

ASSESSING THE IMPACT OF CHATBOT INTEGRATION IN INCREASING STUDENT ENGAGEMENT

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Article Information

Received: 10th January, 2024

Accepted: 22th January, 2024

Published: 8th February, 2024

KEYWORDS: Impact, Chatbot, Integration, Student, and Engagement

Publisher: Empirical Studies and Communication - (A Research Center)

Website: www.cescd.com.ng

ABSTRACT

The present research aims to examine the efficacy of using chatbots as a means to augment student engagement within the context of remote learning settings. The increasing prevalence of online education has underscored the need for preserving and enhancing student involvement. The objective of this study is to evaluate the effects of integrating chatbots on student engagement levels and investigate the influence of these artificial intelligence-driven technologies on the overall learning experience. The findings of this study have far-reaching consequences for educational institutions that are looking to implement novel approaches in order to improve the quality of distance learning experiences. This research provides significant insights to educators, administrators, and educational technology developers by elucidating the concrete advantages of integrating chatbots. In conclusion, it can be argued that chatbots have the capacity to fundamentally alter the dynamics of distance education, facilitating more profound levels of student participation and interaction within an educational environment that is augmented by technology.

Introduction

The use of e-learning has become more prominent in the field of education and training owing to its ability to provide customised teaching, improved accessibility, and greater flexibility. The use of a customised chatbot particularly intended for online education has the

potential to greatly augment students' engagement with their academic resources. The potential for enhancing the efficacy of e-learning may be realised via the integration of a chatbot developed using artificial intelligence (AI) and natural language processing (NLP) techniques. The chatbot's ability to rapidly reply to enquiries, provide personalised assistance, provide speedy feedback, and make unique ideas is the reason behind this. According to Nelson et al. (2019), The importance of ensuring student involvement and participation has significantly increased due to the rising frequency of online education. Kleopatra et al. (2022) argue that this particular strategy has advantages in terms of cost and time effectiveness when compared to traditional classroom instructional techniques. The use of chatbots inside educational environments holds significant promise for augmenting academic accomplishments. The scholarly literature has thoroughly examined the increasing prevalence of these technologies owing to their capacity to provide a customised and immersive learning encounter for students (Gonda et al., 2018; Cunningham-; Bezverhny et al., 2020; Villegas-Ch et al., 2020; Kuhail et al., 2022b). Gonda et al. (2018) propose that instructional agents play a crucial role in guiding students through virtual environments and provide tailored feedback via conversational interactions. According to the findings of Colace et al. (2018), there has been a noticeable upward trajectory in the use of chatbots in the context of online education. The fundamental objective behind this trend is to augment students' learning experiences. Wollny et al. (2021) and Troussas et al. (2022) have emphasised the significance of mobile learning as a key component of e-learning across several settings, including learning management systems, social network platforms, and digital learning platforms. Durall and Kapros (2020) and Okonkwo and Ade-Ibijola (2021) are notable experts who argue that chatbots has the ability to effectively provide a wide range of educational resources to students. The course materials include a diverse range of tools that effectively support the educational process within an academic environment. The resources include a variety of academic documents such as syllabi, sample tests, grading rubrics, due dates, academic counselling services, campus orientation materials, and supplementary study aids. Cunningham-Nelson et al. (2019) claim that the use of intelligent systems has promise in mitigating the burden on educators, hence enabling them to concentrate on enhancing and assessing their instructional framework. Consequently, this has the capacity to lead to heightened levels of student engagement.

Artificial intelligence chatbots have emerged as a viable tool for enhancing the capabilities of human instructors by providing immediate replies to students' inquiries and continuous educational assistance. The primary objective of this study is to investigate the effects of artificial intelligence (AI)-powered technologies, namely chatbots, on the dynamics of the educational setting and the extent of student involvement.

Overview of the Chatbot

According to Kay's (2015) study, the emergence of Artificial Intelligence in Education (AIED) may be dated back to the 1970s. Researchers, producers, and reviewers of instructional software dedicate their time and resources in the pursuit of this purpose. The collection of learner feedback, the evaluation of learner proficiency and identification of areas in need of improvement, the customization of instruction to meet the specific needs of individuals or a small group of students, and ultimately the utilisation of artificial intelligence methodologies to analyse and advance pedagogical theories are all crucial for the establishment of long-lasting educational goals. The role of Artificial Intelligence in Education (AIED) is very significant as it enables the integration of AI research with the fields of psychology and pedagogy in the context of education. The first diagram shown in Figure 1 presents two separate frameworks that demonstrate the integration of artificial

intelligence (AI) and education. The provided text lacks substantive information or contextual details. The amalgamation of these two disciplines is sometimes denoted as "Artificial Intelligence in Education" (AIED). The nascent interdisciplinary field in question has certain objectives and limitations as it strives to establish connections between the realms of artificial intelligence and education.

Education lays a strong emphasis on enabling pupils to fully develop their intellectual talents and innate cognitive powers, whereas artificial intelligence (AI) tends to prioritise teaching computers to imitate human thinking processes. The insights provided by AIED play a significant role in addressing this disparity by offering techniques to cultivate more effective and profound engagements with people, thereby enhancing educational achievements. Researchers who have a strong interest in the incorporation of artificial intelligence in the field of education are actively striving to broaden their knowledge of how these approaches can be successfully utilised to modify and improve students' educational experiences, thereby addressing their distinct and specific needs (Conati, Porayska-Pomsta, & Mavrikis, 2018). Since the advent of computers, researchers have shown a keen interest in assessing the effectiveness of AIED systems in comparison to human instructors (VanLehn, 2011). There has been a notable increase in the adoption of conversational interfaces powered by artificial intelligence. The notion of a chatbot gained considerable prominence with the unveiling of the Turing test by Alan Turing in 1950, also known as the investigation into computer intelligence (Turing, 2009, pp. 23–65). Joseph Weizenbaum is credited with the creation of Eliza in 1966, which is largely acknowledged as a groundbreaking chatbot. Eliza adopted the role of a psychotherapist by participating in a discussion typified by the use of probing questions in response to the feedback supplied by people. In the year 1995, Wallace (2009) designated Alice as the first Chatbot to achieve acknowledgment as a "Human Computer." The emergence and advancement of chatbot technologies, exemplified by Apple's Siri, Amazon's Alexa, IBM's Watson, Microsoft's Cortana, and Google's Assistant, may be ascribed to the advancements achieved in modern technology (Reis et al., 2018). Since the year 2016, there has been a significant progression in the field of chatbot development, leading to the emergence of several types of chatbot systems. The primary focus of the development of these systems has mostly been on applications within the business domain. According to Nayyar (2019), there has been a notable increase in the use of chatbot apps on digital platforms for the purpose of delivering academic assistance to students. The interpretation of the term "chatbot" may exhibit substantial variation. According to Ciechanowski et al. (2019), chatbots are software programmes that enable interactions between humans and computers, enabling users to participate in dialogues that simulate real-life exchanges with computers and other devices. Two examples of methodologies proposed in academic literature are a collaborative learning discourse (Ruan et al., 2019) and an automated system designed to provide resolutions to human queries (Rosruen & Samanchuen, 2018). According to Clarizia et al. (2018), chatbots are regarded as intelligent agents that possess the ability to interact with students and provide solutions to their queries via various methods. Smutny and Schreiberova (2020) and Okonkwo and Ade-Ibijola (2020) underscore the dominant conception of chatbots as interactive entities or conversational agents that provide users prompt and instantaneous responses. The use of chatbots to augment student involvement has become more prevalent in the current technology environment, where communication and several other activities mostly rely on digital platforms. The potential of the Chatbot system to develop into a viable mobile web application that can efficiently facilitate the learning process is exciting. Dsouza et al. (2019) have used chatbot technology in the field of education to enhance students' engagement capabilities and enable the implementation of automated teaching practises. According to Ondas et al. (2019), it is posited that interactions possess the capacity to augment both connectivity and effectiveness.

