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INVESTIGATING INFLUENCE OF CHATBOT ON STUDENT LEARNING AT ONE OF THE RURAL UNIVERSITIES IN SOUTH AFRICA

ДОСЛІДЖЕННЯ ВПЛИВУ ЧАТ-БОТІВ НА НАВЧАННЯ СТУДЕНТІВ В ОДНОМУ З СІЛЬСЬКИХ УНІВЕРСИТЕТІВ ПІВДЕННОЇ АФРИКИ

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ABSTRACT

Purpose. *The purpose of this research is to examine the impact of chatbot technology on students' learning at Walter Sisulu University (WSU), South Africa. As artificial intelligence becomes increasingly integrated into higher education, chatbots have emerged as potential tools to support learning, improve*

Мета. *Метою цього дослідження є вивчення впливу технології чат-ботів на навчання студентів в Університеті імені Вальтера Сісулу (WSU), Південна Африка. Оскільки штучний інтелект все більше інтегрується у вищу освіту, чат-боти стали потенційними інструментами для підтримки навчання, покращення*

engagement, and offer real-time academic assistance.

Methodology. *This study employed a mixed-methods approach, combining quantitative surveys distributed to undergraduate students with qualitative interviews conducted with both students and academic staff.*

Results. *The findings indicate that chatbots enhance students' learning by providing immediate responses to academic queries, promoting self-directed learning, and improving access to learning materials. However, challenges such as inconsistent internet access, limited digital literacy, and low awareness of available chatbot tools were identified as barriers to effective use. The study also revealed a general willingness among students to adopt chatbot-assisted learning if better support and training were provided.*

Conclusions. *These results suggest that while chatbot technology holds promise for improving educational outcomes, successful implementation at WSU requires addressing infrastructural and support-related challenges. The findings provide valuable insights for university policymakers, educators, and developers aiming to optimize AI-driven tools for enhanced teaching and learning in under-resourced educational contexts.*

Keywords: *artificial intelligence, chatbot-assisted learning, enhanced teaching and learning, learning pedagogy, rural university, technology.*

залученості та надання академічної допомоги в режимі реального часу.

Методологія. *У цьому дослідженні використовувався змішаний методологічний підхід, що поєднує кількісні опитування, розповсюджені серед студентів, з якісними інтерв'ю, проведеними як зі студентами, так і з викладачами.*

Результати *показують, що чат-боти покращують навчання студентів, надаючи негайні відповіді на академічні запити, сприяючи самостійному навчанню та покращуючи доступ до навчальних матеріалів. Однак такі проблеми, як нестабільний доступ до Інтернету, обмежена цифрова грамотність та низька обізнаність про доступні інструменти чат-ботів, були визначені як перешкоди для ефективного використання. Дослідження також виявило загальну готовність студентів використовувати навчання за допомогою чат-ботів, якщо їм буде надано кращу підтримку та підготовку.*

Висновки. *Результати свідчать про те, що хоча технологія чат-ботів є перспективною для покращення результатів освіти, успішне впровадження в університеті вимагає вирішення інфраструктурних та допоміжних проблем. Результати дослідження надають цінну інформацію для розробників університетської політики, викладачів та фахівців, які прагнуть оптимізувати інструменти на основі штучного інтелекту для покращення викладання та навчання в освітніх контекстах з недостатніми ресурсами.*

Ключові слова: *штучний інтелект, навчання за допомогою чат-ботів, покращене викладання та навчання, педагогіка навчання, сільський університет, технології.*

INTRODUCTION

Technology has always played a significant role in the growth of education, with each stage bringing new tools and approaches to improve learning opportunities (Ghavifekr & Rosdy, 2015; Mathew & Ibrahim, 2023; Priante & Tsekouras, 2025). Physical classrooms, literature, and in-person contact between students and teachers have always been attributes of education (Malik & Rizvi, 2018; Priante & Tsekouras, 2025). The necessity to adapt and use these developments to better serve their students has been recognized by educational institutions as technology has become more pervasive in our daily lives (Mhlanga, 2024). As a result of this realization, chatbot student assistants are being investigated to offer individualized and accessible support (Kooli, 2023). The integration of chatbot student assistants into educational settings is one of the most promising recent technological advances for promoting student success.

Chatbots for student assistants can fill the vacuum of traditional methods in education by providing immediate access to information, knowledge, tools, ad-vice, and support, as well

as fostering student engagement (Esan & Masombuka, 2025; Kaiss et al., 2023). The development of chatbots for student assistance is a result of artificial intelligence (AI) and natural language processing (NLP) technologies quick advancement (Ayanwale & Ndlovu, 2024). These chatbots are made to have engaging discussions with users, mimicking human-like interactions while taking use of automation's effectiveness and scalability.

