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Utilising Artificial Intelligence Chatbots for Student Support at Comprehensive Open Distance E-learning Higher Learning Institutions in the Fifth Industrial Revolution

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Abstract
Artificial intelligence chatbot technology holds tremendous potential to be deployed as a student support service automation platform in comprehensive open distance e-learning institutions of higher learning in the Fifth Industrial Revolution. Inadequate support service provision to students at comprehensive open distance e-learning institutions of higher education has prompted this investigation into the use of artificial intelligence chatbot technology for the provision of student support services at comprehensive open distance e-learning higher education institutions in the Fifth Industrial Revolution. This qualitative study adopted content analysis as its research methodology, which is grounded in a literature review that incorporated insights from the researchers' experiences with utilising artificial intelligence chatbots for student support in comprehensive open distance e-learning higher education institutions in the Fifth Industrial Revolution. The findings of the study indicate that artificial intelligence chatbot technology may be able to provide support services to students in a comprehensive open distance e-learning setting. Artificial intelligence chatbots can be utilised in the administration department to respond and make calls to students, as well as provide information about the application and registration processes, and assist students in this regard. Students could also use the artificial intelligence chatbots for learning and to conduct research. The study recommends a framework for the use of artificial intelligence chatbots for the provision of support services to students at comprehensive open distance e-learning higher education institutions in a new and emerging phase of industrialisation, namely the Fifth Industrial Revolution.

Keywords: Artificial intelligence chatbot, Student support, Comprehensive open distance e-learning, Fifth Industrial Revolution.

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1.Introduction and background

According to Ziatdinov, Atteraya and Nabbiyev (2024), artificial intelligence (AI) chatbots hold tremendous potential to evolve into automated platforms for the provision of student support services at comprehensive open distance e-learning (CODeL) institutions of higher learning in the Fifth Industrial Revolution (5IR). These AI chatbots are sophisticated computer programmes, engineered to simulate conversations with human users, and is operated primarily through text-based interfaces like messaging applications (apps) or websites (Lee & Yeo, 2022). Leveraging AI technological tools, such as natural language processing (NLP) and machine learning, chatbots possess the capacity to comprehend user inputs, generate fitting responses, and engage with users in a manner akin to human conversation (Ziatdinov et al., 2024). Within the CODeL setting, AI chatbots could assume a pivotal role in delivering immediate assistance, providing guidance to, and supporting personalised interactions with students, thereby, enhancing the student support ecosystem (Lin, Huang & Yang, 2023).

In the context of this study, the 5IR delineates a collaborative symbiosis between AI and human intelligence (HI) aimed at addressing the myriad of challenges encountered by students in CODeL institutions (Noble, Mende, Grewal & Parasuraman, 2022). Unlike the preceding Fourth Industrial Revolution (4IR), where AI-driven machines functioned autonomously in executing repetitive tasks, the 5IR heralds an era where AI-integrated collaborative machines can be partnered with HI to address the demands placed on CODeL institutions regarding the provision of multifaceted student support programmes. This collaborative paradigm could ensure that students receive effective and efficient assistance, tailored to their academic needs and challenges (Noble et al., 2022).

Student support encompasses a spectrum of services and resources that is tailored to assist students, to bolster academic performance, and emotional and social well-being. Ranging from

academic tutoring to mental health counselling, career guidance to financial aid assistance, these support mechanisms aim to empower students to excel academically and thrive personally. In the 5IR, AI chatbots could serve as catalysts for democratising access to these support services, by ensuring they are readily available to students, at anytime and anywhere, thereby mitigating feelings of isolation and frustration often encountered in distance learning environments (Lin et al., 2023).

CODeL institutions epitomise educational establishments that offer a diverse array of academic programmes and courses through distance learning modalities, predominantly leveraging online platforms and resources. As students navigate their academic journey in the CODeL environment, sans a physical presence on campus, communication channels such as telephones, e-mails and, increasingly, social media, become vital conduits for interaction with university staff. However, the efficacy of traditional communication channels is frequently marred by delayed responses or inadequate support, precipitating the need for AI chatbots, to streamline and automate student support initiatives seamlessly (Chabinga, 2021).

AI chatbots could become virtual assistants, poised to revolutionise student support services in CODeL universities by providing timely, personalised assistance and guidance (Rahim, Iahad, Yusof & AI-Sharafi, 2022). By facilitating efficient management of student inquiries and requests, they can contribute to a frictionless learning experience, augment student satisfaction, and optimise administrative processes. Moreover, AI chatbots could function as indispensable resources for students who are grappling with the intricacies of university administration, to propel them towards academic success (Rahim et al., 2022). Hence, this study endeavours to explore and elucidate the utilisation of AI chatbots for student support in CODeL higher education institutions in the 5IR.