Cunningham-Nelson et al. (2019) suggest that online learning environments has the capacity to provide educational institutions a targeted, individualised, and results-oriented method of education, a characteristic that is generally recognised as very beneficial in the contemporary landscape.

The architecture of a chatbot system

Colace (2017) and Clarizia et al. (2018) have established an online chatbot system accessible through the URL <http://ailearning.edu.vn>. The architecture of the website is shown in Figure 1, while the interactions between the chatbot and users are illustrated in Figures1-2.

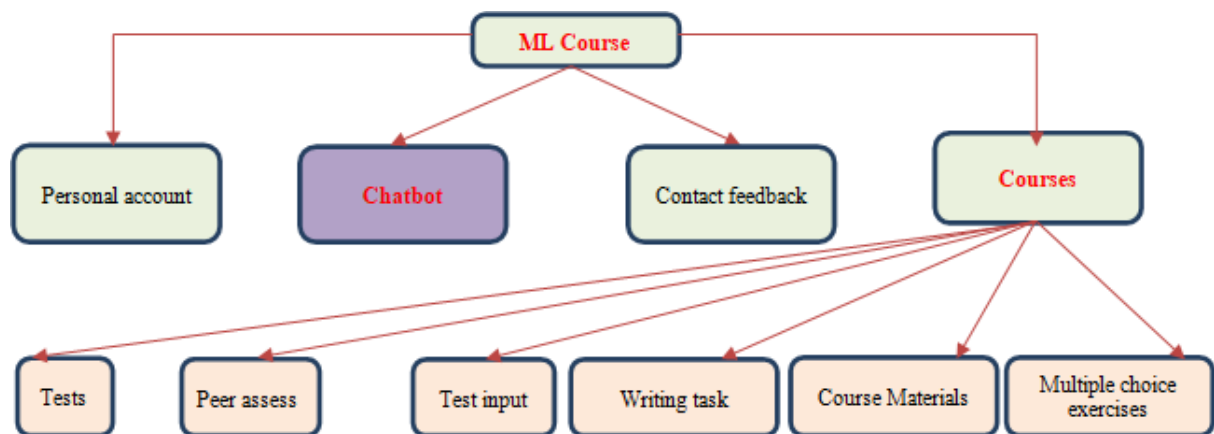


Figure 1: Structure diagram of the UML Course system

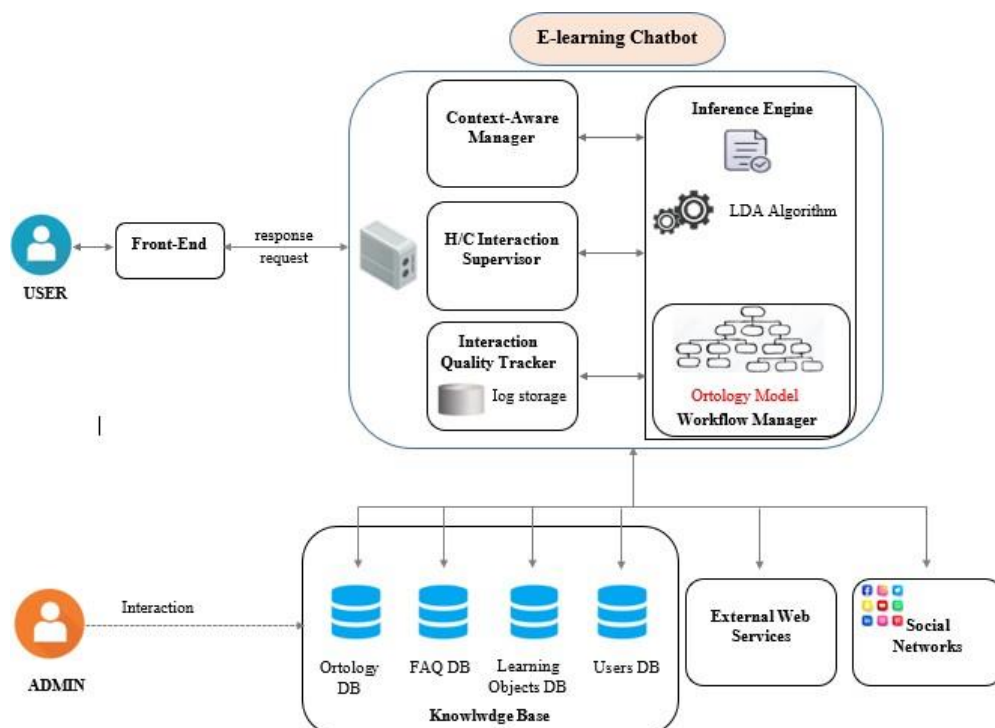


Figure 2: E - learning interactive system architecture (Colace, 2018)

Chatbot Frameworks

One may easily and quickly construct a chatbot using platforms like Google's Dialogflow, Microsoft's Azure Bot Framework, Facebook's Bots for Messenger, and Amazon's Alexa, to name just a few. A handful of the many powerful chatbot systems available today include ManyChat, Chatfuel, Converable, and GupShup. Numerous chatbot architectures are described by S. Raj (2019), including the following:

- **QnA Maker:** is a cloud-based tool from Microsoft for developing chatbots that answer queries using frequently asked questions (FAQs), URLs, and structured data.
- **Dialogflow:** Due to its ease of use and compatibility with a wide range of different services, the Google Cloud Framework is a frequently used cloud-based framework.
- **Rasa:** Any Python project may use the open-source Python frameworks NLU and Core.
- **AI:** is comparable to Rasa in that it functions primarily as a Javascript programming library with a graphical user interface (GUI). Additionally, Raj (2019) describes how to create a chatbot using Dialogflow and the RASA stack.

