digital technology rather than in person is called computer-mediated communication (CMC) [4]. CMC forms including instant messaging, email, chat rooms, online forums, social networks, and *chatbot* or chatterbot [5, 6]. *Chatbot* is a computer program or artificial intelligence which carries out conversations through audio or text [7], and interact with users in a particular domain or topic by giving intelligent responses in natural language [8, 9]. *Chatbot* for general purposes and for educational purposes have been developed [4,10,11]. However, despite *chatbots*’ unlimited possibility to enhance language teaching and learning, the concept of *chatbot* including its advantages as language learning medium is not yet widely known. Therefore, the purpose of this study is to analyze the types of artificial intelligence in the form of chatbots and the possibility of their use as language learning medium. This study also aims to observe a *chatbot* constructed as Japanese language learning medium developed by the author and team, and reports its’ results as an inquiry to find out further about the possibility of *chatbot* to enhance language learning and teaching.
2. Method
This study is a descriptive method study. The data collection in this study conducted through literature reviews on previous researches about chatbot and its use. Literature reviews performed to identify the type of chatbots, especially those developed for educational purposes including language learning, as well as to identify their advantages/disadvantages in language teaching and learning. This study also include a report on observation results on chatbot-based language learning medium developed by the author and team, namely Gengobot.

3. Findings and Discussion
The basic mechanism of chatbot begins with the message sent by the user. The message then processed by NLP (Natural Language Processing), and chatbot responded by replying to the message according to the existing database (see figure 1). For example, when a user sent "how are you?" message, chatbot will look for answers that match this question in the database such as “I am fine”, “Great!” etc.

3.1. The types of Chatbot
The type of chatbot found in this study can be categorized into three types based on its’ structure, purpose, and audience. The sub-categories and their functions is concluded in table 1.

| Category   | Sub-category          | Function                                                                                                                                 |
|------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Structure  | Flow chatbot          | A tree-based chatbot. This chatbot has fixed responds set by the developer, and only responds to questions that are already in the database. Flow chatbots include buttons, keywords, and catchphrases instead of free writing to drive the client down the predefined path. |
|            | Artificially intelligent | Chatbot with artificial intelligence has the ability update their knowledge and perception from previous conversations and users’ experience, letting the users engage more freely. |
|            | Hybrid                | This type of chatbot combines the concepts of Flow and AI chatbots. This chatbot can understand and communicate with users, but remains in the pattern determined by the developer. |
| Purpose    | Functionality         | This chatbots have certain functions depends on the developer (i.e. chatbot for learning, personal assistant, reminder, online shop assistant, etc.) |
|            | Fun                   | Chatbot that intended only for entertainment (i.e. games, funbot, etc.). |
| Audience   | Generalist            | This chatbot has general knowledge that we can ask directly. I.e. Siri developed by Apple, and Cortana developed by Microsoft. Both Chatbots can help us solve common problems such as searching for restaurants, locations and more. |
|            | Specialist            | This chatbot focus on one constrained thing and do that one thing extremely well (i.e. chatbots that used to serve customers online when ordering items). |
Table 1 shows that *chatbot* has several categories and can be developed according to the developer’s necessity. However, *chatbots* that are developed for educational purposes tend to use artificially intelligence structure. Artificially intelligent *chatbot* for general purpose such as MILABOT has also been developed [10]. MILABOT is a deep reinforcement learning chatbot which capable of conversing with humans on popular small talk topics through both speech and text. The system consists of an ensemble of natural language generation and retrieval models, including template-based models, bag-of-words models, sequence-to-sequence neural network and latent variable neural network models [10]. *Chatbots* that developed for educational purposes, especially for language learning, are described further in the following sub-section.

### 3.2. Chatbot in Language Learning and Teaching

*Chatbots* development to utilize learning and teaching have been conducted. *Freudbot* has been developed for psychology students to find out about student-content interaction in distance education. The results shows that the basic analysis of the chatlogs indicated a high proportion of on-task behavior. The findings also suggests that *chatbot* technology may be promising as a teaching and learning tool in distance and online education [12]. *Chatbot* use is also compared with humanoid robot in science lecture class, and reported that the visualization using *chatbot* was helpful for students to understand the lecture smoothly [13]. However, researches on *chatbot* use and development to enhance language learning rather difficult to find. This study identified researches on language teaching and learning as seen in table 2.

| First author (year) | Chatbot name | Subject | Focus | Sample | Research type |
|---------------------|--------------|---------|-------|--------|---------------|
| Jia (2004)          | -            | English, Germany as Foreign Language | Application of a Web-based Chatbot system on foreign language teaching | 1256 | Experiment |
| Fryer (2006)        | Cleverbot    | English as Foreign Language | Chatbot as *English* language learning tools | 211  | Experiment & survey |
| Jia (2009)          | CSIEC *chatbot* | English Learning | A computer assisted English learning *chatbot* based on textual knowledge and reasoning | 1783 | Experiment, survey & questionnaire |
| Goda (2014)         | Cleverbot    | English as Foreign Language | The use of Chatbot before online EFL discussion and The effect on critical thinking | 130  | Comparison based (Experimental & Control group) |
| Fryer (2017)        | Cleverbot    | English as Foreign Language | Comparison of chatbot and human task partners in English learning | 122  | Comparison based (Pre-test & Post-test) |

Table 2 shows that *chatbot* researches were mainly found in English language learning [14,15,16,17,18]. Research reported that the dialogs using *chatbot* are mostly very short because the users find the computer is much less intelligent as a human, since the responses from the computer are often repeated and irrelevant with the topics and the context. However, the results also indicates that
many participants are very interested in using chatbot as chatting partner in speaking foreign language, since it is accessible anywhere and anytime, while it is not easy to find native speakers as human chatting partner. The learners also more confident communicating with chatbot which is obviously less intelligent as the human themselves. It would be pedagogically attractive for the learner to chat with a system of artificial intelligence which could “really” understand the natural language and communicatively generate the natural language to form a human-like dialog [14].