2.Context of the study

CODeL institutions of higher education, typically, encompass universities or colleges that offer a diverse array of academic programmes through distance learning methodologies. These institutions are dedicated to delivering accessible and adaptable education to students who face obstacles in attending conventional on-campus classes, whether due to geographical constraints, professional commitments, or personal situations (Moonasamy & Naidoo, 2022). The fundamental mission of CODeL institutions is to democratise quality education, by ensuring that it is within reach of a broad spectrum of students, regardless of their backgrounds or circumstances. In doing so, they prioritise inclusivity, flexibility, and innovation in their educational paradigms (Chabinga, 2021).

CODeL institutions commonly provide a wide spectrum of undergraduate and graduate programmes that span across various disciplines such as the arts, sciences, business, engineering, healthcare, and beyond. These programmes are thoughtfully crafted to cater to the needs of adult learners, working professionals and non-traditional students. Leveraging diverse delivery methods, including online courses, video lectures, interactive multimedia content, printed materials and virtual classrooms, these institutions harness technology to cultivate engaging and interactive learning environments for their students (Pasque, Smerek, Dwyer, Bowman & Mallory, 2005).

Acknowledging the unique challenges faced by distance learners, CODeL institutions furnish comprehensive support services, which are aimed at fostering both academic and personal success. These services encompass online tutoring, academic advising, career counselling, technical assistance, and access to digital libraries and resources. However, a notable challenge persists within these institutions regarding student support, particularly in responding to student inquiries (Pasque et al., 2005). Traditional communication channels, such as telephone calls and e-mails, often yield inadequate responses, from administrative departments and lecturers alike.

Consequently, the implementation of AI chatbot platforms present a promising avenue for bolstering student support services.

AI chatbots can potentially address existing student support challenges in the CODeL environment, by offering timely and personalised assistance. Capable of fielding general and specific queries, an AI chatbot can not only respond to e-mails and answer phone calls, but also initiate outbound calls, when necessary (Kooli, 2023). Furthermore, it can provide proactive support, by sending reminders about, for instance, upcoming projects and assignment due dates, thereby enhancing student engagement and accountability. Consequently, this study endeavours to explore and develop a framework for leveraging AI chatbots, towards bolstering student support services in CODeL higher education institutions. Through this framework, CODeL institutions would be able to enhance their capacity to meet the diverse needs of their student body, to foster a more enriching and fulfilling educational experience for the students (Lebadze, Grigolia & Machaidze, 2023).

3.Problem statement

The problem that has prompted this study is the inadequate support provided to students in CODeL higher education institutions. Currently, students heavily rely on traditional communication channels, such as telephones and e-mails, to engage with university administration officials regarding matters concerning applications, registrations and general inquiries. However, the challenge lies in the frequent lack of responsiveness from both administrative staff and lecturers, which leave students feeling isolated and frustrated in their academic pursuits. This situation significantly hampers students' academic performance, leading to disturbingly high failure rates and notable dropout rates in CODeL universities (Haleem, Javaid, Qadri & Suman, 2022).

Despite efforts by CODeL institutions to implement student-centred policies that are aimed at addressing this issue, the problem persists – likely exacerbated by the high enrolment numbers. As a

consequence of the lack of effective online support, students often resort to physically visiting the campus for assistance, only to encounter lengthy queues and delays in obtaining help. Nevertheless, CODeL institutions can enhance student support by implementing an AI chatbot system, which is integrated with various university departments and services, that can serve as a virtual assistant that is capable of addressing a wide range of student inquiries, from general information to specific academic queries (Pasque et al., 2023). The AI chatbot can be programmed to respond to general and specific questions that are frequently asked by students, to provide timely assistance. The telecommunications network can be embedded with automate responses or even programmed to initiate calls to students, when necessary, as well as direct students to the relevant departments and divisions within the university for further assistance. AI chatbots can also automatically respond to student e-mails, by addressing both general inquiries and specific questions. It can connect students with examination sections, to address queries related to the examinations. It can also facilitate communication between students and academic departments, ensuring prompt responses to student inquiries (Labadze et al., 2023).

By deploying such a comprehensive AI chatbot system, CODeL institutions can ensure holistic support for students, spanning from administrative tasks to academic guidance. Such holistic support would contribute to improvements in the student pass rates and retention rates, as students' academic issues would be addressed effectively and promptly (Haleem et al., 2022). Therefore, this study aims to develop a framework for the implementation of AI chatbots to enhance student support in CODeL higher education institutions. By leveraging AI technology, CODeL universities can better meet the needs of their students and, ultimately, enhance overall satisfaction and academic success rates.