Benefits of Chatbots Application in Education

According to Winkler and Soellner (2018), the incorporation of chatbots in educational contexts has promise for enhancing students' academic achievements and general psychological well-being in the classroom setting. Numerous academic investigations have presented empirical data supporting the educational advantages linked to the incorporation of chatbots into the educational environment. Numerous scholars have undertaken investigations on the prospective uses of chatbots within educational environments. Notable contributors to this body of study include Duall and Kapros (2020), Hien et al. (2018), Mor et al. (2018), Ndukwe et al. (2019), Okonkwo and Ade-Ibijola (2020), Ranoliya et al. (2017), and Ureta and Rivera (2018).

The use of chatbots has several benefits within the educational domain. First and foremost, this technology facilitates cost savings via the optimisation of administrative procedures and the decrease of reliance on human involvement. Additionally, chatbots provide expedited response times, so facilitating timely and effective connection with pupils. Furthermore, chatbots has the capacity to enhance interactions via the provision of individualised and customised assistance to individual learners. In conclusion, the incorporation of chatbots in the field of education has the potential to cultivate distinct and captivating learning opportunities for pupils (Llic & Markovic, 2016; Bii, 2013). The underlying cause of this phenomena may be ascribed to the perception that chatbots provide a straightforward and dependable means of engaging in online communication (Cameron et al., 2017). Furthermore, the utilisation of chatbots has the capacity to augment productivity by virtue of their capability to attend to often posed inquiries, remedy persistent problems, and provide entry to educational resources (Garcia-Brustenga et al., 2018; Winkler & Söllner, 2018). Students may also use chatbots as a method to enhance their cognitive capabilities and bolster their capacity to retain, analyse, and store information. Chatbots has the capacity to elicit curiosity and engage persons due to their amiable and conversational attributes, alongside their aptitude for swiftly and effectively offering assistance or facilitating the acquisition of knowledge. Chatbots are regarded as a novel invention among the student population.

The use of chatbots in the field of electronic learning signifies a significant advancement. In relation to quality, these approaches are sometimes regarded as the most sophisticated means

of merging technology and education, successfully closing the divide. The use of chatbots designed to replicate interactions with real academics has the ability to provide students with a tailored learning environment, therefore presenting prospective advantages. Bots play a significant role in enhancing a student's academic performance via their active monitoring and analysis of the student's progress and learning habits.

The Influence of Chatbot Platforms on the Efficacy of Student Feedback

Hwang et al. (2021) assert that online education has several benefits, including the capacity to cater to individual student requirements and facilitate enhanced contact and cooperation between educators and learners, irrespective of geographical constraints or scheduling conflicts. Students may be provided with access to online feedback practises via many methods, each of which has its own distinct benefits and allows students to engage with the material at their own preferred speed. Electronic forms of feedback on written assignments include a range of activities, including monitoring modifications in Microsoft Word, expediting email correspondence, delivering spoken feedback during virtual meetings, capturing visual feedback via screen recordings, and receiving automated feedback provided by computer systems. In the year 2020, Cheng and Li conducted a study. Additionally, Ware and Warschauer (2006) and Liu et al. have also contributed to the field. According to the findings of Alharbi and Al-Hoorie (2020) as well as Liu et al. (2021), it was observed that students tend to express their viewpoints more often to their classmates and gain favourable responses in virtual educational settings when they maintain anonymity and conceal their facial characteristics.

According to Butler and Winne (1995), students are able to assess their own progress and identify areas for growth due to the feedback they get throughout the learning process. According to Sadler (1989), it is essential to give exact feedback that offers detailed information on a learner's actions or processes in order to narrow the disparity between their anticipated and actual understanding of the subject matter or skill development. Students use the feedback process as a means to address any deficiencies in knowledge and skills that may impede their academic success. According to many research conducted by Hattie and Timperley (2007), Nicol and Macfarlane-Dick (2006), and Parikh et al. (2000), it has been suggested that the process of receiving constructive criticism might facilitate learning. In their seminal work, Black and Williams (1998) conducted a comprehensive analysis of more than 250 research pertaining to the effects of feedback on student learning outcomes and satisfaction. Their findings revealed a significant positive impact of feedback, leading to enhanced levels of both academic achievement and student contentment. In order to ascertain the trustworthiness of their findings, Henderson et al. (2019) undertook a research study whereby they did a theme analysis of seven case studies and performed a comparative analysis of two specific case studies. The primary objective of this research was to ascertain the factors that contribute to the capacity to provide perceptive critique. The need of carefully creating feedback systems, which may be categorised into capability, projects, and culture, is evident based on these factors. The provision of feedback in online courses is of paramount importance due to the absence of direct interpersonal interaction among students (Ypsilandis, 2002). In order to facilitate the acquisition of knowledge and maintain the active participation of students in educational environments conducted online, when instructors and learners are physically and temporally distant from one another, According to Nicol and Macfarlane-Dick (2006), it is argued that educators are required to provide exceptional feedback. Previous research has shown that the provision of reinforcing remarks, specifically within the realm of online peer assessment, has a notable positive impact on the overall quality of students' work.

The use of chatbot platforms in facilitating Student Interactions

Chatbots, which are conversational instructional agents, have been used in the area of education since the 1970s (Laurillard, 2013). Pedagogical agents, often known as intelligent tutoring systems, refer to digital entities that guide users inside educational environments (Seel, 2011). Conversational Pedagogical Agents (CPAs) represent a distinct classification within the realm of pedagogical agents. Gulz et al. (2011) assert that these organisations use artificial intelligence (AI) to facilitate discourse-driven engagement among students. When designing computer-based learning environments, it is important to consider many elements, as highlighted by Gulz et al. (2011) and King (2002).

In order to facilitate meaningful discourse among students, conversational agents have the ability to use several forms of communication, including spoken language (Wik & Hjalmarsson, 2009), written text (Chaudhuri et al., 2009), and nonverbal cues (Wik & Hjalmarsson; Ruttkay & Pelachaud, 2006). According to Dehn and Van Mulken (2000), variations in the visual representation of the agent may be seen in terms of its dimensions, degree of movement, and similarity to actual individuals or animated figures. In the preceding decade, there has been a proliferation of conversational agents developed specifically for educational settings (Haake & Gulz, 2009). These individuals have the potential to fulfil roles as mentors, coaches, and study companions. Furthermore, conversational agents have been used to fulfil several requirements within the realm of education, such as offering assistance (VanLehn et al., 2007; Heffernan & Croteau, 2004), responding to inquiries (Feng et al., 2006), and facilitating the acquisition of a foreign language.