Several higher education Institutions (HEIs) are striving to overcome several difficulties that students frequently encounter in their first-year experience by introducing different interventions and integrating these chatbots into educational settings (Esan & Esan, 2025; Michel-Villarreal et al., 2023). The incorporation of chatbot student assistants has the potential to transform conventional support systems in the current dynamic educational environment. The progression of education through chatbot student assistants can lead to more excellent student performance and a more inclusive learning environment with careful design, the collaboration between educators and technical specialists, and continual evaluation (Ndunagu et al., 2025).

A considerable body of research has been done on understanding the many components of support services, their effects on student outcomes, and methods for boosting student success, according to numerous works in the literature on student support in higher education (Chetty & Kepkey, 2023; Johnson et al., 2022). Student, social, emotional, and career-related aspects of holistic student support are all important, according to research. According to Seboe (2023), counselling and advising services are associated with better course selection, higher levels of student engagement, and timely degree completion. The study further found that individualized counselling positively influences both academic achievement and student satisfaction. Similarly, Mvikweni and Mthengi (2025) emphasized that support services play a crucial role in student retention and graduation rates. This finding is consistent with Oripova's (2022) argument that students who receive adequate support services are more likely to persist in their academic programmes. Furthermore, Johnson et al. (2022) found that students who utilize support services demonstrate higher levels of participation in extracurricular activities and campus events.

Active participation improves the overall college experience and fosters a feeling of community. Remote delivery of academic resources, career services, and counseling is made possible by online platforms and technological tools (Gray & DiLoreto, 2016). Technology can enhance accessibility and facilitate direct access to information, supporting students, particularly those in their first year of university. Outside of usual business hours, chatbots can help by accommodating different schedules and time zones. Chatbots can provide individualized advice and suggestions by examining user learning patterns and preferences. Students can avoid irritation and stay on task by receiving immediate feedback and responses to their questions.

The integration of artificial intelligence (AI) into educational settings has attracted significant scholarly attention in recent years, particularly the use of chatbots as pedagogical tools. Chatbots AI-driven conversational agents have shown promise in enhancing student engagement, providing immediate feedback, and supporting personalized learning experiences (Chakraborty et al., 2023; Williams, 2024).

Several studies have explored the educational implications of chatbots in diverse academic contexts. Laun and Wolff (2025) found that chatbots facilitate learner autonomy and contribute to improved academic performance when embedded in learning management systems. Similarly, a study by YetiŞensoy and Karaduman (2024) highlighted that students perceived chatbots as non-threatening tools that helped them engage more actively with

learning materials. Furthermore, systematic reviews by Okonkwo and Ade-Ibijola (2021) and Kuhail et al. (2023) showed that chatbots support learning through interactive question-and-answer formats, thereby increasing students' motivation and satisfaction. However, most of these studies have been conducted in technologically advanced settings where students have consistent access to digital devices and high-speed internet conditions not uniformly present in many African universities.

In the African context, research on chatbots in education is emerging but still limited. A study by Suleiman et al. (2025) examined the application of chatbots in Nigerian universities and found that they have the potential to improve administrative communication, although their pedagogical use remains limited. In South Africa, Patel and Ragolane (2024) discussed the broader application of artificial intelligence in higher education, emphasizing infrastructural constraints and limited digital literacy as significant barriers to adoption. Despite South Africa's relatively advanced educational technology infrastructure compared to other sub-Saharan countries, there is minimal empirical research specifically focusing on how chatbots impact student learning experiences, academic performance, or engagement especially in historically disadvantaged institutions like Walter Sisulu University (WSU).

Walter Sisulu University, being a comprehensive university catering to a diverse student population, presents a unique context where digital tools can bridge gaps in accessibility and student support. Preliminary institutional reports and anecdotal evidence suggest that while digital tools are used for administrative support and blended learning, the educational integration of AI tools such as chatbots is either nascent or experimental.

To date, there is no comprehensive empirical study examining the impact of chatbots on students' learning in Walter Sisulu University. While international literature demonstrates the benefits of chatbots in education, and some regional studies explore administrative uses of AI, the pedagogical implications, effectiveness, and student perceptions of chatbots at WSU remain unexplored. Therefore, this study aims to bridge the gap between global knowledge and local application by evaluating how chatbot integration influences learning outcomes and experiences in this specific institutional context using the concept of Unified Theory of Acceptance and Use of Technology (UTAUT) as its theoretical framework (Esan & Masombuka, 2025; Esan & Esan, 2025).

