



Chatbots and Flipped Learning: Enhancing Student Engagement and Learning Outcomes through Personalised Support and Collaboration

FX. Risang Baskara^{1,2}

¹ Swinburne University of Technology, Sarawak Campus, Malaysia

² Universitas Sanata Dharma, Yogyakarta, Indonesia



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ABSTRACT

Objective: This paper explored the relationship between chatbots and flipped learning in an educational setting. It also identifies the benefits and drawbacks of using chatbots in a flipped learning context and the ethical and privacy concerns related to their use. **Method:** The study utilized a theoretical analysis approach, which included a comprehensive review of relevant literature from Scopus and World of Science databases. The data collected from the literature review was analyzed using a qualitative approach. **Results:** The study found that chatbots can potentially enhance student engagement and learning outcomes in a flipped learning context by providing personalized support, facilitating group discussions and collaborations, providing feedback and assessment on student work, supporting self-directed learning, and enhancing student engagement and motivation. However, using chatbots in a flipped learning context also raises ethical and privacy concerns, including data privacy, data security, and student anonymity. **Novelty:** Contributes to the existing research on using chatbots in education by providing insights into the potential benefits and drawbacks of using chatbots in a flipped learning context. The study highlights the importance of considering the ethical and privacy concerns and the future potential of chatbots in a flipped learning context and proposes future research directions.

INTRODUCTION

Advances in technology have led to new approaches to education, including the use of flipped learning and chatbots. These technologies can potentially enhance student engagement and learning outcomes by providing personalized support and opportunities for active learning (Diwanji et al., 2018; Gonda & Chu, 2019; Lin & Mubarok, 2021; Tangkittipon et al., 2020). Flipped learning, for instance, inverts the traditional classroom model, allowing students to engage in activities outside class and utilizing class time for discussions and problem-solving (El-Miedany, 2019; Rossano et al., 2022; Yusuf & Taiye, 2021). This approach has increased student engagement and motivation (Almodaires et al., 2019). Similarly, chatbots provide students with personalized support and facilitate collaboration, feedback, and assessment (Chen et al., 2021; Frangoudes et al., 2021; Kumar & Silva, 2020). These programs simulate human conversation and can provide students with a more engaging and interactive learning experience (Suhel et al., 2020). Therefore, the use of flipped learning and chatbots in education has become increasingly popular, with many Educators seek to leverage these technologies potential to enhance student learning outcomes.

The current research aimed to examine the relationship between chatbots. It flipped learning by providing a theoretical framework explaining how the two can effectively support student learning. The study reviews relevant flipped learning and chatbot literature, highlighting critical theoretical frameworks and concepts. It also analyses the

potential benefits and drawbacks of using chatbots in a flipped learning context, such as increased student engagement and improved learning outcomes, as well as any potential ethical and privacy concerns that may arise in using chatbots in this context. The study also suggests future directions for research on this topic. The use of technology in education is not a new concept; over the years, various technologies have been used to enhance student engagement and learning outcomes (Bouchrika et al., 2021; Cameron & Bizo, 2019; Serrano et al., 2019). However, the use of chatbots in a flipped learning context is still in its infancy, and more research must be done on the topic.

This research addresses that gap by providing a theoretical framework that explains how chatbots and flipped learning can be integrated to enhance student engagement and learning outcomes. The theoretical framework of this study draws on the critical principles of flipped learning, such as active learning and student-centered instruction (Kiang & Yunus, 2021; Law et al., 2020; Li et al., 2021; McLean & Attardi, 2023; Tomas et al., 2019). The study explores how chatbots can support these principles by providing personalized support for students outside of class, facilitating group discussions and collaborations, and providing feedback and assessment on student work (Gupta & Chen, 2022; Huang et al., 2022; Kim et al., 2020, 2021; Shin et al., 2022). The research is also significant as it provides educators with a better understanding of the potential benefits and drawbacks of using chatbots in a flipped learning context. The findings of this research have the potential to inform the design and implementation of chatbots in flipped learning environments to enhance student engagement and learning outcomes.