Chhibber and Law (2019) and Baylor (2011) have posited that chatbots has the capacity to fulfil several functions in the domain of student interaction, including but not limited to teaching agents, peer agents, teachable agents, and motivational agents. According to Kulik and Fletcher (2016) and Wambsganss et al. (2020), research suggests that teaching agents have the capability to provide instructions, examples, questions, and prompt feedback, similar to human instructors. In contrast, peer agents fulfil the role of educational partners for students, facilitating student engagement. The individual responsible for executing this approach has a lower level of expertise compared to the agent responsible for providing tutoring services. Nevertheless, peer advisors retain the ability to guide pupils in the appropriate manner. It is common for students to engage in conversations with their peers in order to clarify concepts or get a deeper knowledge of a topic that they are struggling to comprehend. Peer agents may play a crucial role in facilitating good learning dialogues among their peers.

In order to expedite the process of learning, students may provide teachable agents with personalised instructions. The agent assumes the role of a neophyte and solicits the class for advice on how to proceed with the instructional material. Baylor (2011) asserts that motivational agents serve as mere companions to students, providing support to enhance their self-assurance and promote good behaviour, rather than actively engaging in their educational pursuits.

According to Flstad et al. (2018), the nature of chatbot-user discussions might vary depending on the initiator, resulting in either chatbot-driven or user-driven interactions. Budiu (2018) asserts that a predominant characteristic of chatbot conversations is their adherence to a linear script, whereby the range of potential outcomes is constrained and contingent upon the user's input. The use of if-else logic is a common practise in the

development of chatbot systems. When there is consensus amongst the participants, the exchange of ideas in a discourse may go more smoothly. However, when users diverge from the authorised process, complications develop.

The use of artificial intelligence in user-initiated chats facilitates adaptable interactions, as it grants users the ability to depart from the predetermined script of a chatbot and pose a diverse range of inquiries. Chatbots may be categorised as either "one-way" or "two-way" based on the degree of control given to the user. According to Dutta (2017), user-driven chatbots use machine learning algorithms to evaluate user input and provide an appropriate response from a database of pre-existing text. In contrast, chatbots that are driven by user input and provide two-way communication use a strategy of carefully constructing individual phrases in order to deliver accurate and tailored replies to the user (Winkler & Söllner, 2018). De Angeli and Brahnam (2008) claim that chatbots have the capability to acquire knowledge from previous user encounters in similar contexts.

The Impact of Chatbots in Online Learning Experience

Clarizia et al. (2018) define chatbots as digital agents that possess the capability to function as virtual assistants, effectively handling enquiries and providing information in response. Several researchers have made advancements in the development of text-based chatbots (Salas-Pico & Yang, 2022; Topal et al., 2021). The ability of this chatbot to respond to user enquiries is facilitated by its adherence to a predetermined set of programmed rules. Computer systems or computers that possess the ability to acquire knowledge and improve their performance without human intervention are often known as "artificial intelligence" (AI) (Angelov et al., 2021). In recent years, scholars have focused their attention on chatbots (Salas-Pico & Yang, 2022; Topal et al., 2021). According to Angelov et al. (2021), individuals possess the ability to promptly examine inquiries and provide resolutions. Several chatbots have been discussed in the literature, including the Frequently Asked Questions chatbot (Han & Lee, 2022; Ranoliya et al., 2017), ELIZA, a pioneering Natural Language Processing software that simulated human-machine communication (Natale, 2019), and colMOOC, a conversational virtual agent designed to enhance learners' engagement in massive open online courses (Tegos et al., 2019).

Okonkwo and Ade-Ibijola (2020) conducted a study which revealed that a predominant focus of chatbot development in university settings is to provide assistance to educators. Mendoza et al. (2020) found that students who interacted with chatbots had positive attitudes. Several research (Hiremath et al., 2018; Mikic-Fonte et al., 2018; Pham et al., 2018; Sinha et al., 2020) have shown that students use chatbots as a means to inquire, get responses, and receive personalised support.

The study conducted by Yin et al. (2021) examined the academic achievements and levels of motivation among undergraduate students. The participants were picked at random and divided into two groups: the experimental group, which used chatbots as a means of assistance, and the control group, which did not. The findings indicated that there was little disparity in performance levels seen between the two groups. The use of the chatbot was shown to be positively associated with increased levels of motivation among students, in comparison to their counterparts who did not engage with the chatbot. In their work, Arruda et al. (2019) developed a chatbot with the specific aim of aiding computer science students in addressing their modelling requirements. Based on the results of the research, it was seen that students saw the chatbot to be beneficial, with a significant number expressing a desire to use it in subsequent instances. Kamita et al. (2019) conducted a study which found that the use of

chatbots and online courses had a beneficial effect on the mental well-being of students. Based on the findings of the study, it can be inferred that chatbots have a higher probability of achieving success in facilitating self-directed learning, enhancing motivation levels, and mitigating stress levels. The University of Georgia was responsible for the development and incorporation of the chatbot "Jill Watson" into a computer science course. According to Lipko (2016), the participants in the research exhibited a higher level of receptiveness than first expected and conveyed a strong interest in using the chatbot across various academic settings.

Overview of Distance Education for Students

One definition of student engagement is "students' willingness, need, desire, and compulsion to participate in, and be successful in, the learning process" (Bomia, Beluzo, Demeester, Elander, Johnson, & Sheldon, 2007). It is essential to employ pedagogical strategies that maximise student learning and participation in order to successfully conduct online courses. According to Mandernach, Donnelly-Sallee, and Dailey-Hebert (2011), engagement emphasises students' dispositions or attitudes towards classroom experiences and lifetime learning above their actual mastery of subject matter. Student engagement has been defined as the degree to which students pay attention, interact with one another in class, and have a desire to learn (Briggs, 2015). Student involvement is influenced by a variety of affective factors, including attitude, personality, motivation, effort, and self-confidence (Mandernach et al., 2011). According to research by Jaggars and Xu (2016), the quantity and quality of communication within predetermined boundaries positively correlate with students' success in online courses. If teachers measure their students' level of involvement and take these emotional elements into consideration when planning lessons and activities, they may be able to better motivate them to become interested in their learning and academics (Mandernach et al., 2011). When students have an intrinsic incentive to do well in their classes, a sincere interest in learning, and are ready to put in the work required by their teachers, they are more likely to be engaged in their education (Mandernach et al., 2011).

When teachers monitor their students' levels of engagement, they may modify their teaching strategies in response to shifts in their learners' motivation, participation, and perspective on the subject matter and their education in general (Mandernach et al., 2011). For assembling anecdotal evidence of student participation in online classes, teachers have access to a range of materials. Teachers can examine student data, including login times, time spent on learning modules, and content views, by using surveys, reflections, debates, and other formative tools (Grey & DiLoreto, 2015).