The **purpose** of this research is to examine the impact of chatbot technology on students' learning at Walter Sisulu University (WSU).

Hence, the research contributions are as follows:

- Empirical investigations into the effectiveness of chatbot technologies in enhancing student learning outcomes within a rural South African university context. While existing literature on educational chatbots is largely concentrated in urban settings, this research offers context-specific insights into how students in resource-limited environments interact with, benefit from, and perceive chatbot tools integrated into their academic support systems.
- The development of new frameworks for educational chatbots that integrate cultural and socio-economic background into existing UTAUT framework, to align with the digital realities of rural South African students.

METHODOLOGY

A prototype design in combination with a qualitative research method (focus groups) is employed to collected more in-depth information on the students' experience with the

chatbot. The developed prototype was similarly to (Tudor et al., 2025), the design also aids first-entering students in getting the necessary information that they need in when enrolling at a university. The proposed design allows students to get assistance with queries about the course offered, admin-related stuff, financial services, counselling service, library depart-mental contact, and many other queries related to them familiarizing themselves with the university.

In this study, we utilized the concept of unified theory of acceptance and use of technology (UTAUT) which is a comprehensive framework developed in (Esan & Esan, 2025; Venkatesh et al., 2003) to explain user behavior regarding the use of technology. We also used the UTAUT variables to design questionnaire based on the chatbot technology which was distributed to student via google form. Out of 180 students only 153 students were able to give their responses. The questionnaire with the protype were distributed to undergraduate students who were in their first, second and third year in the Department of Information Technology at Walter Sisulu University (WSU). We chose how the chatbots would respond to each kind of query based on the length of the interactions. Some can be answered directly via chat, while others must be directed to human assistance.

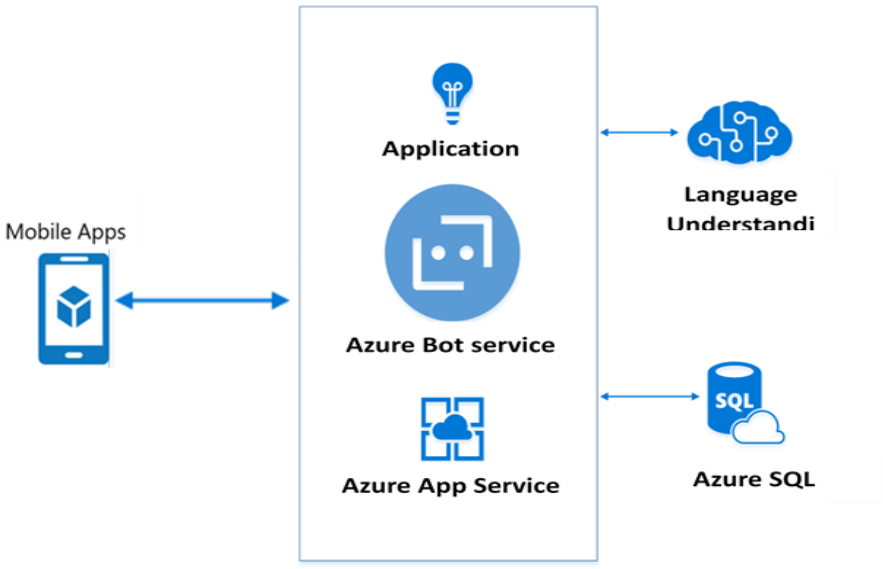
Then, to build and host the chatbots we had to use the Azure bot service, we chose and employed a bot development engine using the mobile application. We compared the chatbot prototypes to the potential benefits we had found in the literature and from our prior work experience to review the chatbots and determine whether the main advantages we had found could truly be supported by the existing structure for implementation.

CHATBOT STUDENT ASSISTANCE PROTOTYPE

A smartphone is used by the user (student) to access the chatbot, the user (student) is authorized by means of Azure App Service, the user (student) interacts with the bot service and asks for availability information using a specific number on the phone, the chatbot replies with the answer in a SQL database once the user (Student) is satisfied with the result and to assist the DevOps team in enhancing bot performance and utilization, Application Insights collects runtime telemetry throughout the process. The architecture for the proposed design Chatbot is shown in Figure 1.

Figure 1

Proposed architecture of the student assistant chatbot



The data collected for this study was analyzed using the statistical package for the social sciences (SPSS). The appropriate statistical techniques were used to assess the gathered data. For the efficient analysis of quantitative data, SPSS is user-friendly and supports the researcher through any challenges that may arise. In SPSS, a set of variables must be defined, and cases must be further created by appropriately entering data into these variables. Examples of these include the moderator, intervening, dependent, and independent variables. An independent variable, to put it simply, is a cause whose value is unaffected by any other variables in a study.