Purpose of the study

The purpose of the study is to investigate the use of AI chatbot for student support in a comprehensive open distance e-learning higher education institution in the 5IR. The following are the objectives:

- Evaluate the significance of AI chatbots to support students in CODeL higher education institutions in the 5IR.
- Identify the technological infrastructure required to develop AI chatbots to support students in CODeL higher education institutions in the 5IR.
- Propose a framework to develop an AI chatbot to support students in CODeL higher education institutions in the 5IR.

Literature review

The literature review in this study discusses the following: the significance of AI chatbots to support students in CODeL higher education institutions; the types of AI chatbots to support students in CODeL higher education institutions; and the infrastructure required to use AI chatbots to support students in CODeL higher education institutions.

4.Significance of AI chatbots to support students in CODeL

AI chatbots are available round the clock, and able to provide students with instant support, regardless of the time zone or location. This accessibility would ensure that students can receive assistance whenever they need it; thus, enhancing their learning experience and satisfaction. AI chatbots can be programmed to understand and respond to a wide range of student queries related to course information, enrolment procedures, assignment deadlines, technical issues, and more. They can provide quick and accurate answers, eliminating the need for students to wait for human assistance (Lee & Yeo, 2022).

AI chatbots can guide students through the enrolment process, help them to understand the requirements for the academic programme they are interested in, and to select courses, and assist with the completion of the necessary paperwork. They can also provide information on deadlines, payment options and their enrolment status. AI chatbots can also help students to navigate the university's learning management system (LMS), by providing guidance on how to access course materials, submit assignments, participate in discussions, and interact with instructors and peers (Kooli, 2023).

AI chatbots can provide students with information about course schedules, syllabi, textbooks, recommended readings, and supplementary resources. They can also assist students in locating relevant materials within the university's digital library or online repositories. Based on predefined criteria or rubrics, AI chatbots can offer feedback on assignments, quizzes, and exams, and provide constructive criticism, suggest areas for improvement and direct students to additional resources or tutoring services, if needed (Ilieva, Yankova, Klisarova- Belcheva, Dimitrov, Bratkov & Angelov, 2023).

AI chatbots can help students track their academic progress, including grades, completion status and upcoming deadlines. They can send automated reminders about assignment due dates, exam schedules, and other important events, to help students stay organised and on track. AI chatbots can analyse students' preferences, learning styles and performance data, to offer personalised recommendations for courses, study materials, extracurricular activities, and academic support services. This personalised approach can enhance student engagement and motivation (Hasanein & Sobaiah, 2023).

AI chatbots that are equipped with natural language processing (NLP) capabilities can communicate with students in multiple languages, overcoming language barriers and ensuring inclusivity in ODEL environments. They can assist students when they register for courses by providing guidance on the available options, prerequisites, and scheduling conflicts. They can also help to troubleshoot any

technical issues encountered during the registration process (Ilieva et al., 2023).

AI chatbots can answer questions related to financial aid options, scholarship opportunities and tuition payment plans. They can provide information on eligibility criteria, application procedures and deadlines, to help students access the financial support they need. AI chatbots can also assist with troubleshooting when technical issues related to accessing the university's online learning platform are encountered or with downloading course materials or submitting assignments. They can provide step-by-step instructions, troubleshoot common problems, and escalate more complex issues to technical support staff, if necessary (Hasanein & Sobaiah, 2023).

AI chatbots can assist students with the completion of administrative forms, such as change of address requests, course withdrawal forms and transcript requests, by providing guidance about the required information, submission procedures and processing times. AI chatbots can answer questions about university policies and procedures, such as academic integrity guidelines, grading policies, and withdrawal deadlines, and provide accurate information to ensure students understand their rights and responsibilities as members of the university community (Javiad, Haleem, Singh, Kan & Khan, 2023).

AI chatbots can offer basic academic advising services, such as helping students to understand the degree requirements, track their progress towards graduation, and explore course options. They can also refer students to academic advisors or faculty members for more personalised guidance. AI chatbots can send automated reminders and notifications about important events, such as registration deadlines, payment due dates and academic advising sessions. They can help students stay organised and informed about upcoming administrative tasks (Javaid et al., 2023).

Technological infrastructure required to develop AI chatbots to support students in CODeL

Developing an AI chatbot to support students in CODeL institutions requires a robust technological infrastructure that can handle the complexities of natural language processing, machine learning, and integration with existing university systems. By establishing a robust technological infrastructure that encompasses all these elements, CODeL institutions can develop and deploy an AI chatbot that could effectively support students in their academic endeavours, enhance their overall experience, and contribute to improved academic outcomes (Ilieva et al., 2023).