Potential of Chatbot Technology in Facilitating Distance Education

The pedagogical value of conversational interfaces is influenced by several elements, including effectiveness size (ES) and the benefits of chatbots in facilitating learning outcomes (Plantak Vukovac et al., 2021). Research has shown that the influence of chatbots on students' interactions with them and their courses is contingent upon their general features. According to the researchers, other characteristics, such as students' attitudes towards technology, learning abilities, and educational background, are identified as contributors to this correlation. There have been suggestions positing that the proactive support provided by chatbots, their integration with existing learning and instant messaging systems, their accessibility, and their reaction time are all contributing reasons to enhanced educational outcomes. Ranoliya et al. (2017) discovered two distinct characteristics that differentiate chatbots from other entities. Nevertheless, doing a comprehensive comparison and contrast of

the research at a macroscopic level is challenging due to the considerable heterogeneity in the study designs used throughout the published literature. Earlier this year, scholars proposed the development of a prototype for an educational chatbot. The purpose of its creation was to facilitate the preparedness of students for a certain set of advanced courses (Huang et al., 2021). The participants were instructed to sustain a state of concentrated concentration on their ability to effectively communicate and engage in sound decision-making for the whole of the activity. Kumar (2021) used several natural language processing techniques to identify questions, while using domain ontologies to ascertain the most suitable solutions. The use of chatbots has the capacity to significantly transform the manner in which students interact with course materials and seek clarification, particularly in light of the expansion of online education.

Provision of immediate assistance and engagement

- Real-Time Responses

Chatbots provide immediate answers to students' queries, enhancing the learning experience by eliminating delays in obtaining information or assistance (Essel, 2022).

- 24/7 Availability

Chatbots are accessible at any time, accommodating the diverse schedules and time zones of remote learners.

1. Personalised Learning Paths

- Adaptive Learning

Chatbots analyse student performance and preferences to create personalised learning paths, tailoring content to individual needs.

- Skill Assessments

Chatbots conduct skill assessments and quizzes to identify areas of strength and weakness, enabling students to focus on targeted learning.

1. Interactive Learning Experiences

- Gamified Learning

Chatbots incorporate gamification elements such as quizzes, challenges, and rewards, making learning more interactive and engaging.

- Role-Based Scenarios

Chatbots simulate real-world scenarios, allowing students to apply theoretical knowledge to practical situations.

1. Resource Recommendations

- Content Suggestions

Chatbots recommend supplementary resources, such as articles, videos, and ebooks, to enhance students' understanding of topics.

- Learning Material Customization

Chatbots curate learning materials based on students' preferences and learning styles, ensuring a tailored educational experience.

1. Language and Communication Practise

- Language Learning

Chatbots offer language learners the opportunity to practise conversational skills and receive language-related feedback.

- Conversational Practise

Students engage in simulated conversations with chatbots, improving communication and language proficiency.

1. Assignment Assistance and Grading

- Assignment Guidance

Chatbots provide instructions, tips, and guidelines for completing assignments effectively.

- Automated Grading

Chatbots grade assignments using predefined criteria, providing quick feedback to students.

1. Administrative Support

- Schedule Management

Chatbots assist students in managing their schedules, assignments, and deadlines.

- Enrollment and Registration

Chatbots guide students through the enrollment and registration process, simplifying administrative tasks.

The Effects of Integrating Chatbots on Student Engagement

The assessment of benefits and drawbacks of chatbot technology in the educational sector is necessary due to its nascent stage of development (Beckingham, 2019). Users should engage in experimentation with this technology to fulfil this demand. This elucidates the reasons for the limited use of chatbots within educational environments. However, according to recent research conducted by Winkler and Soellner (2018), the integration of chatbots in educational settings has shown significant enhancements in both academic achievements and student well-being. An increasing body of research indicates that chatbots has potential for use within educational environments. The chatbot named "Jill Watson" was created using the IBM

Watson platform (McFarland, 2016) and was specifically designed for the purpose of overseeing and facilitating forum conversations among students enrolled in a computer science course at the University of Georgia. The study resulted in an observed increase in student participation during class. The lack of personalised support provided by educational institutions significantly contributes to the low rates of student retention seen in massive open online courses (MOOCs). Chatbots have the potential to compensate for this limitation, especially in educational environments characterised by a vast scale, such as universities or Massive Open Online Courses (MOOCs). According to Sinha et al. (2019), it can be inferred that chatbots have the potential to support educators in delivering personalised teachings while minimising budgetary and temporal constraints.

Recent studies indicate that the prevalence of chatbots is increasing. According to the study, a majority of respondents, namely over 80%, reported having prior experience in engaging with a chatbot. A significant proportion of those who did not engage with a chatbot were seen to be aged 45 years or older. The current era has seen a notable surge in the popularity of chatbots, a phenomenon that has been well recorded in scholarly literature. Empirical studies have shown that young people, in particular, exhibit a high level of openness and acceptance towards this novel technological advancement (Almansor & Hussain, 2019).

In the pursuit of enhancing student engagement and promoting effective learning, educational institutions are increasingly considering the incorporation of chatbots as a promising solution. This study examined the possible utilisations of chatbots inside educational institutions, including the optimisation of administrative processes as well as the enhancement of students' opportunities for individualised learning.

Adaptive Learning Paths: Chatbots has the capacity to individualise education via the implementation of personalised learning paths. Using data pertaining to a student's learning style, interests, and progress. Chatbots have the potential to provide personalised education for students, enhancing their motivation, retention, and competence levels.

Targeted Support and Feedback: The use of chatbots to provide immediate and tailored solutions to student inquiries and issues has significant promise in enhancing students' comprehension of academic content and facilitating their resolution of learning obstacles.

Student Services and Administrative Support: Chatbots have the potential to assume several administrative responsibilities, including but not limited to scheduling, registration, and information dissemination. Furthermore, facilitating access to assistance for children not only enhances their support system but also optimises staff efficiency.

Streamlined Communication: Chatbots have been identified as a very efficient mechanism for disseminating news and event-related information to both faculty and students inside educational institutions. This ensures that instructors consistently remain informed and aligned.

Accessible Learning Materials: The use of chatbots may be advantageous for students with diverse learning styles and preferences since it enables them to access knowledge via a multitude of modalities. The facilitation of the integration of all pupils is enabled by this.

Learning Analytics: Analysing the data acquired by chatbots may provide teachers with valuable insights into their students' learning patterns and enable them to identify specific

areas of difficulty. Learning analytics may provide assistance in making instructional decisions.

Peer Interaction and Collaboration: Chatbots have the potential to enhance interpersonal communication and facilitate collaboration among individuals in the context of various jobs and projects. This feature enhances collaborative learning and interpersonal contact within online groups.

Challenges Associated with Chatbot Integration in Student Engagement

The potential of chatbots to optimise operations and improve customer service has generated interest across several industries, including academia. According to Okonkwo and Ade-Ibijola (2020), the development of chatbots targeting college students primarily takes into consideration the needs and preferences of teachers. Mendoza et al. (2020) reported on the notable positive feedback received from students subsequent to their use of a chatbot. According to many studies (Hiremath et al., 2018; Mikic-Fonte et al., 2018; Pham et al., 2018; Sinha et al., 2020), students use chatbots for various objectives, such as gathering information, receiving responses to inquiries, and engaging in personalised instruction.