A dependent variable, on the other hand, is an effect whose value is contingent upon any modifications to the independent variable. An intervening variable, also known as a mediating variable, is a hypothetical variable that is typically employed in research to elucidate the causal relationships between other variables. Finally, the variable that has the ability to change the relationship between independent and dependent variables is known as the moderating variable. A descriptive statistical method was used to show the frequencies and percentages of the respondents' demographic profiles. Correlation analysis was performed to look into the relationships between the variables. Analysis of variance (ANOVA) and regression analysis were used to test the model. The analysis of the study focused mostly on the intentions of the students. For the qualitative, we interviewed the students who were given the prototype and obtained their insight on the use of the chatbot for teaching and learning. Their responses are shown in following sections.

RESULTS

This section presents the results and findings obtained from this study while using the proposed UTAUT model to investigate the impact of chatbot technology in one of the tertiary institutions in South Africa.

Respondent's demographic

Among the participants, 65.4% were female and 34.6% were male. The age distribution of participants was as follows: 99.3% were aged between 17 and 25, which is the majority and the reason is because most of these students are undergraduate students, while 0.7% were between 26 and 35. In terms of grade levels in qualifications, 37.9% were in first year, 19.8% were in second year, 42.5% are in third year (final year), as illustrated in Table 1.

Table 1

Demographic characteristics of respondent (n = 153)

Demographic	Frequency	Percent (%)
Gender		
Female	100	64.5
Male	53	34.6
Age		
17 – 25	152	99.3
26 – 35	1	0.7
Levels of study		
First year	58	37.9
Second year	30	19.8
Third year	65	42.5

Reliability and Correlation Analyses

This study employed construct validity to determine the extent of correlation between the decision variables and other measures that are theoretically expected to be related to them. Before testing for construct validity and correlation, the decision variables were assessed for reliability.

The internal consistency of these variables was evaluated using Cronbach's alpha (α) and correlation matrix (Adamson & Prion, 2013). The questionnaire items underwent an item analysis to evaluate the internal consistency of the decision variables. Cronbach (α) values, which indicate the reliability of the questionnaire, were obtained by performing this analysis for each construct. Items in the questionnaire were either included or excluded based on the following three criteria: Cronbach alpha (α) greater than 0.8 (α > 0.8) was viewed as indicating strong reliability, Cronbach alpha (α) ranging from 0.6 to 0.7 was seen as acceptable reliability, and Cronbach alpha (α) below 0.6 (α < 0.6) was regarded as indicating unacceptable poor reliability. The summary of the reliability data for each component factor of the research instrument is provided in Table 2.

Table 2
Robust check

Constructs	Cronbach Alpha (α)	Average Variance Extracted (AVE)
Perceived Usefulness	0.71	0.55
Effort-Efficiency	0.76	0.67
Social Influence	0.79	0.71
Facilitating Conditions	0.84	0.82
Internet cost	0.89	0.82
Culture Influence	0.91	0.82

Table 2 displays Cronbach's alpha (α) values for the items associated with each construct. It is important to note that only the items deemed acceptable are included in this table. A Cronbach α greater than 0.8 is considered to indicate strong reliability, as it demonstrates high internal consistency among the items within a construct (Esan & Esan, 2025).

The three constructs facilitating condition (3 items), internet cost (4 items) and cultural influence (3 items) also showed a high internal consistence with respective adjusted Cronbach alpha measures of 0.84, 0.89, and 0.91. The constructs such as perceived usefulness (α = 0.71), self-efficacy (α = 0.74) and social influence (α = 0.76) have moderate threshold which is still acceptable reliability and sufficient for this study (Cheung et al., 2023).

Finally, average variance extracted (AVE) values, which are a measure of variation explained by the latent variable to random measurement error ranged from 0.55 for perceived usefulness to 0.82 for facilitating condition, internet cost and cultural influence, which is higher than the threshold of 0.60 (Polyportis & Pahos, 2024).

Correlation Analyses

A correlation matrix was computed to assess the degree of relationship between various constructs. The correlation coefficient (r) shows the strength of the relationship between

two numerical variables, and correlation is a statistical measure of the linear relationship between two variables (Schober et al., 2018).

The magnitude of r signifies the degree of correlation between the two variables. Consequently, a stronger relationship exists when r has a greater absolute value. The following guide was used for this study: 1 denotes a perfect correlation, 0.8 indicates a high degree of correlation, a correlation of 0.60 is considered moderate, a weak correlation is indicated by a value of 0.185, and 0 indicates no correlation. The results of correlation analysis to verify the proposed relationship among variables is shown in Table 3.