Further, the main chatbot used in language learning researches as seen in Table 2 is Cleverbot, which developed by British AI scientist Rollo Carpenter in 1986 and went online on 1997. The results of researches of using Cleverbot reported that most students enjoyed using this chatbot [15,17]. They also generally felt more comfortable conversing with the bots than a student partner or teacher. However, the results also suggest that chatbots are generally only useful for advanced and/or very keen language students. Language teachers also need to get involved and bring chatbot technology into the foreign language learning classroom as a permanent tool for language practice [15]. Research reported that preceding conversation before classroom discussion with a chatbot lead to an increase in the number of contributions that students made to discussion [17]. Moreover, pre-discussion with a chatbot also could increase the students’ awareness of critical thinking and enable them to form inquiring mindsets [17]. However, the result of comparisons in speaking task with chatbot and human partner indicated a significant drop in students' task interest with chatbot, but not human partner. The reason of drop in task interest with chatbot was caused by novelty effect [18]. On the other hand, CSIEC chatbot reported successfully helped students with course unit review, make the students more confident, and improved students’ listening ability, as well as enhanced students’ interest in language learning. The comparison of examination results before and after the using chatbot showed great improvement of students’ performance [15].

From above results, it is understood that the use of chatbot gave many advantages in language learning and teaching, as in enhancing classroom motivation and learning [15,19]. However, chatbot also reported to have flaws comparing to human partner, especially in the novelty aspect [18]. Several researches and chatbot development for English language learning have been conducted, but chatbot development and researches in other languages teaching and learning is still difficult to find. As an attempt to answer this challenge, the author and team tried to develop a chatbot-based multi-language grammar application, namely Gengobot, which will be introduced further in the next sub-section.

3.3. Gengobot as Japanese Language Learning Medium

Gengobot is a chatbot-based dictionary application about multi-language grammar developed by the author, using CodeIgniter (CI) framework. CI is a PHP framework that can be used to develop PHP-based website application without the necessity to write all the code from the beginning. CI framework was chosen because it is an opensource framework and free to modify, smaller than other framework, and uses MVC (Model-View-Controller) concept that functioned in programming process to call needed databases easily. The main purpose of Gengobot development is to provide a Japanese grammar learning medium for beginner level of Japanese language learners. However, to broaden its’ use, the application also equipped with grammar contents in English and Indonesian, and integrated with social media LINE. LINE official account has Messaging API feature that allows an account to run chatbot that has been created (see figure 2). The database system used in Gengobot is MySQL (see figure 3 and figure 4). MySQL was chosen because it is free licensed, and the database structure used in MySQL is in table form which is flexible and easy to use. The database created for this chatbot including: (1) Database of user data storage, including name, language, training score, etc.; (2) Grammar database in three languages; (2) Questions database and their answer (for ‘Exercise’ feature).
Figure 2. LINE Messaging API and chatbot mechanism.

Figure 3. Gengobot database creation using MySQL.

Figure 4. The process of importing database using MySQL.

Figure 5. Gengobot interface designing process.

Gengobot consists of fixed responds including buttons, keywords, and catchphrases set as database. The buttons includes several menus as ‘Menu’, ‘Help’, ‘Language’, and ‘Contact’ option as shown in figure 5, as well as several sub-menus that developed under each menu. From observation and evaluation results, Gengobot was successfully developed as a language learning medium, especially to support students’ learning about Japanese grammar with description available in English and Indonesian. Gengobot also considered user friendly since it could be accessed through social media LINE. The features in Gengobot also includes ‘Exercise’, so the students not only able to learn about Japanese grammars, but also able to test their knowledge about grammars they have learned. However, Gengobot is a flow chatbot, so the interaction between users/students and chatbot still very limited to the inputted database. Although as grammar learning application it is still considered sufficient, to improve its’ use for enhancing language learning, as well as other language skills teaching and learning, Gengobot still need to be developed further in its’ technology and features.

4. Conclusion
This study aimed to analyze the types of chatbots and the possibility of their use as language learning medium. From the results, it is known that chatbot can be categorized into three types, and has advantages and disadvantages. As the advantages, chatbot is reported can help language learners through six ways: (1) students tend to feel more relaxed talking to a computer than to a person; (2) chatbots are willing to repeat the same material with students endlessly; (3) many bots provide both text and synthesized speech, allowing students to practice both listening and reading skills; (4) Bots are new and interesting to students; (5) students have an opportunity to use a variety of language structures and vocabulary that they ordinarily would not have a chance to use; (6) chatbots could potentially provide quick and effective feedback for students’ spelling and grammar [15]. However, chatbot also reported to have a flaw on its novelty aspects and need to be improved. This study also observed a chatbot-based Japanese language learning medium developed by the author, namely Gengobot. As the results, Gengobot have a high potential to be used as a Japanese language learning medium especially in learning grammar, yet need to be developed further in its’ technology and features.
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