The research found that there was no statistically significant disparity in learning outcomes between the experimental and control groups, regardless of whether they received help from a chatbot. However, the findings did indicate that learners who interacted with the chatbot had higher levels of motivation. Arruda et al. (2019) reached out to undergraduate students studying computer science in order to engage them in the development of a chatbot designed for goal-oriented requirements modelling. The study conducted by Kamita et al. (2019) revealed that the integration of chatbots in online educational settings had positive outcomes in terms of students' mental well-being. Specifically, the use of chatbots was shown to enhance self-directed learning, increase motivation levels, and alleviate stress among students. The University of Georgia has built a chatbot named "Jill Watson" specifically designed for use in a computer science course. According to a study conducted by Lipko (2016), there was a higher level of engagement and interest among students who used the chatbot, leading to a desire to utilise it again in subsequent lectures.

Research studies conducted by Harper et al. (2003), Sandu and Guide (2019), and Vlachopoulos and Makri (2021) have shown that students' ability to understand and remember course material improves when they are at ease with seeking clarification by asking questions. There is a notable challenge faced by students at the University of Ghana in terms of their ability to actively engage in classroom discussions. The reason for this is that an increase in class size results in a decrease in the amount of personal attention provided by professors (Essel et al., 2019). There exists a potential reluctance among students to engage in questioning due to concerns over the potential reaction from the teacher (Oktaria & Soemantri, 2021; Verleger & Pembridge, 2018).

Integrating chatbots into student engagement processes can offer numerous benefits, but it also presents several challenges that institutions need to address. Here are some common challenges associated with chatbot integration in student engagement:

Initial Resistance and Acceptance: Students and staff might be initially resistant to interacting with chatbots, viewing them as impersonal or inadequate replacements for human interaction. Overcoming this resistance and fostering acceptance is crucial for successful integration.

User Experience and Design: Designing chatbots with a user-friendly interface and a natural language processing system that understands various student inquiries can be challenging. Poor user experience could lead to frustration and reduced engagement.

Accuracy and Reliability: Ensuring that chatbots provide accurate and reliable information is essential. If a chatbot provides incorrect information, it can erode trust and undermine the purpose of using the technology.

Lack of Personalization: Chatbots, especially simple ones, might struggle to provide personalized responses tailored to individual student needs. This limitation can affect the quality of interactions and engagement.

Limited Scope of Responses: Chatbots often have predefined responses based on frequently asked questions. However, they might struggle to handle complex or unique queries that fall outside their programmed scope.

Data Privacy and Security: Chatbots require access to student data, which raises concerns about data privacy and security. Institutions must ensure that sensitive information is protected and that the chatbot adheres to privacy regulations.

Integration with Existing Systems: Integrating chatbots with existing student information systems, learning management systems, and communication platforms can be technically challenging. Compatibility issues may arise, affecting the chatbot's performance.

Training and Maintenance: Chatbots need continuous training and updates to improve their performance and accuracy. This requires resources and technical expertise.

Cultural and Linguistic Challenges: Chatbots might struggle with understanding regional accents, colloquial language, or cultural nuances, especially in diverse student populations.

Loss of Human Touch: While chatbots can provide quick responses, they lack the empathy and human touch that some students may seek during sensitive or emotional interactions.

Addressing these challenges involves a combination of technological improvements, user training, ongoing monitoring, and continuous improvement. Institutions should carefully assess their specific needs and develop a comprehensive strategy for integrating chatbots into their student engagement processes.

Conclusion

In conclusion, the assessment of the impact of chatbot integration in increasing student engagement has provided valuable insights into the evolving landscape of education technology and its potential to enhance student experiences. Through this study, we have gained a deeper understanding of the multifaceted implications that chatbot integration holds for both educational institutions and their student populations.

The findings of this research highlight the significant strides that can be made in fostering student engagement through the strategic incorporation of chatbot technology. By providing rapid and tailored responses to inquiries, chatbots have demonstrated their capacity to improve accessibility to information, streamline administrative processes, and enhance communication channels. This newfound efficiency not only benefits students by addressing

their needs promptly but also frees up administrative personnel to focus on more complex tasks that require a human touch.

However, it is essential to acknowledge the nuanced nature of student engagement. While chatbots offer a convenient and accessible means of interaction, they should be seen as complementary to, rather than replacements for, human engagement. The human connection, empathy, and personalized guidance that educators and advisors provide remain irreplaceable elements in fostering holistic student development. Thus, successful chatbot integration requires a delicate balance between automation and preserving the human touch.

In closing, this study illuminates the transformative power of chatbot integration in augmenting student engagement within educational settings. By leveraging this technology thoughtfully and collaboratively, institutions can elevate the educational experience, fostering a dynamic learning environment where students feel supported, empowered, and equipped for success.

Recommendations

Based on the study assessing the impact of chatbot integration in increasing student engagement, here are some recommendations for institutions looking to effectively implement and utilize chatbots to enhance student engagement:

Select a chatbot platform that aligns with your institution's goals and technical capabilities. Consider factors such as natural language processing capabilities, integration options with existing systems, scalability, and ease of customization.

Prioritize user experience and design a chatbot interface that is intuitive, visually appealing, and user-friendly. Ensure that the chatbot can effectively understand and respond to a range of student inquiries.

Implement advanced algorithms to enable chatbots to provide personalized responses and recommendations based on students' profiles, preferences, and behaviors. This enhances the feeling of individualized attention.

Establish a robust content management system to ensure that the information provided by the chatbot is accurate, up-to-date, and aligned with institutional policies. Regularly update the chatbot's knowledge base.

Integrate the chatbot seamlessly with existing student information systems, learning management systems, and communication platforms. This enables the chatbot to provide timely and relevant information.

Make the chatbot accessible across various platforms, including websites, mobile apps, and social media. This accommodates different communication preferences and devices used by students.

By implementing these recommendations, institutions can leverage chatbots as effective tools to enhance student engagement, streamline communication, and provide valuable support services.