The current study is not the first to examine the use of chatbots in education. However, using chatbots in education is challenging (Huang et al., 2022; Hwang & Chang, 2021; Kuhail et al., 2022; Okonkwo & Ade-Ibijola, 2021; Tsivitanidou & Ioannou, 2020; Wollny et al., 2021; Yang & Evans, 2019). One of the main challenges is the ethical and privacy concerns related to using chatbots in education (Chen et al., 2022). The study also examines these challenges and suggests ways to address them in a flipped learning context. However, previous studies have focused on using chatbots in traditional classroom settings (Bahja et al., 2020; Yin et al., 2021), and more research should be needed on using chatbots in a flipped learning context.

Flipped learning is a pedagogical approach that inverts the traditional classroom model by having students watch video lectures and engage in activities outside class. Class time is used for active learning activities such as discussions and problem-solving (Brewer & Movahedazarhouli, 2018). Research on flipped learning has shown that it can increase student engagement and learning outcomes (Bergmann & Sams, 2014). Chatbots are computer programs that are designed to simulate human conversation. Research on the use of chatbots in education has primarily focused on their use in traditional classroom settings, with studies showing that chatbots can improve student engagement and learning outcomes (Abbas et al., 2022; Hew et al., 2022).

The use of chatbots in a flipped learning context is still in its infancy, and there needs to be more research on the topic. However, some studies have suggested that chatbots can support the critical principles of flipped learning, such as active learning and student-centered instruction (Diwanji et al., 2018; Varnavsky, 2022). For example, chatbots can provide personalized support for students outside of class, facilitate group discussions and collaborations, and provide feedback and assessment on student work.

While the use of chatbots in a flipped learning context has the potential to enhance student engagement and learning outcomes, there are also potential drawbacks and

challenges. One of the main challenges is the ethical and privacy concerns related to using chatbots in education (Bahja et al., 2020). These concerns include data privacy, data security, and student anonymity. Additionally, there are concerns about the reliability and validity of the feedback provided by chatbots (Vanichvasin, 2021). Chatbots are only as good as the information they are programmed with, and their feedback may only sometimes be accurate or appropriate.

The use of chatbots in the context of flipped learning presents promising opportunities for enhancing student engagement and improving learning outcomes, despite the potential challenges that come with it. Although the existing literature on chatbots in education has primarily focused on their use in traditional classroom settings, integrating chatbots with flipped learning has received little attention from scholars (Chen et al., 2022; Jeon, 2021). To bridge this gap, the present study provides a theoretical framework that illuminates how chatbots can support flipped learning principles and enhance student engagement and learning outcomes. This approach has the potential to facilitate active learning and student-centered instruction.

This study aimed to explore the relationship between chatbots and flipped learning in an educational context. Specifically, this study seeks to identify the benefits and drawbacks of using chatbots in a flipped learning context and the ethical and privacy concerns related to their use. The study will use a theoretical analysis approach to review relevant literature and analyze the collected data. The findings of this study will contribute to the existing research on the use of chatbots in education and provide insights into the potential of chatbots in a flipped learning context. The study will also propose future research directions, emphasizing the importance of addressing the ethical and privacy concerns related to using chatbots in education and exploring the full potential of chatbots in a flipped learning context. This study is of significant value to educators, policymakers, and researchers in the field of education, as it provides insights into the potential of chatbots to enhance student engagement and learning outcomes in a flipped learning context and highlights the importance of addressing the ethical and privacy concerns related to their use.

RESEARCH METHOD

This study employed a theoretical analysis approach to explore the relationship between chatbots and flipped learning. The study utilized a comprehensive review of relevant literature from Scopus and World of Science databases to gather data. The literature review was carried out with a focus on identifying the key benefits, drawbacks, ethical and privacy concerns, and the future direction of chatbots in a flipped learning context.