Table 3

Correlation matrix showing relationship between variables

Construct	PU	FC	SI	EE	SB	CI	SE	IC
PU	1							
FC	0.358	1						
SI	0.421	0.628	1					
EE	0.300	0.652	0.594	1				
SB	0.213	0.414	0.462	0.488	1			
CI	0.368	0.264	0.421	0.509	0.512	1		
SE	0.423	0.322	0.529	0.643	0.725	0.718	1	
IC	0.185	0.191	0.058	0.689	0.607	0.611	0.683	1

The investigation of potential correlations between the various variables was done using a Pearson correlation analysis. The variables observed were perceived usefulness, facilitating condition, social influence, effort expectancy, socio- economic background, cultural influence, and internet cost.

All of the variables correlate to one another at r = 1, according to the Pearson correlation results. The strong positive correlation between SI and FC was found, with r = 0.628 and $p < 0.0001$. Also, there is a strong positive correlation between the following constructs: SE and SB with r = 0.725, SE and CI with r = 0.718. Positive, meaningful relationships with a moderate level of intensity fall into the second category of relationships. Significant at $p < 0.0001$, these relationship strengths fall within the range of $0.607 > r < 0.689$.

Qualitative Results

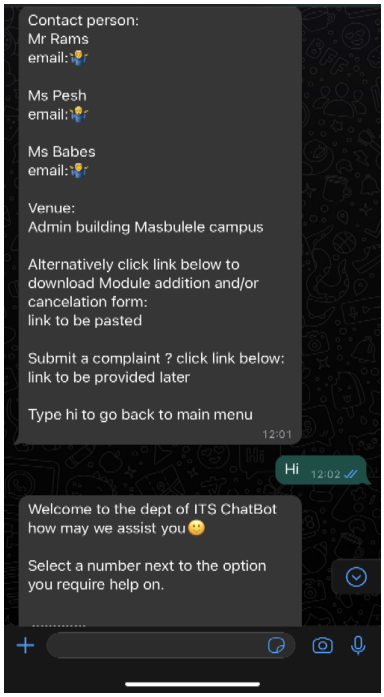
This section provides the qualitative results of the research and discuss the different designs used as prototypes for student assistant chatbots and provide discussion of the results.

Student Assistance Chatbot Admin Prototype 1

To help students at different stages of their studies learn more about the department, we developed a chatbot. The chatbot in this platform serves as an administrator who wants to help students find information for the various levels of study they have enrolled for with the department. Students must communicate with this virtual administrator and ask for the information they require. Students must successfully present a proper number that corresponds to the level at which they require the information to receive accurate information. Several conversation messages are shown in Figure 2.

Figure 2

Student assistant chatbot admin

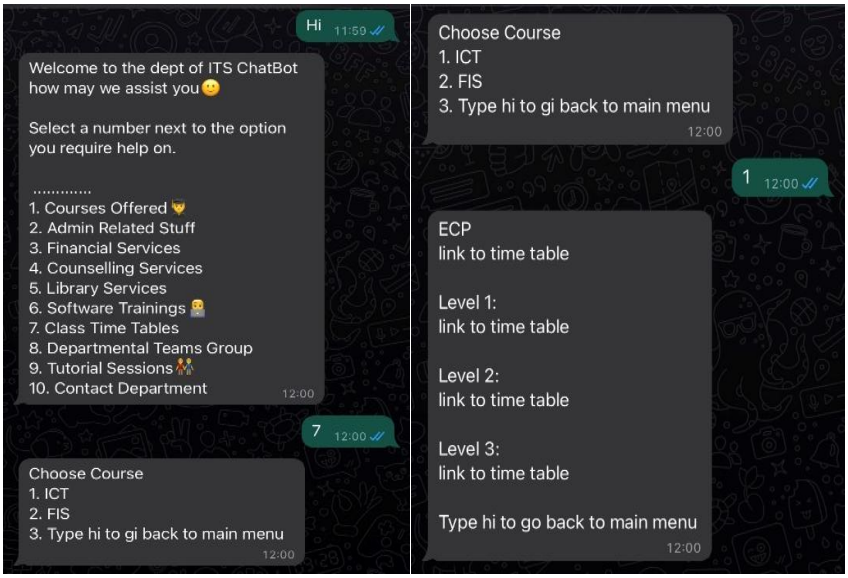


Student Assistance Chatbot Helpdesk Prototype 2

As a department inside the university, we frequently receive fresh requests from our students. Sometimes, because of heavy workloads and staff limitations, our administration section's helpdesk is unable to react to these requests in a timely manner. To address frequently asked questions, respond to simple requests, and assist students in properly sending helpdesk requests to the appropriate teams, a helpdesk bot was established. Several chat messages are displayed in Figure 3.