References

- Alkhawaja, I., & Abd Halim, B. (2019). Challenges of e-learning system adoption in Jordanian higher education *International Journal of Academic Research in Business and Social Sciences*, 9(9), 487–494.
- Almarabeh, T., Mohammad, H., Yousef, R., & Majdalawi, K. (2014). The University of Jordan e-learning platform: State, students' acceptance, and challenges *Journal of Software Engineering Applications*, 7(12), 999
- Al-Salman, S., and Haider, S. (2021). Jordanian university students' views on emergency online learning during COVID-19 *Online Learning*, 25(1), 286-302.
- Al-Shboul, M., Rababah, O., Al-Saideh, M., Betawi, I., & Jabbar, S. (2013). A vision to improve e-Learning at the University of Jordan, *World Applied Sciences Journal*, 21(6), 902–914.
- Brewer, R., & Movahedazarhouli, S. (2018). Successful stories and conflicts: A literature review on the effectiveness of flipped learning in higher education *Journal of Computer-Assisted Learning*, 34(4), 409–416.
- Cameron, K. E., & Bizo, L. A. (2019). Use the game-based learning platform KAHOOT! to facilitate learner engagement among animal science students. *Research in Learning Technology*, 27, 1–14.
- Canals, L., & Al-Rawashdeh, A. (2019). Teacher training and teachers' attitudes towards educational technology in the deployment of online English language courses in Jordan, 32(7), 639–664.
- Car, T., Dhinakaran, A., Kyaw, M., Kowatsch, T., Joty, S., Theng, Y., & Atun, R. (2020). Conversational agents in health care: a scoping review and conceptual analysis
- Chang, C. Y., Hwang, G. J., & Gau, M. L. (2022). Promoting students' learning achievement and self-efficacy: A mobile chatbot approach for nursing training *British Journal of Educational Technology*, 53(1), 171–188.
- Chaudhuri, S., Kumar, R., Howley, I.K., & Rosé, C.P. (2009). Engaging collaborative learners with helping agents In *AIED* (pp. 365–372).
- Chen, L., Widarso, G., & Sutrisno, H. (2020). A chatbot for learning Chinese: Learning achievement and technology acceptance *Journal of Educational Computing Research*, 58(6), 1161–1189.
- Chen, P., Chen, Z., & Lin, K. (2020). Artificial intelligence in education: A review, pp. 75264–75278
- Chen, Y., Jensen, S., Albert, L. J., Gupta, S., & Lee, T. (2022). Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success *Information Systems Frontiers*, 25(2), 1–22.

- Cheng, H., & Li, L. (2020). Teaching and learning with children: Impact of reciprocal peer learning with a social robot on children's learning and emotional engagement
Computers and Education
- Chhibber, N., & Law, E. (2019). Using conversational agents to support learning by teaching
- Ciechanowski, L., Przegalinska, A., & Magnuski, P. (2019). Gloor, In the Shades of the Uncanny Valley: An Experimental Study of Human-Chatbot Interaction, *Future Generation Computer Systems*, 92 (2019), pp. 539–548.
- Clarizia, F., Colace, M., Lombardi, F., Pascale, F., & Santaniello, D. (2018). Chatbot: An Education Support System for Students, *International Symposium on Cyberspace Safety and Security*, Springer
- Cunningham-Nelson, S., Boles, W., Trouton, L., & Margerison, E. (2019). A review of chatbots in education: Practical steps forward 30th annual conference for the Australian Association for Engineering Education (AAEE 2019): Educators becoming agents of change: Innovate, integrate, Engineers Australia, motivate
- De Angeli, A., & Brahmam, S. (2008). I hate you! disinhibition with virtual partners
Interacting with computers, 20(3), 302–310.
- Dehn, D.M., & Van Mulken, S. (2000). The impact of animated interface agents: a review of empirical research *International Journal of Human-Computer Studies*, 52(1), 1–22.
- Dsouza, R., Sahu, S., Patil, R., & Kalbande, D. (2019). Chat with bots intelligently: A critical review and analysis 2019 International Conference on Advances in Computing, Communication, and Control (ICAC3), pages 1–6.
- Durall, E., & Kapros, E. (2020). Co-design for a competency self-assessment chatbot and survey in science education, international conference on human-computer interaction, Springer (2020).
- Dutta, D. (2017). Developing an intelligent chat-bot tool to assist high school students in learning general knowledge subjects (Tech. Rep., Georgia Institute of Technology)
- Essel, B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E., & Baah, K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education *International Journal of Educational Technology in Higher Education*, 19(1), 1–19.
- Feng, D., Shaw, E., Kim, J., & Hovy, E. (2006). An intelligent discussion bot for answering student queries in threaded discussions In *Proceedings of the 11th International Conference on Intelligent User Interfaces* (pp. 171–177).
- Flstad, A., Skjuve, M., & Brandtzaeg, B. (2018). Different chatbots for different purposes:towards a typology of chatbots to understand interaction design In *International Conference on Internet Science* (pp. 145–156).
- Frangoudes, F., Hadjjaros, M., Schiza, E. C., Matsangidou, M., Tsivitanidou, O., & Neokleous, K. (2021). An overview of the use of chatbots in medical and healthcare

- education Learning and Collaboration Technologies: Games and Virtual Environments for Learning, 8th International Conference, LCT 2021, 170–184.
- Griol, D., Garca-Herrero, J., & Molina, J. (2011). The educagent platform: Intelligent conversational agents for e-learning applications In *Ambient Intelligence: Software and Applications* (pp. 117–124). Springer.
- Gulz, A., Haake, M., Silvervarg, A., Sjöden, B., & Veletsianos, G. (2011). Building a social conversational pedagogical agent: Design challenges and methodological approaches In *Conversational Agents and Natural Language Interaction: Techniques and Effective Practises* (pp. 128–155), IGI Global
- Haake, M., & Gulz, A. (2019). A look at the roles of look and role in embodied pedagogical agents—a user preference perspective *International Journal of Artificial Intelligence in Education*, 19(1), 39–71.
- Han, W., Park, J., & Lee, H. (2022). Analysis of the effect of an artificial intelligence chatbot educational programme on non-face-to-face classes: A quasi-experimental study *BMC Medical Education*, 22(1), 1–10.
- Heffernan, T., and Croteau, A. (2004). Web-based evaluations show differential learning for tutorial strategies employed by Ms. Lindquist. In *International Conference on Intelligent Tutoring Systems* (pp. 491–500).
- Hien, H., Cuong, P., Nam, L., Nhung, H., & Thang, L. (2018). Intelligent assistants in higher-education environments: Fit-ebot, a chatbot for administrative and learning support *Proceedings of the ninth international symposium on information and communication technology* (2018)
- Hiremath, G., Hajare, A., Bhosale, P., Nanaware, R., & Wagh, K. (2018). Chatbot for the education system *International Journal of Advance Research, Ideas, and Innovations in Technology*, 4 (3) (2018), pp. 37–43.
- Hwang, J., & Chang, Y. (2021). A review of the opportunities and challenges of chatbots in education, *Interactive Learning Environments*, 1–14.
- Ismail, M., and Ade-Ibijola, A. (2019). Lecturer's Apprentice: A chatbot for assisting novice programmers 2019 international multidisciplinary information technology and engineering conference (IMITEC), pages 1–8. IEEE (2019).
- King, R. (2023), Chatgpt: A Conversation on Artificial Intelligence, Chatbots, and Plagiarism in Higher Education, *Mol. Bioeng.*, 16, 1–2.
- Kulik, A., & Fletcher, D. (2016). Effectiveness of intelligent tutoring systems: a meta-analytic review *Review of Educational Research*, 86(1), 42–78.
- Kumar, A., & Silva, A. (2020). Work-in-progress: A preliminary study on students' acceptance of chatbots for studio-based learning 2020 IEEE Global Engineering Education Conference (EDUCON), 1627–1631.