The literature review followed a systematic and iterative process, identifying articles using relevant keywords and evaluating their relevance and quality. The articles selected for inclusion in the review were evaluated based on their research design, methodology, and the quality of the findings. The literature review was conducted rigorously and systematically, ensuring that the selected articles represented the research on the topic.

The data collected from the literature review was analyzed using a qualitative approach. The analysis involved the identification of key themes and patterns, which were used to develop a theoretical framework for the study. The theoretical framework was developed by identifying the fundamental principles of flipped learning and exploring how chatbots can support these principles.

The theoretical framework was then used to identify the benefits and drawbacks of using chatbots in a flipped learning context. The benefits and drawbacks were evaluated based on their impact on student engagement and learning outcomes. The ethical and privacy concerns related to using chatbots in education were also identified and analyzed. Finally, the study proposed future directions for research on the topic. The future directions were identified based on the gaps in the current research and the potential for further exploration of the topic. The future directions proposed included the development of ethical and privacy-compliant chatbot systems, providing accurate and appropriate feedback, enhancing student engagement and motivation, supporting self-directed learning and student autonomy, and evaluating the effectiveness of chatbots in a flipped learning context.

The theoretical framework of this study draws on the critical principles of flipped learning, such as active learning and student-centered instruction. The study explores how chatbots can support these principles by providing personalized support for students outside of class, facilitating group discussions and collaborations, and providing feedback and assessment on student work.

Table 1. Steps in employing a theoretical analysis approach in studying chatbots in a flipped learning context.

Step	Description
Step 1	To gather data, they conducted a comprehensive literature review from Scopus and World of Science databases.
Step 2	They evaluated the relevance and quality of the articles selected for inclusion in the review based on their research design, methodology, and findings.
Step 3	We analyzed the data collected using a qualitative approach, identifying key themes and patterns to develop a theoretical framework for the study.
Step 4	They used the theoretical framework to identify the benefits and drawbacks of using chatbots in a flipped learning context based on their impact on student engagement and learning outcomes.
Step 5	They identified and analyzed ethical and privacy concerns about using chatbots in education.
Step 6	Future research directions on the topic include developing ethical and privacy-compliant chatbot systems, providing accurate and appropriate feedback, enhancing student engagement and motivation, supporting self-directed learning and student autonomy, and evaluating the effectiveness of chatbots in a flipped learning context.

Active learning is crucial to education. However, the principle of flipped learning emphasizes student engagement and participation in the learning process (Hyun et al., 2017; Khan et al., 2017). Chatbots can support active learning by providing personalized support for students outside of class, such as answering questions, explanations, and feedback on student work. This can increase student engagement and motivation in the learning process. Chatbots can be programmed to adjust their responses based on student feedback, allowing them to provide custom solutions to common student issues. This can make learning more effective, efficient, and enjoyable for students. Additionally, research has found that using chatbots in flipped learning can improve student learning outcomes (Khan et al., 2017). Chatbot technology can also be used to facilitate group activities and collaborative learning. For example, it can foster discussion and debate, provide instant feedback on group work, and provide guidance

on project-based learning. This helps create an engaging and interactive learning environment for students.

Student-centered instruction is another fundamental principle of flipped learning. At the same time, it emphasizes the needs and interests of the student. Chatbots can support student-centered instruction by providing personalized support for students, such as recommending additional readings or providing study tips. This can increase student motivation and engagement in the learning process. Chatbots can also diagnose students' misunderstandings, allowing teachers to quickly identify areas of confusion and create targeted lessons to address the issue. Additionally, chatbots can provide students with immediate feedback, allowing them to adjust their learning strategies in real time (Chen et al., 2020). This can help to improve student performance and boost overall learning outcomes. Chatbots can also facilitate peer-to-peer learning, providing an interactive platform where students can collaborate and share information (Kuhail et al., 2022). This can create an environment of mutual support and accountability, encouraging students to engage further with the subject matter. Finally, chatbots can track student progress, allowing teachers to identify student strengths and weaknesses and tailor instruction accordingly (AIDhaen, 2022).

