This is the Title for LAK22 Data Challenge

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Abstract
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1. Introduction

Natural and flowing dialogue is an essential aspect of communication and creating shared understanding. Simulating dialogue has been one of the goals of researchers since the first chatbot, ELIZA, was developed more than 50 years ago (Weizenbaum, 1966). ELIZA utilised rudimentary natural language processing (pattern matching and substitution) to explore communication between humans and machines. Several variants of this system were created, including a therapist designed to mirror back a patient's words, as in Rogerian psychotherapy.

The use of chatbots has exploded in popularity over recent decades in numerous fields; including customer service, gaming, healthcare, and education (Adamopoulou & Moussiades, 2020a). Chatbots are automated agents which can provide real time interaction with users without requiring human input. Chatbots can take various forms. Interaction - both written and spoken - may take place with robots, through an online form, with NonPlayer Characters (NPCs) ingame, and personal mobile or home intelligent assistants (e.g. Alexa). Traditionally, chatbots have relied on rule and script-based approaches to respond to user input. Input that matched a certain pattern would result in a predetermined response. They proved to be useful for structured conversations, such as simple customer support and informational gathering. However, these agents were only able to handle interactions with the scope of their programming and unexpected or complex input was challenging. More advanced systems utilised decision trees and finite state machines to provide more versatility, but were still limited in their capabilities (Adamopoulou & Moussiades, 2020b). Advances in natural language processing, voice recognition and speech synthesis, have made chatbots even more useful and accessible. In particular the advent of generative artificial intelligence (AI) through LLMs has enabled chatbots to be more contextually aware and provide diverse and unique responses to the input they receive. This significant technological breakthrough has unlocked more natural and human-like conversations.

In the context of second language acquisition, practising dialogue is imperative for developing natural language skills and communication competence (Chapple, 2009). Conversing with chatbots is one of the closest approximations there is of conversation with real people. As native and proficient speakers for conversation practice can be challenging to access due to geographical, time, and resource constraints, chatbots provide an alternative for practice in a given target language. Also known as dialogue-based computer-assisted language learning (DB-CALL), chatbots have shown to have a significant positive effect on the development of second language proficiency (Bibauw et al.,

[1]Proceedings of the 4th Workshop on Predicting Performance Based on the Analysis of Reading Behavior, March 21-22, 2022
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2022; Deng & Yu, 2023; Lin, 2015). In language learning, chatbots can be used for conversation practice, roleplay, answering language related questions, conducting assessments, and providing feedback (Huang et al., 2022).

Huang et al. (2022) identifies three benefits of using chatbots for language learning:

- 24/7 access - chatbots are available on demand to support language learning
- Broad language knowledge - human language partners may have limited knowledge and experience in specific areas (e.g. American vs British English idioms). Chatbots can be built an trained for a variety of purposes depending on learners' needs
- "Tireless assistants" - chatbots are capable of conversing with learners endlessly whereas human language partners may tire.

Several limitations of chatbots have also been identified (Haristiani, 2019, Huang et al., 2022). These include:

- Novelty effect - heightened initial interest, enthusiasm, and engagement due to the chatbots newness and learner curiosity
- Formulaic and predictable responses (Croes & Antheunis, 2021)
- Lack of personalisation to individual learner needs and localisation issues (Lidén & Nilros, 2020)
- Lack of contextual understanding
- Technological limitations - unlike humans, chatbots can be more sensitive to erroneous input (such as spelling mistakes). They may also find it difficult to maintain conversational consistency or stay "on topic" (Fryer et al., 2019)

This paper presents a bibliometric analysis of peer review research articles from the Web of Science database on chatbots in the context of second language acquisition. It also explores the potential of LLMs in this space, and suggests opportunities and challenges for the future.

Specifically, this paper seeks to answer the following research questions (RQ):

- What are the publication trends in research on chatbots and English second language learning?
- Who are the key authors and research groups working on and researching chatbots for English second language learning?
- What are the milestone articles in the field of chatbots for English second language learning?
- What are the key themes - current and emerging, challenges, and future directions of chatbot use in English second language learning?

This paper presents a bibliometric analysis of the research in chatbots and English second language learning. It also provides a qualitative discussion on themes, potential gaps, challenges, and future implications in the field.