- Lin, C., and Mubarak, H. (2021). International forum of educational technology and society learning analytics for investigating the mind map-guided AI chatbot approach in an EFL flipped classroom Technol. Soc. 24, 16–35.
- Lin, M., & Chang, D. (2020). Enhancing post-secondary writers' writing skills with a chatbot Journal of Educational Technology & Society, 23 (1) (2020), pp. 78–92.
- Liu, W., Lowe, R., Serban, V., Noseworthy, M., Charlin, L., & Pineau, J. (2016). How NOT to evaluate your dialogue system: An empirical study of unsupervised evaluation metrics for dialogue response generation, arXiv preprint arXiv:1603.08023.
- Llic, J., & Markovic, B. (2016). Possibilities, Limitations, and Economic Aspects of Artificial Intelligence Applications in Healthcare, Ecoforum Journal, 5(1), 1–8.
- Mabunda, K., and Ade-Ibijola, A. (2019). Pathbot: An intelligent chatbot for guiding visitors and locating venues In the 2019 6th International Conference on Soft Computing and Machine Intelligence (ISCMI), pages 160–168, IEEE (2019),
- Mendoza, S., Hernandez-Leon, M., Sanchez-Adame, L., Rodriguez, J., De Couchant, D., & Meneses-Viveros, A. (2020). Supporting student-teacher interaction through a chatbot: an international conference on human-computer interaction
- Mikic-Fonte, F., Llamas-Nistal, M., & Caeiro-Rodriguez, M. (2018). Using a chatterbot as a FAQ assistant in a course about computer architecture, 2018 IEEE Frontiers in Education Conference (FIE), pages 1–4. IEEE (2018)
- Molnar, G., and Szuts, Z. (2018) The role of chatbots in formal education In the 2018 IEEE 16th International Symposium on Intelligent Systems and Informatics (SISY), pages 000197–000202
- Mor, E., Santanach, F., Tesconi, S., & Casado, C. (2018). Code Lab: Designing a conversation-based educational tool for learning to code. International conference on human-computer interaction
- Ndukwe, I., Daniel, B., and Amadi, C. (2019). A machine-learning grading system using chatbots International conference on artificial intelligence in education
- Nieves, B. (2018). IA conversacional: Definición y Conceptos Básicos. Planeta Chatbot. Retrieved from <https://planetachatbot.com/ia-conversacional-conceptos-basicos-y-ladefinicion-107529e213c1>.
- Okonkwo, C., and Ade-Ibijola, A. (2020). Python-bot: A chatbot for teaching Python programming Engineering Letters, 29 (1)
- Okonkwo, W., & Ade-Ibijola, A. (2021). Chatbot applications in education: A systematic review Computers and Education: Artificial Intelligence, 2, 1–10.
- Ondas, S., Pleva, M., & Hladek, D. (2019). How chatbots can be involved in the education process is discussed in the 2019 17th International Conference on Emerging eLearning Technologies and Applications (ICETA), pages 575–580.

- Pane, F., Steiner, D., Baird, D., Hamilton, S., & Pane, D. (2017). How Does Personalised Learning Affect Student Achievement?
- Pham, X., Pham, T., Nguyen, Q., Nguyen, T., & Cao, T. (2018), Chatbot as an Intelligent Personal Assistant for Mobile Language Learning, in Proceedings of the 2018 2nd International Conference on Education and E-Learning, pages 16–2.
- Reis, A. Paulino, D., Paredes, D., Barroso, I., Monteiro, M., Rodrigues, J., & Barroso, J. (2018). Using intelligent personal assistants to assist the elderly: an evaluation of Amazon Alexa, Google Assistant, Microsoft Cortana, and Apple Siri. 2018 2nd International Conference on Technology and Innovation in Sports, Health, and Wellbeing (TISHW), pages 1–5.
- Rosruen, N., and Samanchuen, T. (2018). Chatbot utilisation for medical consultation systems: 3rd Technology Innovation Management and Engineering Science International Conference
- Ruane, E., Birhane, A., & Ventresque, A. (2019). Conversational AI: Social and Ethical Considerations, AICS (2019), pp. 104–115.
- Ruttkay, Z., & Pelachaud, C. (2006). From Brostotrust: Evaluating Embodied Conversational Agents, vol. 7. Berlin: Springer Science & Business Media.
- Sharwar, B. A., & Atwell, E. S. (2007). Chatbots: Are They Really Useful? Journal for Language Technology and Computational Linguistics, 22(1), 29–49.
- Shawar, B. A. (2005): A corpus-based approach to generalising a chatbot system School of Computing, University of Leeds, Leeds
- Singh, R. (2018) AI and chatbots in education: What does the future hold? Retrieved from <https://chatbotsmagazine.com/ai-and-chatbots-in-education-what-does-the-futurehold-9772f5c13960>.
- Sinha, S., Basak, S., Dey, Y., & Mondal, A. (2020). Springer is an educational chatbot that answers questions.
- Tegos, S., Demetriadis, S., & Karakostas, A. (2015). Promoting academically productive talk with conversational agent interventions in collaborative learning settings Computers & Education, 87, 309–325.
- Turing, A. (2009). Computing machinery and intelligence Parsing the test
- Ureta, J., and Rivera, J. (2018) Using chatbots to teach stem-related research concepts to high school students
- VanLehn, K., Graesser, A., Jackson, G.T., Jordan, P., Olney, A., & Rosé, C.P. (2007). Natural language tutoring: A comparison of human tutors, computer tutors, and text Cognitive Science, 31(1), 3–52.

- Wambsganss, T., Winkler, R., Söllner, M., & Leimeister, M. (2020). A conversational agent to improve response quality in course evaluations. In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems* (pp. 1–9)
- Weizenbaum, J. (1966). Eliza—a computer programme for the study of natural language communication between man and machine *Communications of the ACM*, 9 (1) (1966), pp. 36–45.
- Wik, P., & Hjalmarsson, A. (2009). Embodied conversational agents in computer-assisted language learning *Speech Communication*, 51(10), 1024–1037.
- Wimpenny, K., Adefila, A., & DeWinter, A. (2018). Jordan Opportunity for Virtual Innovative Teaching and Learning: A Needs Analysis Report Contextualising the State of the Art in International Online Teaching and Learning, with Particular Attention to the Jordanian Case Coventry University.
- Winkler, R., & Söllner, M. (2018). Unleashing the potential of chatbots in education: A state-of-the-art analysis
- Xu, A., Liu, Z., Guo, Y., Sinha, V., & Akkiraju, R. (2017). A new chatbot for customer service on social media *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 3506-3510)
- Yin, J., Goh, T. T., Yang, B., & Xiaobin, Y. (2021). Conversation technology with micro-learning: The impact of chatbot-based learning on students' learning motivation and performance *Journal of Educational Computing Research*, 59(1), 154–177