Additionally, chatbots can help create a more flexible learning environment, allowing students to learn at their own pace and in their way. With a chatbot, students can learn topics as deeply as they choose and always access support when needed (Chen et al., 2022). This helps facilitate a more comprehensive understanding of the studied topics, leading to excellent knowledge retention. Furthermore, chatbots can also help to measure student progress and provide feedback in real-time (Devi et al., 2022). Through this, instructors can better identify improvement areas for the individual student and the course. This allows for more targeted instruction and a more tailored learning experience that can lead to improved outcomes.

Chatbots can create virtual discussion forums or facilitate group projects, allowing students to collaborate and share ideas flexibly and asynchronously. Chatbots in a flipped learning context can facilitate group discussions and collaborations (Kim et al., 2020; Lebeuf et al., 2017). This can increase student engagement and motivation in the learning process. Chatbots can also provide feedback and assessment on student work (Pérez et al., 2020; Tsivitanidou & Ioannou, 2020), such as essays or programming assignments. This can be done efficiently and accurately, allowing for a more effective assessment of student learning.

Moreover, chatbots can be used to generate learning materials adapted to the individual needs of students (Winkler & Söllner, 2018). This can help ensure students receive personalized learning experiences, increasing engagement and motivation. Finally, chatbots can facilitate communication between instructors and students (Mendoza et al., 2022), allowing more effective and timely responses to questions or concerns. Chatbots can effectively reduce instructors' workload, allowing them to focus on more pressing tasks. Furthermore, chatbots can provide 24/7 support to students, allowing them to access assistance and resources whenever needed. Ultimately, using chatbots can result in improved student outcomes and increased satisfaction. The theoretical framework of this study also suggests that chatbots can support self-directed learning (Han et al., 2022; Sharma et al., 2022). Chatbots can be programmed to provide students with resources and support for self-directed learning by recommending additional readings or providing study tips. This can help to increase student autonomy and ownership of their learning. Furthermore, chatbots can enhance student

engagement and motivation (Abbas et al., 2022; Essel et al., 2022). Chatbots can be designed to be engaging and interactive, which can help to increase student motivation and engagement in the learning process. This can be achieved using conversational interfaces, gamification, and other interactive features.

Regarding ethical and privacy concerns, using chatbots in a flipped learning context must be done carefully and with the student's best interests in mind. Chatbots should be programmed to respect student privacy and data security and to maintain student anonymity (Hasal et al., 2021). Additionally, the use of chatbots in a flipped learning context should be done in compliance with relevant laws and regulations (Jeon et al., 2022).

Schools and educators should be aware of any potential risks. They are associated with using chatbots, such as the potential for bias in the programming of the chatbot (Zabel & Otto, 2021). Furthermore, using chatbots in a flipped learning context should be done with appropriate safeguards, such as an opt-out option for students who do not wish to participate (Valério et al., 2020). Additionally, educators should ensure that they have complete visibility into the process of the chatbot's conversation with students so that any inappropriate interaction can be monitored and addressed. Finally, students should be made aware of any potential risks associated with using chatbots and allowed to opt in or out of the chatbot.

In summary, the theoretical framework of this study suggests that chatbots can be used to support the critical principles of flipped learning, such as active learning and student-centered instruction. Chatbots can provide personalized support for students, facilitate group discussions and collaborations, provide feedback and assessment on student work, support self-directed learning, and enhance student engagement and motivation. The use of chatbots in a flipped learning context also needs to consider ethical and privacy concerns and be in compliance with relevant laws and regulations. Table 2 outlines how chatbots support the critical principles of flipped learning, including active learning, student-centered instruction, self-directed learning, and collaboration. Chatbots provide personalized student support, enhance student engagement and motivation, and facilitate communication between instructors and students.

Table 2. Chatbots and flipped learning: Supporting critical principles.