The Natural Language Processing (NLP) algorithm is infrastructure that would be a requirement in the development of AI chatbot for student support service in CODeL universities. A sophisticated NLP engine should form the backbone of the chatbot, as it would enable understanding and interpretation of natural language queries from students. This engine should be capable of processing text inputs, identify intent, and extract the relevant entities to provide accurate responses. In essence, a well-engineered NLP algorithm would serve as the backbone of an AI chatbot designed to deliver effective and personalised student support services in CODeL universities, towards enhancing overall educational experiences and outcomes (Southworth, Migliaccio, Glover, Glover, Reed, McCarty, Brendemuhl & Thomas, 2023).

Machine learning algorithms are essential for training the chatbot to improve its accuracy and responsiveness over time. Techniques such as supervised learning for intent classification, entity recognition and reinforcement learning, for continuous improvement of conversation flow, can be employed. By harnessing the power of these machine learning algorithms, chatbots can continuously learn and adapt to user needs, to deliver more accurate, context-aware, and engaging support experiences in educational settings such as CODeL universities (Labadze et al., 2023).

The chatbot would require seamless integration with a multitude of university systems and databases, to ensure that it can access a diverse range of relevant information and provide accurate responses to user queries. These integrations encompass a variety of critical components within the university ecosystem, including student databases, course registration systems, examination databases, academic department portals, and other administrative systems. To elaborate further, the integration of student databases is essential for retrieving personalised information about students, such as their enrolment status, academic history, and contact details (Mendoza, Sánchez-Adame, Urquiza-Yllescas, González-Beltrán & Decouchant, 2023).

This integration would enable the chatbot to offer tailored assistance to individual students, based on their specific circumstances and requirements. Integration with course registration systems would allow the chatbot to access up-to-date information regarding course offerings, availability, prerequisites, and registration procedures. This functionality would enable students to receive guidance on course selection, registration deadlines, and related inquiries, in real-time. Furthermore, integration with examination databases would enable the chatbot to retrieve information about examination schedules, locations, and regulations. This capability will allow students to obtain timely assistance with exam-related queries, including information about exam dates and study resources, and exam preparation tips (Oliveira & Matos, 2023).

Integration with academic department portals would facilitate access to department-specific information, such as faculty directories, course syllabi, academic policies, and research opportunities. This integration would allow students to seek guidance on academic matters specific to their field of study and connect with the relevant faculty members or advisors (Mendoza et al., 2023). Additionally, integration with other administrative systems, such as finance, housing, and campus facilities, will enable the chatbot to address a wide range of non-academic inquiries and provide comprehensive

support to students who are navigating various aspects of university life. Overall, the seamless integration of the chatbot with these university systems and databases would be crucial to enhancing the user experience, streamlining information retrieval processes, and ensuring the delivery of accurate and timely assistance to students and other stakeholders within the university community.

The chatbot should be integrated with the university's learning management system, to access course materials, student data and administrative information. This integration would enable the chatbot to provide personalised support and access relevant resources for students.

Application programming interfaces would be essential for establishing communication between the chatbot and external systems. APIs would facilitate data exchange and enable the chatbot to retrieve real-time information, such as course schedules, exam dates and academic resources, from university databases (Southworth et al., 2023). Creating a user-friendly interface is paramount to facilitating seamless interaction between students and the chatbot. This interface should be intuitive, accessible, and adaptable to various platforms, to ensure a smooth user experience across different devices and channels. The chatbot's deployment could span across multiple platforms, encompassing web and mobile applications, and popular messaging platforms like Slack or Microsoft Teams. On web applications, the interface should feature clear navigation, visually appealing design elements and responsive layouts, to accommodate different screen sizes and resolutions. It should offer intuitive controls, such as buttons, dropdown menus, and text input fields, to enable users to interact with the chatbot effortlessly and access information efficiently (Boeding, 2020).

For mobile applications, the interface should prioritise mobile-friendly design principles, including touch-friendly controls, streamlined navigation and optimised layouts for smaller screens. Leveraging platform-specific design guidelines, such as Material Design for Android or Human Interface Guidelines for iOS, can help

to ensure consistency with native app experiences and enhance usability for mobile users. Integration with messaging platforms, like Slack or Microsoft Teams, can provide students with the convenience of accessing the chatbot directly, within their preferred communication tools. The interface should align with the conventions and functionalities of the respective messaging platform, to enable users to engage with the chatbot through familiar interactions, such as sending messages, using slash commands, or interacting with chat-based interfaces (Oliveira & Matos, 2023).