Figure 3

Student assistant chatbot helpdesk



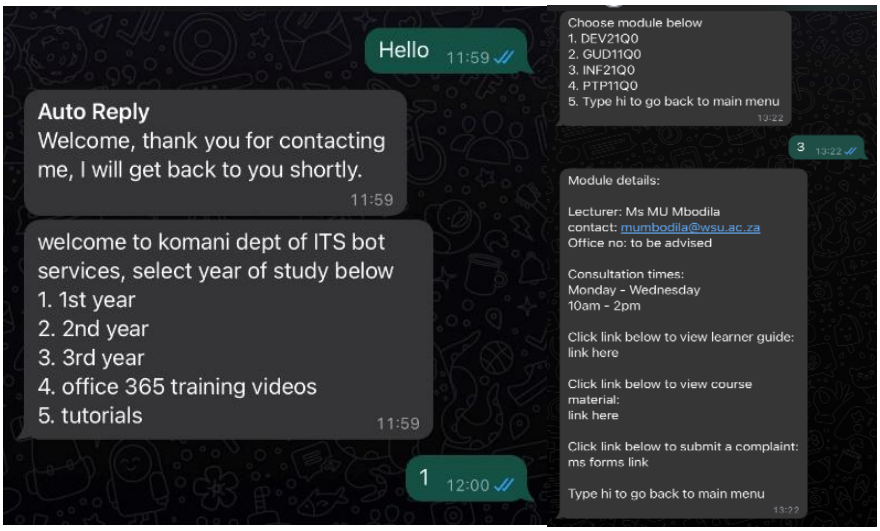
Student Assistance Chatbot Module Detail Prototype 3

A reading list bot has been created to assist students in obtaining information about a newly launched program in the department, such as the program name, modules, names of the lectures, learner guides, and other material required for the program.

A reading list for each of their programs can be created using various pieces of information. Based on the information supplied in the list, students can examine these lists, which inform them precisely what they are doing, the name of the lecturer, consultation time, timetable, and how to access additional pertinent materials. Students will receive instructions on how to use the information from the chatbot, which will serve as a guide. Several chat messages are displayed in Figure 4.

Figure 4

Student assistant chatbot module details



Below there are some representative examples of student statements confirming the positive viewpoints.

Easy to Use

> *"Using the chatbot was really easy. I didn't need any special instructions; it was pretty intuitive. I just typed my question, and it responded within seconds. It felt a lot like texting, which I'm already used to. I liked that I didn't have to go through a long process to access help; no logging into a separate system or waiting for office hours. Everything was right there. Sometimes it misunderstood my question if I wasn't clear, but I could rephrase it and still get what I needed. Overall, it saved me time and made learning feel more flexible and on-demand."*

Self-Efficacy

> *"At the beginning, I wasn't sure if I'd be able to use the chatbot properly; I thought maybe it was meant for more tech-savvy people. But once I tried it, I realized it was actually quite simple. The more I used it, the more confident I became in asking the right questions and understanding how to get useful responses. Now, I feel like I can use it efficiently to support my learning, especially when I need quick explanations or practice questions. It's made me feel more independent; I don't always have to rely on the teacher or classmates. I've learned how to guide my own learning through the chatbot, which makes me feel more in control."*

Perceived Usefulness

> *"At first, I was a bit skeptical about using a chatbot for learning; it felt kind of impersonal. But once I started interacting with it, especially for quick explanations or revision questions, I realized how convenient it was. I could ask questions at any time, even late at night, and still get an answer instantly. That really helped with my understanding, especially in subjects where I needed*

repetition to grasp the concepts. It's not the same as talking to a real teacher, but for quick help or clarifications, it was very useful. Sometimes the answers were a bit generic, but overall, it made learning more accessible and less intimidating. I actually felt more confident asking questions to the chatbot than in class."

Effort-Expectancy

"Honestly, I didn't find it hard at all to use the chatbot. It felt very natural, kind of like using any messaging app. I didn't need any special training or instructions; it was just type and go. The interface was clean and straightforward, and the responses came quickly. I think anyone with basic digital skills could use it without much effort. I also appreciated that I didn't have to scroll through long menus or complicated options; it just worked. So, in terms of effort, it was minimal, which made me more willing to keep using it regularly."

Voluntariness of Use

"Using the chatbot wasn't something we were forced to do; it was totally optional. I actually appreciated that, because it gave me the freedom to explore it at my own pace. Some of my classmates didn't use it much, but I found it helpful, especially during revision. Knowing that it was available but not mandatory made it feel less like a burden and more like a helpful tool I could turn to when I needed extra support. I think because it wasn't imposed on us, I was more open to trying it and sticking with it."