Critical Principles	Chatbots' Support
Active learning	Personalized support, answering questions, explanations, and feedback on work Custom solutions to common student issues based on student feedback Increased student engagement and motivation Improved learning outcomes Facilitation of peer-to-peer learning Student progress tracking
Student-centered instruction	Personalized support, such as recommending readings and providing study tips Diagnosis of misunderstandings, targeted instruction Immediate feedback, adjustment of

Critical Principles	Chatbots' Support
Self-directed learning	learning strategies Support for self-directed learning, resources, and study tips Increased student autonomy and ownership of learning Enhance student engagement and motivation.
Collaboration	Facilitation of group discussions and collaborations Increased student engagement and motivation Feedback and assessment of student work

RESULTS AND DISCUSSION

Results

Chatbots in a flipped learning context can enhance student engagement and learning outcomes. Chatbots can be used to answer student questions, provide explanations, and give feedback on student work, which can help to increase student engagement and motivation in the learning process. One of the main benefits of using chatbots in a flipped learning context is the ability to provide personalized support for students (Chang et al., 2022; Chen et al., 2022). Another benefit of using chatbots in a flipped learning context is the ability to facilitate group discussions and collaborations. Chatbots can create virtual discussion forums or facilitate group projects, allowing students to collaborate and share ideas flexibly and asynchronously (Kim et al., 2020, 2021). This can increase student engagement and motivation in the learning process. Chatbots can also provide feedback and assessment on student work, such as essays or programming assignments (Cotton et al., 2023; Haque et al., 2022; Zhai, 2022). This can be done efficiently and accurately, allowing for a more effective assessment of student learning.

Chatbots can also support self-directed learning. Chatbots can be programmed to provide students with resources and support for self-directed learning by recommending additional readings or study tips (Prondoza & Panoy, 2022; Yin et al., 2021). This can increase student autonomy and ownership of their learning. Furthermore, chatbots can also enhance student engagement and motivation. Chatbots can be designed to be engaging and interactive, which can help to increase student motivation and engagement in the learning process (Chen et al., 2022; Kuhail et al., 2022). This can be achieved using conversational interfaces, gamification, and other interactive features.

However, using chatbots in a flipped learning context has potential drawbacks and challenges. One of the main challenges is the ethical and privacy concerns related to using chatbots in education (Følstad et al., 2021). Using chatbots raises concerns about data privacy, security, and student anonymity. These concerns must be addressed to ensure chatbots' safe and responsible use in a flipped learning context. To ensure student safety and privacy, organizations should establish protocols and policies to guide the use of chatbots when delivering flipped learning content. Additionally, organizations must ensure that the chatbot is programmed to protect student anonymity and that no personal information is stored during the interaction (Hasal et al., 2021). Furthermore, organizations should train educators to use chatbots securely

and responsibly. Another drawback of using chatbots in a flipped learning context is the reliability and validity of the feedback provided by chatbots (Chuah & Kabilan, 2021). Chatbots are only as good as the information they are programmed with, and their feedback may not always be accurate or appropriate. This can lead to confusion and frustration for students, and it is crucial to consider the reliability and validity of chatbot-provided feedback. Additionally, there is a possibility that the use of chatbots in a flipped learning context may lead to a decrease in the amount of human interaction between students and teachers. This can lead to a lack of personalization and a decrease in the effectiveness of the learning experience.

To remedy this, chatbots should be programmed with a wide range of accurate and appropriate feedback options that can be tailored to the individual student's needs. Furthermore, educators should be mindful of the amount of human interaction available to students and create opportunities for meaningful engagement with teachers and peers (Furrer et al., 2014). Finally, chatbots should be used in a way that supplements the teaching experience and does not replace the need for more personal and human interactions. In order to do this, educators should be trained in using chatbot technology and how to use it effectively in the classroom. Additionally, students should be taught how to use the chatbot to optimize learning outcomes and recognize when more human interaction is needed. Finally, the chatbot should be monitored to promptly provide accurate and appropriate student responses.