As the chatbot may handle sensitive student data, robust security measures will have to be implemented to protect privacy and prevent unauthorised access. This includes encryption of data in transit and at rest, secure authentication mechanisms. Robust security measures should be implemented, to protect the chatbot infrastructure against cyber threats and unauthorised access, including encryption protocols, access controls, authentication mechanisms, and regular security audits. Compliance with data privacy regulations such as POPIA to safeguard students' sensitive information should be prioritised (Boeding, 2020).

Integrating the chatbot with a diverse array of communication channels, to meet the varying preferences and habits of students, would be essential. This integration should span across multiple platforms, including websites, mobile apps, messaging platforms – such as Facebook Messenger, Slack, WhatsApp – and voice assistants – like Amazon Alexa and Google Assistant. The chatbot can be seamlessly embedded into university websites, to provide students with instant access to information and assistance, while they browse online resources. Whether accessing the university homepage, departmental pages or specific academic resources, students can engage with the chatbot without navigating away from the website (Ilieva et al., 2023).

Integrating the chatbot into university mobile apps would extend its accessibility to students who prefer to engage via their smartphones or tablets. Through the mobile app interface, students

would be able to access a wide range of services and information, from academic resources to campus events, with the convenience of a familiar app environment. By integrating with popular messaging platforms, like Facebook Messenger, Slack and WhatsApp, the chatbot will meet students where they already are; thus, enabling seamless communication through channels they use daily. Whether seeking academic guidance, campus updates or administrative assistance, students would be able to interact with the chatbot directly, within their preferred messaging app. Integration with voice assistants, such as Amazon Alexa and Google Assistant, can introduce a new dimension of interaction that allows students to engage with the chatbot using natural language voice commands. Whether accessing information hands-free in their dorm rooms or while on the go, students would be able to simply ask their voice assistant to retrieve relevant information or perform tasks, enhancing convenience and accessibility (Essel, Vlachopoulos, Tachie-Menson, Johnson & Baah, 2022). Leveraging cloud infrastructure offers scalability, flexibility and cost-effectiveness for hosting and deploying the chatbot. Cloud platforms, such as Amazon Web Services (AWS), Azure or Google Cloud, provide a wide range of services for building and running AI applications. A cloud computing platform serves as the foundation for hosting and managing AI chatbot applications (Baah, 2022). Cloud platforms can offer the scalable infrastructure, storage, and computing resources necessary for deploying chatbots. A data storage and management system should be implemented to securely store student data, chat logs and interaction histories. This system should comply with data privacy regulations and ensure data security. Options include relational databases, NoSQL databases, or cloud-based storage solutions such as Amazon S3 or Azure Blob Storage (Zhang, Oh, Lange, Yu & Fukuoka, 2020).

The implementation of monitoring tools and analytics capabilities would allow administrators to track the performance of the chatbot, identify areas for improvement and gain insights into user behaviour. This includes monitoring system uptime, analysing user

interactions and collecting feedback for continuous optimisation. Monitoring tools and analytics systems can track the performance of the chatbot, monitor user interactions and identify areas for improvement. Logging and analytics platforms, such as Elasticsearch, Logstash, Kibana (ELK stack) or the cloud-based monitoring services, provided by the cloud platform, can also be used (Boeding, 2020). The infrastructure should be designed to handle fluctuations in user traffic and scale seamlessly, to accommodate growing numbers of users. High availability and reliability would be essential to ensure uninterrupted access to the chatbot. The infrastructure should be designed to handle fluctuations in user traffic and accommodate scalability requirements as the user base grows. Auto-scaling features, provided by cloud platforms, can be utilised to automatically adjust computing resources based on demand (Zhang et al., 2020).

5.Research methodology

This qualitative study adopts content analysis as its research methodology, which is grounded in a comprehensive literature review that incorporated insights from the researchers' experiences with the use of AI chatbots for student support in the CODeL higher education institution within the context of the Fifth Industrial Revolution (5IR). Themes and keywords such as "Artificial Intelligence Chatbot", "Student support", "Comprehensive Open Distance e-Learning", and "Fifth Industrial Revolution" guided the exploration of relevant literature.

The literature review process involved utilising various search engines, including Google Scholar, ResearchGate, Web of Science, EBSCOhost, ScienceDirect, Springer and Sage, which were selected for their capacity to connect researchers with diverse websites, hosting pertinent information. The search was refined by using specific keywords that resulted in a substantial number of literature sources. The researchers systematically navigated through the search results, and sifted through thousands of sources, to identify and access literature relevant to the study.