Social Influence

"Initially, I wasn't sure about using the chatbot for my studies. However, after seeing several classmates actively engaging with it and sharing their positive experiences, I felt encouraged to give it a try. Our instructor also highlighted its benefits during lectures, which further motivated me.

Observing others use it effectively made me realize its potential value, and I didn't want to feel left out or miss out on a helpful resource. This collective enthusiasm created a supportive environment that influenced my decision to incorporate the chatbot into my learning routine."

Overall, the students were satisfied with the instantaneous and immediate responses they received to inquiries during chats. They were generally welcoming the usage of the chatbot as a learning tool. They didn't encounter delayed responses to their questions asked within the chat platform compared to their experiences with the instructor, where their questions may have received a delayed response or no answer at all. Despite this positive feedback, student highlighted some negative viewpoints on the integration of the chatbot in their learning, which can be summarized in the statements below:

Repetitive and Irrelevant Responses

"My experience with the chatbot was not pleasant. I realized I was getting similar answers to the variety of questions I asked during the chat sessions."

Frustration Due to Misunderstandings

"Sometimes it was frustrating asking for one thing and getting an answer about a different topic."

Outdated Information and Broken Links

"The majority of the information I had seemed outdated to me. Besides, links/URL provided were broken, and this situation worried me at times."

Lack of In-Depth Understanding

> *"I missed more in-depth answers from the chatbot and not simply definitions and links to find additional resources. I feel only the instructor can do this."*

Limited Interaction and Follow-Up

> *"Few times I just received a link or a short answer to my question."*

Challenges in Applying Knowledge

> *"Some of my questions couldn't be answered because they were about how to apply the knowledge from the course. I needed more instructions."*

Decreased Critical Thinking Skills

> *"Reliance on chatbots for information can cause students to passively accept answers without questioning their validity or exploring alternative perspectives."*

Lack of Emotional Support

> *"AI chatbots may not be able to provide the same level of emotional support and guidance as human teachers, impacting student well-being and mental health."*

After synthesizing the negative feedback received, we can say that the students complained about their interaction with the chatbot because it didn't carry out in-depth learning and the human element was missing. They also acknowledged that the chatbot gave the same responses to different questions. The need for more instructions on how to apply the knowledge acquired from the course was also highlighted. Notwithstanding, students formed good views after interacting with the chatbot and fully appreciated the interaction approach. The vast majority recommended the integration of chatbots in other courses of their studies and more than half of the participants preferred the chatbot comparing to the interaction with the instructor. Some representative responses are presented below:

> *"The chatbot often misunderstood my questions, leading to irrelevant answers. Enhancing its ability to comprehend and respond accurately would make it more useful."*
>
> *"I would appreciate if the chatbot could offer detailed explanations and step-by-step solutions, especially for complex topics like mathematics."*
>
> *"Linking the chatbot with our LMS would allow it to access course materials, assignments, and grades, providing more personalized assistance."*
>
> *"As a non-native English speaker, having the option to interact with the chatbot in my native language would enhance my learning experience."*
>
> *"Incorporating voice recognition would make the chatbot more accessible, especially for students with disabilities or those who prefer auditory learning."*
>
> *"It's crucial that the chatbot adheres to strict data privacy regulations to protect sensitive student information."*
>
> *"Receiving immediate feedback on assignments from the chatbot would help me understand my mistakes and improve my performance."*
>
> *"Allowing the chatbot to tailor learning paths based on individual progress and preferences would make learning more effective."*

"Integrating features that recognize and respond to emotional cues could provide students with the necessary support during stressful periods."

"Ensuring that the chatbot's content is up-to-date and introducing new features based on user feedback would keep the tool relevant and effective."

DISCUSSION

This study examined the impact of chatbot integration on student learning within a rural South African university, using the UTAUT as a guiding framework. UTAUT posits that learners actively construct their own knowledge through experience, reflection, and interaction with their environment, rather than passively receiving information. The findings from this research highlight the ways in which chatbots can support constructivist learning principles, particularly in resource-constrained educational contexts.

The research results revealed that the chatbot was not merely used as a tool for receiving pre-packaged information, but rather as an interactive platform that encouraged students to ask questions, explore concepts, and reinforce their understanding through conversation-based learning. Many students reported using the chatbot to revisit lecture topics, clarify difficult material, and test their comprehension, reflecting active engagement with content. This aligns with constructivist ideals, where learning is most effective when students are participants in their own educational process, constructing meaning through dialogue and reflection. Also, in terms of students perceived expectancy, effort expectancy, trust, and social influences.