Chatbots in a flipped learning context can enhance student engagement and learning outcomes. However, potential drawbacks and challenges must be considered, such as ethical and privacy concerns, feedback reliability and validity, and decreased human interaction (Følstad et al., 2021; Haristiani, 2019). Considering and addressing these drawbacks and challenges is essential to ensure chatbots' safe and effective use in a flipped learning context. Furthermore, chatbots should be well-designed and implemented to ensure the most effective use. It should also be evaluated regularly to ensure the chatbot provides the expected benefits without causing more harm than good.

Firstly, ethical and privacy concerns are paramount when implementing chatbots in education. The use of chatbots raises concerns about data privacy, security, and student anonymity. To ensure the safe and responsible use of chatbots in a flipped learning context, protocols, and policies must be established to guide their use. Additionally, chatbots must be programmed to protect student anonymity, and organizations must train educators to use chatbots securely and responsibly. Another concern is the reliability and validity of the feedback provided by chatbots. While chatbots can provide efficient and immediate feedback, it is essential to consider the accuracy and appropriateness of the feedback. Our study found that the feedback provided by chatbots could be tailored to the individual student's needs. However, educators should be mindful of the amount of human interaction available to students and create opportunities for meaningful engagement with teachers and peers. Finally, it is crucial to recognize the potential decrease in human interaction between students and teachers when using chatbots in a flipped learning context. To ensure the most effective use of chatbots, educators should be trained in using chatbot technology and how to use it effectively in the classroom. Students should also be taught how to use the chatbot to optimize learning outcomes and recognize when more human interaction is needed.

In conclusion, further discussion is needed to address the potential drawbacks and challenges of using chatbots in a flipped learning context. Our findings suggest that the

benefits of using chatbots outweigh the potential risks when used responsibly and effectively. With proper guidance and training, chatbots can be an excellent tool to enhance student engagement and learning outcomes in a flipped learning context.

Discussion

Using chatbots in a flipped learning context raises several ethical and privacy concerns. One of the main concerns is the protection of student data. Chatbots collect and store student data; keeping it private and secure is crucial. This includes ensuring student data is not shared with third parties without the student's consent. Appropriate security measures are in place to protect the data from unauthorized access.

Another concern is the anonymity of students. Chatbots can facilitate group discussions and collaborations, and it is essential to maintain student anonymity in these contexts (Neto & Fernandes, 2019). This includes ensuring that student names or other identifying information are not shared with other students or third parties without the student's consent. Another concern is the reliability and validity of the feedback provided by chatbots. Chatbots are only as good as the information they are programmed with, and their feedback may only sometimes be accurate or appropriate (Jenneboer et al., 2022). This can lead to confusion and frustration for students, and it is essential to consider the reliability and validity of chatbot-provided feedback.

Additionally, using chatbots in a flipped learning context raises concerns about bias. Chatbots are programmed based on data and algorithms, and ensuring that the data and algorithms used do not perpetuate biases is essential (Hasal et al., 2021). This includes being aware of the potential for bias in the data used to train the chatbot and ensuring that the chatbot is tested for bias. Another concern is the potential for chatbots to replace human interaction and personalization in the learning process (Shumanov & Johnson, 2021). While chatbots can provide personalized support for students, it is crucial to ensure that using them does not decrease human interaction between students and teachers. This can lead to a lack of personalization and a decrease in the effectiveness of the learning experience.

Lastly, it is vital to ensure that the use of chatbots in a flipped learning context is done in compliance with relevant laws and regulations. This includes ensuring that chatbots follow data protection laws and regulations, such as the General Data Protection Regulation (GDPR) in the European Union (Regulation GDPR, 2018). Furthermore, chatbots should be monitored closely to ensure they are used ethically and do not violate laws and regulations. Additionally, it is crucial to consider the users' privacy and ensure that the data collected is used for the intended purposes and is not misused. To ensure this, organizations should implement appropriate policies and procedures for the use of chatbots and should provide relevant training for the staff responsible for monitoring these chatbots. Moreover, organizations should put in place measures to ensure that data collected by chatbots is securely stored and used only for the intended purposes.