2. Related work

Several literature reviews and meta-analyses have been conducted in recent years. Pérez, Daradoumis, and Puig (2020) reviewed the literature on chatbots in the field of education. Using the review procedure outlined by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Page et al., 2021), they found that chatbots are regularly used and effective in education to assist and teach in a large variety of educational settings, including supporting learning for minority groups and learners with disabilities. Wollny et al. (2021) also reviewed chatbots in education - specifically where they have been applied and their pedagogical roles: learning, assisting, and mentoring. Four main chatbot objectives were distilled from their review: 1. Skill Improvement (e.g. provide content and practice), 2. Efficiency of education (e.g. automation of repetitive tasks), 3. Students' motivation, and 4. Availability of education (i.e. unbound by temporal or spatial constraints). Kuhail et al. (2023) reviewed 36 articles between 2011 and 2021 and found that over a third of chatbots were for computer science education. Further, over half of the chatbots surveyed were able to provide recommendations for educational content. Very few chatbots

were used for scaffolding, as motivational agents, and only two chatbots acted as teachable agents where the learners were tasked with teaching the chatbot. According to the review, most of the chatbots surveyed provided chatbot-driven conversation within a narrow knowledge domain; that is, the chatbot led and directed the conversation. Very few chatbots allowed user-driven conversations (presumably due to the technical complexity of implementing an open ended design). Despite this potential weakness, the review found that most experimental studies showed a statistically significant improvement in "learning and student satisfaction" (p. 1007).

Regarding language learning, in 2022, Bibauw et al. conducted a meta-analysis of studies on dialogue-based CALL. Results from 17 meta-analysable studies showed a significant medium effect of interaction with chatbots on target language proficiency (comparable with other CALL interventions such as game based learning); systems that provided corrective feedback were particularly effective. Zhai (2023) reviewed AI-based dialogue systems for improving the ESL interactional competence in university students. Also utilising the PRISMA process, they reviewed 28 articles published in the last 10 years. Through this systematic review, they identified six dimensions (made up of 25 sub-dimensions) that influence the application of chatbots for learning English: technological integration, task designs, student engagement, learning objectives, technological limitations, and the novelty effect. Zhai also identified current gaps in chatbot design for the higher education context, and suggested future research directions, including emphasising meaning based-communication, debate, and problem solving.

The current study will focus specifically on the use of chatbots in learning English as a second language. The advent of advanced Large Language Models (LLMs) has provided innovative solutions to many of the technical obstacles that earlier iterations of chatbot technology encountered.

3. Methodology

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3.1.1. Third level heading

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Table 1
Table title

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An Example of equation

$$E = mc^2, \tag{1}$$

where ...

An example of the Figure 1, which also uses cross-reference. The style should be switched to Normal.

Figure 1: Example figure

4. Acknowledgements

Identification of funding sources and other support, and thanks to individuals and groups that assisted in the research and the preparation of the work should be included in an acknowledgment section, which is placed just before the reference section in your document.

5. References

The references should be formatted according to the following gudelines: A paginated journal article [2], an enumerated journal article [3], a reference to an entire issue [4], a monograph (whole book) [5], a monograph/whole book in a series (see 2a in spec. document) [6], a divisible-book such as an anthology or compilation [7] followed by the same example, however we only output the series if the volume number is given [8] (so series should not be present since it has no vol. no.), a chapter in a divisible book [9], a chapter in a divisible book in a series [10], a multi-volume work as book [11], an article in a proceedings (of a conference, symposium, workshop for example) (paginated proceedings article) [12], a proceedings article with all possible elements [13], an example of an enumerated proceedings article [14], an informally published work [15], a doctoral dissertation [16], a master's thesis: [17], an online document / world wide web resource [18, 19, 20], a video game (Case 1) [21] and (Case 2) [22] and [23] and (Case 3) a patent [24], work accepted for publication [25], prolific author [26] and [27]. Other cites might contain 'duplicate' DOI and URLs (some SIAM articles) [28]. Multi-volume works as books [29] and [30]. A couple of citations with DOIs: [31, 28]. Online citations: [32, 18, 33, 34].

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