Documents were meticulously identified and selected based on their relevance and utility to the study. Initial screening involved scrutinising titles and abstracts, to eliminate duplicates. In the subsequent round, full-text articles that met the inclusion criteria underwent further review. The researchers employed thematic analysis, following Braun and Clarke's (2006) technique, to systematically analyse qualitative data or text from prior studies. This involved examining, synthesising and interpreting data by categorising it according to the key research objectives related to the investigated topic.

The collected and extracted data, from the included articles, were then summarised and recorded to facilitate a contextual and meaningful understanding of the issues under investigation. The resulting findings were organised into thematic categories, such as "Artificial Intelligence Chatbot", "Student support", "Comprehensive Open Distance e- Learning" and "Fifth Industrial Revolution", to provide valuable insights into the integration of AI chatbots for student support in CODeL higher education institutions in the 5IR.

6.Findings of the study

The findings of the study underscore the value of utilising AI chatbots for student support services in CODeL higher education institutions in the 5IR. The utilisation of an AI chatbot in a CODeL institution can benefit the university by providing effective support services to students. If students are well supported, they are better prepared for and likely to perform well in their academic endeavours, and the university will manage to retain more students.

AI chatbots can guide students through the enrolment process, help them to understand the requirements for the programmes they are interested in, assist with the selection of courses and with the completion of the necessary paperwork (Ilieva et al., 2023).

AI chatbots can provide students with information about course schedules, syllabi, textbooks, recommended readings, and supplementary resources. AI chatbots can help students track their

academic progress, including grades, completion status and upcoming deadlines.

Chatbots can answer questions related to financial aid options, scholarship opportunities and tuition payment plans. It can assist students in completing administrative forms, such as change of address requests, course withdrawal forms and transcript requests. AI chatbots can also offer basic academic advising services, such as helping students understand degree requirements, track their progress towards graduation, and explore course options (Boeding, 2020).

In order to support the students, technological infrastructure is needed to ensure that the AI chatbot is capacitated to support the students in CODeL higher education institutions. NLP can be used to allow human intelligence (HI) to converse with AI, without experiencing glitches. The machine learning algorithm can provide the AI chatbot with the ability to self-programme on things it does not know, so that it will be able to support the students effectively and efficiently (Oliveira & Matos, 2023).

Such AI algorithms will also enable the AI chatbot to be integrated with other university systems and databases, to ensure students have access to a diverse range of relevant information and that accurate responses to students' queries are provided. AI chatbots can be integrated with the university's administration system, to allow students access to administrative information. For instance, it can be linked to the examination section for students to access to their examination information, or the finance section, for access to their finance information. AI chatbots can be used to send automated notifications on important events that are taking place in the departments and university (Southworth et al., 2023).

Recommendation

This section proposes a framework to utilise AI chatbots for student support in CODeL higher education institutions in the 5IR. The AI chatbot has the capacity to support students regarding administrative matters, by answering calls and responding to e-mails. The AI chatbot can further support students with the modules they are

registered for by providing the students with accurate information about all various departments in the university, as illustrated in figure 1. The framework is focused on the core activities that students need support with, and the technological infrastructure that is needed for the AI chatbot to provide effective and efficient support to students in CODeL higher education institutions in the 5IR.