In summary, the use of chatbots in a flipped learning context raises several ethical and privacy concerns, including the protection of student data, the anonymity of students, the reliability and validity of feedback, the potential for bias, the potential for replacing human interaction and personalization, and compliance with relevant laws and regulations. Addressing these concerns and ensuring chatbots' safe and responsible use in a flipped learning context is essential. Using chatbots in a flipped learning context can potentially enhance student engagement and learning outcomes; however,

it raises several ethical and privacy concerns. Addressing these concerns is essential for the safe and responsible use of chatbots in education. In this section, we discuss future research directions that focus on exploring the full potential of chatbots in a flipped learning context and addressing the challenges associated with their use.

One promising area of future research is the development of ethical and privacy-compliant chatbot systems. This includes ensuring student data is kept private and secure, maintaining student anonymity, and complying with relevant laws and regulations. Future research should investigate ways to ensure that chatbots are designed and implemented with appropriate protocols and policies to ensure their safe and ethical use in education. Another critical area of research is the development of chatbot systems that provide accurate and appropriate feedback. Research should investigate ways to improve the reliability and validity of chatbot-provided feedback and ensure that feedback is not biased (Kim et al., 2021). Additionally, research should explore the development of chatbot systems that provide personalized and adaptive feedback tailored to individual student needs and preferences.

Enhancing student engagement and motivation in the learning process is another promising area of research. Research should explore ways to make chatbots more engaging and interactive, using gamification and other interactive features. Additionally, research should investigate the role of chatbots in supporting self-directed learning and student autonomy. This includes investigating ways to provide students with resources and support for self-directed learning. Future research should also investigate the use of chatbots in assessing student learning. This includes exploring ways to use chatbots to provide feedback on student performance and ways to use chatbots to provide formative and summative assessments. Additionally, research should investigate the integration of chatbots with existing educational platforms and technologies, including learning management systems and other educational technologies.

Finally, future research should focus on evaluating and assessing the effectiveness of chatbots in a flipped learning context. This includes investigating the impact of chatbots on student engagement, motivation, and learning outcomes and evaluating the effectiveness of different chatbot implementations. To determine the effectiveness of chatbots in a flipped learning context, it is essential to measure student performance, feedback, and student-bot interactions. Additionally, qualitative data such as interviews and focus group discussions should be used to gain further insights into how students perceive using chatbots in a flipped learning context. Furthermore, research should evaluate the cost-effectiveness and scalability of chatbots to assess their usability in a wide range of educational contexts.

In summary, future research on using chatbots in a flipped learning context should focus on addressing the challenges associated with their use and exploring their full potential. This includes developing ethical and privacy-compliant chatbot systems, providing accurate and appropriate feedback, enhancing student engagement and motivation, supporting self-directed learning and student autonomy, and evaluating the effectiveness of chatbots in a flipped learning context. These research directions can lead to the safe and effective use of chatbots in education and contribute to improving student learning outcomes.

The use of chatbots in a flipped learning context is an area ripe for further investigation. The integration of chatbots with flipped learning has the potential to enhance student engagement and learning outcomes, but some potential drawbacks

and challenges need to be addressed. Future research in this field should address these challenges and explore the full potential of chatbots in a flipped learning context. One area of future research is the development of ethical and privacy-compliant chatbot systems. This includes ensuring student data is kept private and secure, maintaining student anonymity, and ensuring compliance with relevant laws and regulations. Another area of future research should focus on developing chatbot systems that can provide accurate and appropriate feedback. This includes investigating ways to improve the reliability and validity of chatbot-provided feedback and exploring methods to ensure that chatbot feedback is not biased.

Additionally, future research should explore ways to enhance student engagement and motivation in the learning process by using chatbots. This includes investigating ways to make chatbots more engaging and interactive and exploring the use of gamification and other interactive features. Another area of research should investigate the role of chatbots in supporting self-directed learning and student autonomy. This includes looking at ways to provide students with resources and support for self-directed learning. Finally, research should investigate the use of chatbots in assessing student learning (Okonkwo & Ade-Ibijola, 2021). This includes exploring ways to use chatbots to provide feedback on student performance and ways to use chatbots to provide formative and summative assessments. Additionally, research should investigate the integration of chatbots with existing educational platforms and technologies. This includes exploring ways to effectively integrate chatbots with existing learning management systems and other educational technologies.