Quantitative studies consistently show that students perceive chatbots as useful tools for enhancing learning outcomes. For instance, a study involving 842 undergraduate students found that perceived relative advantages, compatibility, trialability, perceived usefulness, and trust were significant predictors of students' intention to use chatbots for academic purposes. Similarly, a study in Lesotho confirmed that students who recognized the benefits of chatbots expressed a strong intention to adopt them.

Ease of use is a critical factor in technology adoption. Quantitative analyses indicate a strong positive relationship between perceived ease of use and students' acceptance of chatbots. For example, a study in Malaysia reported a correlation value of 0.813 between perceived ease of use and students' acceptance, with a significance level of 0.000. The role of social influence in chatbot adoption appears to be context-dependent. In some studies, social influence was found to be statistically insignificant in predicting students' behavioral intention to use chatbots.

For instance, a study in Hong Kong indicated that social influence did not significantly affect students' intention to use ChatGPT for assessment support. Access to resources and support structures is essential for successful technology adoption. Studies indicate that facilitating conditions, such as reliable internet access and institutional support, significantly impact students' ability to use chatbots effectively. For example, a study in Zimbabwe highlighted the importance of institutional infrastructure in supporting the use of WhatsApp for lecture delivery during the COVID-19 lockdown. Trust in chatbot technology is a significant determinant of its adoption. A study in Hong Kong found that trust was the strongest determinant of students' acceptance of ChatGPT for assessment support. Trust influences students' willingness to rely on chatbots for academic purposes, especially in high-stakes contexts like assessments.

When compared to previous research such as (Schei et al., 2024), who explored chatbot use in urban universities and found that chatbots fostered collaborative and exploratory learning the results of this study resonate in several ways. Both studies underscore how chatbot interactions can promote cognitive engagement and curiosity. However, a notable difference lies in the level of peer-to-peer interaction. While (Schei et al., 2024) found chatbots to be effective in enhancing collaborative learning through group chatbot activities and discussion prompts, students in this rural university primarily used the chatbot individually, largely due to infrastructural limitations and less integrated learning systems. This suggests that while constructivist learning was achieved at an individual level, social constructivism where knowledge is co-constructed through interaction with others was less prominent due to contextual constraints.

Another contrast is evident in technological confidence and exposure (Naidoo, 2025; Soobramoney & Govender, 2025). In more digitally advanced environments, students entered the chatbot experience with higher baseline skills and expectations, whereas students in this rural context displayed gradual adaptation and learning of digital tools alongside their academic content. This dual learning process both of digital skills and academic knowledge adds a layer of complexity that is less evident in studies from urban or global North contexts.

Importantly, this research contributes to the existing literature by emphasizing the constructivist potential of chatbots in marginalized and under-resourced settings. While prior studies often focus on the novelty or efficiency of chatbots, this study highlights how they can democratize access to active learning, especially in contexts where human academic support is limited. The chatbot acted as a cognitive scaffold, allowing students to build knowledge independently, while also encouraging reflection, repetition, and gradual mastery hallmarks of effective constructivist learning environments.

CONCLUSIONS

This study explored the impact of chatbot technology on student learning at a rural university in South Africa, highlighting both the opportunities and challenges that emerge when digital innovations intersect with educational development in under-resourced contexts. The findings revealed that chatbots can play a crucial role in supplementing traditional teaching methods by offering real-time academic support, enhancing student engagement, and providing accessible learning resources beyond the constraints of time and location. These benefits were particularly evident in how students used chatbots to clarify course content, revise for assessments, and seek administrative guidance.

However, the study also identified significant challenges. Limited internet connectivity, uneven access to digital devices, and varying levels of digital literacy among students and staff posed barriers to effective chatbot use. Furthermore, while students appreciated the availability and responsiveness of the chatbot, some expressed concerns about its limitations in handling complex queries and offering personalized academic feedback. The success of chatbot integration, therefore, depends not only on the technological tool itself but also on the broader support ecosystem, including digital infrastructure, training, and curriculum alignment.

Finally, while chatbot implementation at the rural university demonstrated a positive impact on student learning, especially in promoting self-directed learning and reducing dependency on limited human resources, its full potential can only be realized through ongoing investment in infrastructure, inclusive digital literacy programs, and continuous

refinement of chatbot content to align with evolving academic needs. This study underscores the importance of context-specific solutions and stakeholder involvement in leveraging educational technologies for meaningful and equitable learning experiences in rural higher education.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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ARTIFICIAL INTELLIGENCE STATEMENT

No artificial intelligence tools were used in the preparation of this manuscript.

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