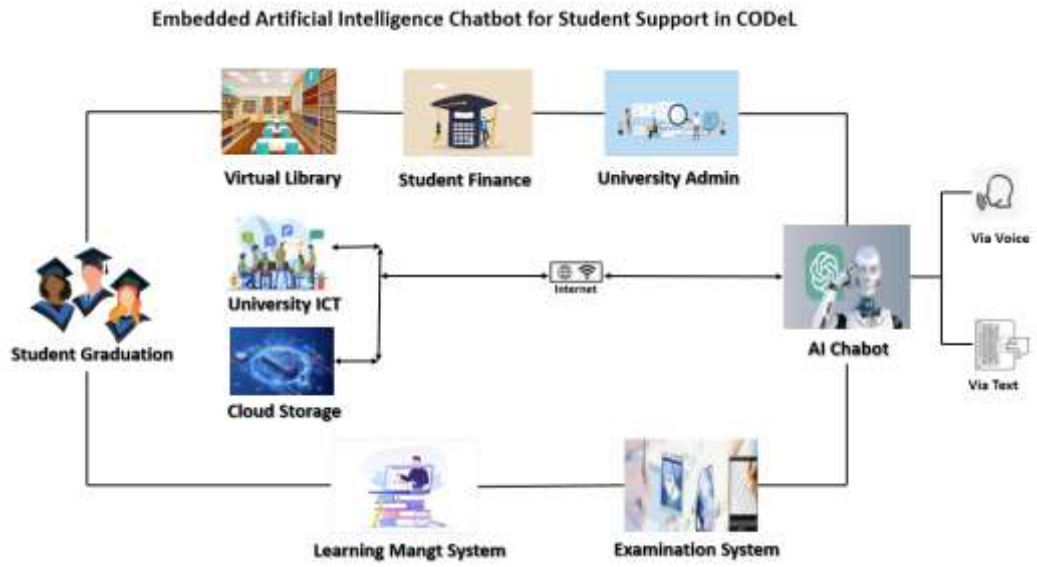


Figure 1: Framework to utilise AI chatbot for student support in CODeL institutions in the 5IR

This framework begins with the AI chatbot that would be central to the provision of student support services in CODeL higher education institutions in the 5IR. This framework intends to ensure that students in CODeL universities are fully supported in all critical areas of the university. The AI chatbot will be embedded to several systems in the university, to ensure that automated responses and feedback is generated automatically through it.

The AI chatbot will be embedded in the university administration section, whereby it will be enabled to answer calls and

make calls to the students, if there is a need. This will help, since many CODeL university students complain that calls are not answered. Students also complain that administration officials do not respond to e-mails; therefore, the chatbot would be able to automatically respond to e-mails. The AI chatbots can allow students access to any administrative information they may need from the university, e.g., automated notifications regarding admission calls, registration periods, and so forth, and guide students through the steps and procedures on how to apply for admission and registration. Through the AI chatbot, students will be able to view the university programme offerings and they would be advised as to whether they qualify or not. This will help students not to waste time applying for something they don't qualify for.

The AI chatbot will also be embedded in the student finance system. This will allow students to have access to their financial records, without having to physically visit the university or calling or even sending an e-mail to the university. Through the AI chatbot, students can stay up to date with the balances due to them or what they owe the university. The embedded system will also allow the students to pay their outstanding fees digitally. Automated notifications would be sent to students, to update them on their financial standing and advise them on how to pay. Students will get a notification for every transaction taking place within their students' account. This will avoid situations where students learn about their outstanding fees when they are supposed to graduate.

The AI chatbot will also be integrated to the library system. The students will be able to access the library website and databases using the AI chatbot. The AI chatbot will generate automated notification to students, especially when they have outstanding books. Even when students owe the library, the AI chatbot can send notifications to students and provide them with possible digital methods of paying their library fines. Students can also access various databases in the library to have access to credible information resources. The AI chatbot will also allow students to converse with the

cybrarians when they need help in navigating the library. Notifications on various services can be sent to students through the AI chatbot, automatically; therefore, such services will be available 24/7, without interruption, unless there is no network or there are power cuts.

The AI chatbot will also be embedded in the student examination system, to enable access to their exam information, such as the examination dates and time. They would be able to authenticate their credentials, so that they can be allowed to have access to and write their online examinations, as well as submit their examination scripts. They will also be able to access their examination results.

Through the AI chatbot, students will have access to the teaching and learning management system. Students will be able to engage online with their study materials, such as study guides and other supporting documents. Students would also be able to interact with the lecturers and students and share and collaborate on study activities. Through the AI chatbot, students would also have access to online classes and be able to discuss the module content and engage in activities with their lecturers and fellow students. The AI chat will ensure that students in CODeL university settings are supported enough, so that they are capacitated to graduate on time. The embedded AI chatbot will ensure that students are supported in their academic endeavours, towards achieving successful academic outcomes, to improve CODeL university pass rates and students' retention rates.

7.Conclusion

The utilisation of AI chatbots stands as a pivotal asset, because of its ability to bolster the support for students in CODeL institutions of higher learning in the 5th Industrial Revolution. These chatbots serve as an indispensable resource that could provide students with uninterrupted, round-the-clock access to vital administrative information and services offered by CODeL universities. By streamlining processes, such as online applications, registration and

inquiries, AI chatbots can ensure seamless navigation through various academic and administrative tasks. Additionally, students would benefit from instantaneous responses to queries, including phone calls; thus, fostering efficient communication channels. Moreover, AI chatbots can empower CODeL students with access to financial information, enabling them to manage their financial affairs, and facilitate payment arrangements seamlessly through integrated platforms. The integration of library services within the chatbot framework would further enhance students' academic experience, by granting them access to virtual library resources and study materials. Furthermore, the incorporation of online examination capabilities and result dissemination would ensure that students meet the criteria to undertake assessments and that they are able to track their academic progress, effortlessly. By facilitating online classes and providing comprehensive academic support, AI chatbots can contribute significantly to the academic journey of CODeL students, ultimately fostering timely graduation. Thus, the implementation of AI chatbots can be a crucial mechanism in ensuring that students in CODeL institutions receive the necessary support and resources to thrive in their educational pursuits in the 5IR.