One final area of research should focus on developing methods and frameworks for evaluating the effectiveness of chatbot systems in educational settings. This includes looking at ways to measure the impact of chatbot systems on student learning outcomes and evaluating the usability and effectiveness of chatbot systems (Bahja et al., 2020; Pérez et al., 2020). Additionally, research should explore using chatbot systems for personalized and adaptive learning. This includes investigating ways to create personalized learning experiences and exploring methods for using chatbots to adapt to individual student needs and preferences.

Lastly, future research should also focus on evaluating and assessing the effectiveness of chatbots in a flipped learning context. This includes investigating the impact of chatbots on student engagement, motivation, and learning outcomes and evaluating the effectiveness of different chatbot implementations. To determine the effectiveness of chatbots in a flipped learning context, it is essential to measure student performance, feedback, and student-bot interactions. Additionally, qualitative data such as interviews and focus group discussions should be used to gain further insights into how students perceive using chatbots in a flipped learning context. Furthermore, it is essential to consider the cost-effectiveness of chatbot implementations compared to traditional teaching methods. Similarly, the scalability of chatbots should also be evaluated to assess their usability in a wide range of educational contexts.

In summary, future research on using chatbots in a flipped learning context should focus on addressing the challenges and exploring the full potential of chatbots in this context. This includes developing ethical and privacy-compliant chatbot systems, providing accurate and appropriate feedback, enhancing student engagement and motivation, supporting self-directed learning and student autonomy, and evaluating the effectiveness of chatbots in a flipped learning context.

CONCLUSION

Fundamental Findings: This paper has provided a theoretical analysis of the relationship between chatbots and flipped learning in an educational setting. The study identified the benefits and drawbacks of using chatbots in a flipped learning context and the ethical and privacy concerns related to their use. The study highlights that chatbots can potentially enhance student engagement and learning outcomes in a flipped learning context. However, their use must be well-designed and implemented to ensure their effectiveness. **Implication:** The study has important implications for educators, policymakers, and researchers in the field of education. It emphasizes the importance of addressing the ethical and privacy concerns related to using chatbots in education and the need for further research to explore the full potential of chatbots in a flipped learning context. Additionally, the study highlights the need for well-designed and implemented chatbot systems that can provide accurate and appropriate feedback, enhance student engagement and motivation, and support self-directed learning. **Limitation:** The study is limited because it only provided a theoretical analysis of the relationship between chatbots and flipped learning. Future research should focus on conducting empirical studies to evaluate the effectiveness of chatbots in a flipped learning context. **Future Research:** The study proposes future directions for research on the topic. Future research should address the challenges and explore the full potential of chatbots in a flipped learning context. This includes developing ethical and privacy-compliant chatbot systems, providing accurate and appropriate feedback, enhancing student engagement and motivation, supporting self-directed learning and student autonomy, and evaluating the effectiveness of chatbots in a flipped learning context. The proposed future research will enhance our understanding of the potential of chatbots in a flipped learning context and provide insights for educators, policymakers, and researchers in the field of education.

In conclusion, this study provides important insights into using chatbots in a flipped learning context. The study identifies the benefits and drawbacks, ethical and privacy concerns, and future directions for research. The study emphasizes the importance of addressing the ethical and privacy concerns related to using chatbots in education and the need for further research to explore the full potential of chatbots in a flipped learning context.

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***FX. Risang Baskara (Corresponding Author)**

Faculty of Business, Design and Arts, Swinburne University of Technology, Sarawak Campus,
Jalan Simpang Tiga, 93350 Kuching, Sarawak, Malaysia
English Letters Department, Faculty of Letters, Universitas Sanata Dharma,
Jl. STM Pembangunan, Mrican, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa
Yogyakarta 55281
Email: risangbaskara@usd.ac.id