References

Boeding, J.A. 2020. *How AI powered chatbots are being adopted and used by higher education institutions to improve the student experience by scaling professional staff.* PhD in Education. University of Pennsylvania.

Braun, V & Clarke V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psycholog*y, 3(2), 77-101.

Chabinga, K. 2021. *Emerging technologies for teaching and learning: an investigation into the use and role of iPads in Grade six English second language in three primary schools in Northern Zambia.* Doctor of Philosophy in the Department of Languages and

Literacy Studies. University of Cape Town, South Africa.

Essel, H.B., Vlachopoulos, D., Tachie-Menson, A., Johnson E.E., Baah, P.K. 2022. The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education. *International Journal of Education Technology in Higher Education,* 19(57), 1-19.

Haleem, A., Javaid, M., Qadri, M.A & Suman, R. 2022. Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, 3, 275-285.

Hasanein, A.M., Sobaith, A.E.E. 2023. Drivers and consequences of ChatGPT use in Higher Education: Key stakeholder perspectives. *European Journal of investigation in Health, Psychology and Education*, 13, 2599–2614.

Ilieva, G., Yankova, T., Klisarova-Belcheva, S., Dimitrov, A., Bratkov, M &Angelov, D. 2023. Effects of generative chatbots in Higher Education. *Information,* 14(9), 1-26.

Javaid, M., Haleen, A., Singh, R.P., Khan, S & Khan, I.H. 2023. Unlocking the opportunities through ChatGPT tool towards ameliorating the education system. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 3, 1-12.

Kooli, C. 2023. Chatbots in education and research: a critical examination of ethical implications and solutions. *Sustainability*, 15(7), 1-15.

Labadze, L., Grigolia, M & Machaidze, L. 2023. Role of AI chatbots in education: Systematic literature review. *International Journal of Education Technology in Higher Education*, 20(56),1-17.

Lee, D & Yeo, S. 2022. Developing an AI-based Chabot for practicing responsive teaching in mathematics. *Journal of Computer in Education,* 191,104646.

Lin, CC. Huang, AYQ., Yang SJH. 2023. A review of AI-driven conversational chatbots implementation methodologies and challenges (1999-2022). *Sustainability,* 15(5),1-13.

Mendoza, S., Sánchez-Adame, L.M., Urquiza-Yllescas, J.F., González-Beltrán., B.A & Decouchant, D. 2023. A model to

develop chatbots for assisting the teaching and learning process. *Sensors*, 22(15), 1-21.

Moonasamy, AR & Naidoo, GM. 2022. Digital learning: challenges experienced by South African university students during COVID-19 pandemic. *The independent Journal of Teaching and Learning*, 17(2), 76-90.

Noble, S.M., Mende, M., Grewal, D., Parasuraman, A. 2022. The Fifth Industrial Revolution: How harmonious human–machine collaboration is triggering a retail and service revolution. *Journal of Retail*, 98, 199–208.

Oliveira, P.F & Matos, P. 2023. Introducing a chatbot to the web portal of a higher education institution to enhance student interaction. *Engineering Proceedings*, 56(1), 1-6.

Pasque, P.A., Smerek, R.E., Dwywe, B., Bowman, N & Mallory, B.L. 2005. *Higher education collaborative for community engagement and improvement*. National Forum on Higher Education for the Public Good.

Rahim, NIM., Iahad, NA., Yusof, AF & AI -Sharafi, MA. 2022. AI-Based chatbots adoption model for higher education institution: A hybrid PLS –SEM – neural network modelling approach. *Sustainability*, 14(19),1-22.

Southworth, J., Migliaccio, K., Glover, J., Glover J., Reed, D., McCarty, C., Brendemuhl, J & Thomas A. 2023. Developing a model for AI across the curriculum: Transforming the higher education landscape via innovation in AI literacy. *Computers and Education: Artificial Intelligence,* 4, 1-10.

Zhang, J., Oh, Y.J., Lange, P., Yu, Z & Fukuoka, Y. 2020. Artificial intelligence chatbot behaviour change model for designing artificial intelligence chatbots to promote physical activity and a healthy diet: Viewpoint. *Journal of Medical Internet Research*, 22.

Ziatdinov, R., Atteraya, MS & Nabiyev, R. 2024. The fifth industrial revolution as a transformative step towards society 5.0. *Societies*, 14(2),1-15.